



State of Missouri regional COVID-19 hospitalized cases model

November 4, 2020

Multiple data points inform Missouri's COVID-19 response

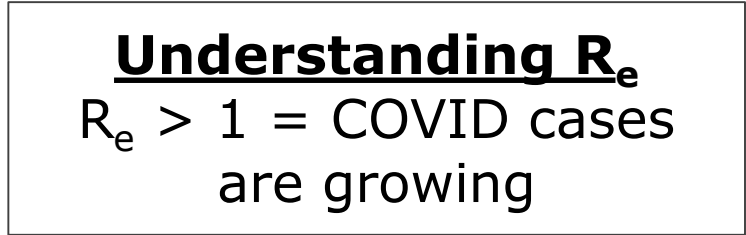
- Syndromic surveillance
- Healthcare system capacity (bed, PPE, and staff availability)
- Testing
- COVID-19 cases and deaths
- Economic and social impact
- Insights from U.S. states, nationally, and other countries
- Evidence from scientific literature
- Mathematical disease modelling

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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Central (Region F)



Overview		
Population	502,486	
Cumulative Cases	18628	
Cumulative Deaths	164	
7-day New Cases	2346	
WoW % Case Change	14.2%	

Reproductive Rate		
Pre-intervention	2.3	
Last Week	1.157	
Current Week	1.12	+/- 0.05
WoW % Change	-3.2%	

Bed / Ventilator Availability		
% ICU Beds Occupied	63%	
% ICU Beds Occupied C19	15%	
% ICU Beds Free	37%	
% Ventilators in use	43%	
% Ventilators available	57%	

Base Case Central Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more



Greater Kansas City Area (Region A)



Overview		
Population	1,395,314	
Cumulative Cases	40150	
Cumulative Deaths	558	
7-day New Cases	3608	
WoW % Case Change	9.8%	

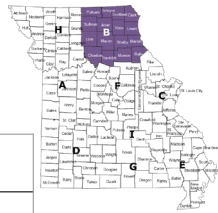
Reproductive Rate		
Pre-intervention	2.8	
Last Week	1.148	
Current Week	1.163	+/- 0.05
WoW % Change	1.3%	

Bed / Ventilator Availability		
% ICU Beds Occupied	78%	
% ICU Beds Occupied C19	13%	
% ICU Beds Free	22%	
% Ventilators in use	23%	
% Ventilators available	77%	

Base Case Kansas City Region	* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients
Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more	



Northeast (Region B)



Overview		
Population	179,448	
Cumulative Cases	4441	
Cumulative Deaths	37	
7-day New Cases	601	
WoW % Case Change	15.4%	

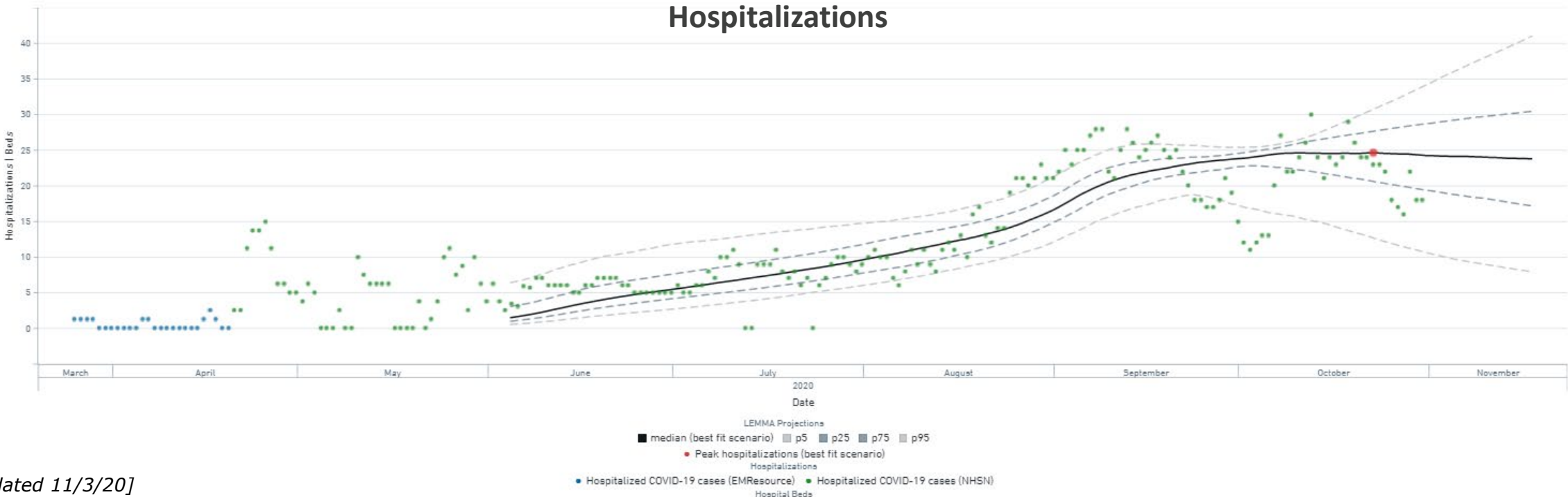
Reproductive Rate		
Pre-intervention	N/A	
Last Week	1.023	
Current Week	1.019	+/- 0.06
WoW % Change	-0.4%	

Bed / Ventilator Availability		
% ICU Beds Occupied	100%	
% ICU Beds Occupied C19	47%	
% ICU Beds Free	0%	
% Ventilators in use	6%	
% Ventilators available	94%	

Base Case Northeast Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more



Northwest (Region H)



Overview		
Population	234,361	
Cumulative Cases	7622	
Cumulative Deaths	129	
7-day New Cases	629	
WoW % Case Change	8.9%	

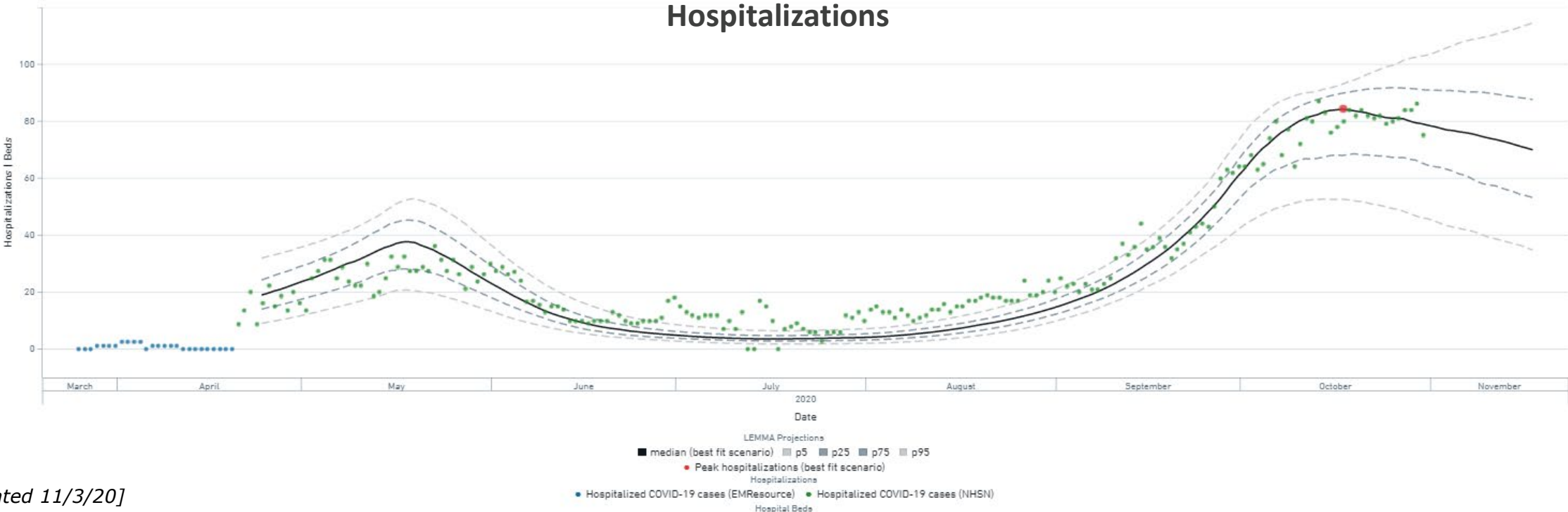
Reproductive Rate		
Pre-intervention	1.24	
Last Week	1.127	
Current Week	1.017	+/- 0.07
WoW % Change	-9.8%	

Bed / Ventilator Availability		
% ICU Beds Occupied	84%	
% ICU Beds Occupied C19	44%	
% ICU Beds Free	16%	
% Ventilators in use	22%	
% Ventilators available	78%	

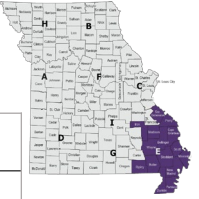
Base Case Northwest Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more



Southeast / Cape Girardeau (Region E)



Overview

Population	363,478	
Cumulative Cases	13575	
Cumulative Deaths	184	
7-day New Cases	1450	
WoW % Case Change	11.8%	

Reproductive Rate

Pre-intervention	2.61	
Last Week	1.157	
Current Week	1.156	+/- 0.05
WoW % Change	-0.1%	

Bed / Ventilator Availability

% ICU Beds Occupied	50%	
% ICU Beds Occupied C19	19%	
% ICU Beds Free	50%	
% Ventilators in use	32%	
% Ventilators available	68%	

Base Case Southeast Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more

Hospitalizations



[Data updated 11/3/20]

Southwest / Springfield (Regions D,G, I)



Overview

Population	1,221,847	
Cumulative Cases	39327	
Cumulative Deaths	523	
7-day New Cases	3571	
WoW % Case Change	9.9%	

Reproductive Rate

Pre-intervention	2.36	
Last Week	1.129	
Current Week	1.113	+/- 0.06
WoW % Change	-1.4%	

Bed / Ventilator Availability

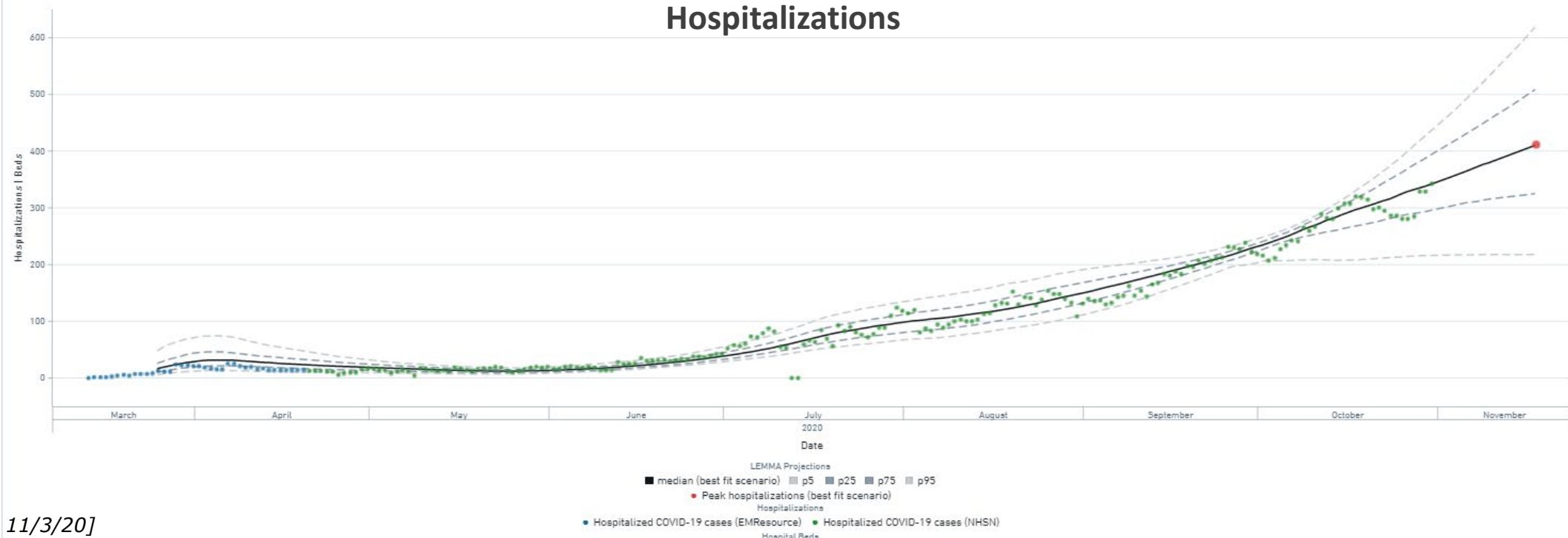
% ICU Beds Occupied	67%	
% ICU Beds Occupied C19	30%	
% ICU Beds Free	33%	
% Ventilators in use	33%	
% Ventilators available	67%	

Base Case Southwest Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more

Hospitalizations



Greater St Louis Area (Region C)



Overview

Population	2,229,518	
Cumulative Cases	66681	
Cumulative Deaths	1469	
7-day New Cases	5503	
WoW % Case Change	8.9%	

Reproductive Rate

Pre-intervention	3.39	
Last Week	1.163	
Current Week	1.166	+/- 0.03
WoW % Change	0.3%	

Bed / Ventilator Availability

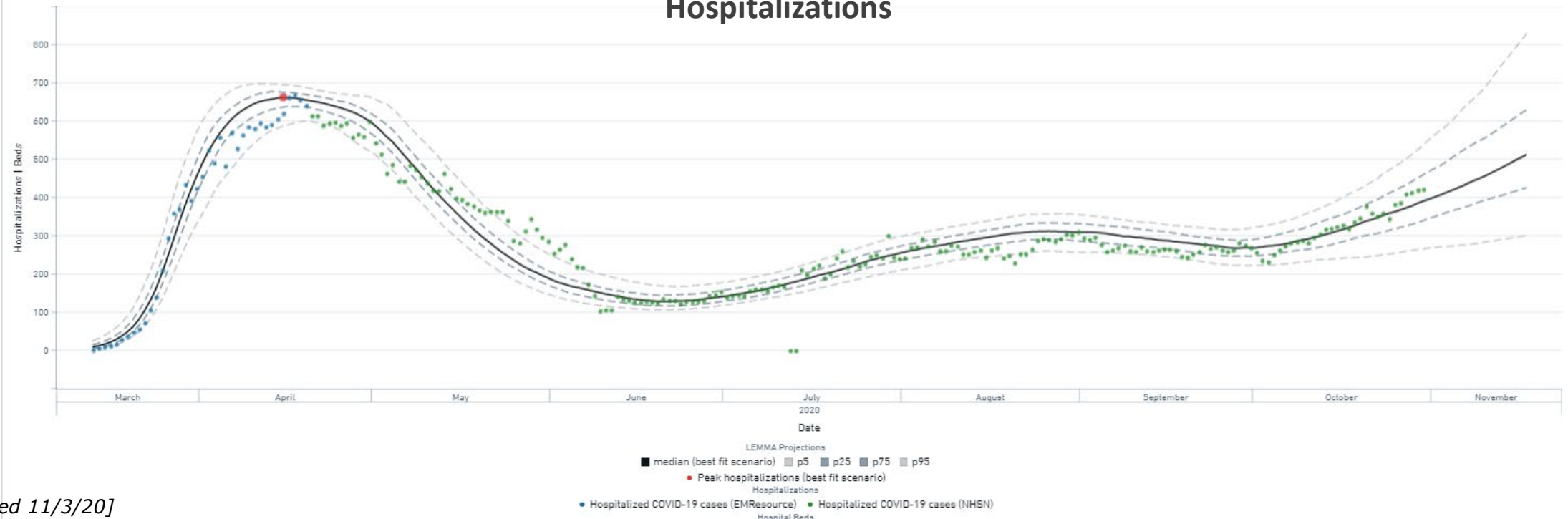
% ICU Beds Occupied	67%	
% ICU Beds Occupied C19	15%	
% ICU Beds Free	33%	
% Ventilators in use	40%	
% Ventilators available	60%	

Base Case St. Louis Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Nov 18, 2020, Model Percentiles: median, p25, p75, p5, p95, + 1 more

Hospitalizations



Version 1.0, As of June 3, 2020

Missouri's Regional COVID-19 Hospitalized Cases Model: Overview and Frequently Asked Questions

Model Overview

One of the many data analyses that inform Missouri's COVID-19 response is a regional model of hospitalized COVID-19 cases that the State of Missouri developed in partnership with the Washington University in St. Louis and Missouri Hospital Association.

Missouri's model uses a standard SEIR (susceptible, exposed, infectious, recovered) compartmental structure that is based upon a tool called LEMMA (Local Epidemiological Modeling for Management & Action), which was developed by experts from UMass Amherst, UC Berkeley, UCSF, and WUSTL. The model focuses on COVID-19 hospitalized cases to directly address the question of hospital capacity and provide a more accurate picture of COVID-19's impact on the healthcare system.

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graph LR
    Susceptible --> Exposed
    Exposed --> Infectious
    Infectious --> Removed
    Infectious --> Hospitalized
    Hospitalized --> Floor
    Hospitalized --> ICU
    Hospitalized --> Vent
  
```

To help inform decisions at the regional and local level, each region is modeled separately using the latest local data, including COVID-19 confirmed and suspected hospitalizations, population, policy interventions, and average hospital length of stay.

General FAQs

Why are regional models of COVID-19 important?

When new diseases such as COVID-19 emerge, there is much uncertainty about how best to control the epidemic. Decision makers must make the best possible decisions with the available information at hand.

Mathematical models are commonly used to make projections of how infectious diseases might impact key outcomes such as hospitalized cases or deaths. Today, there are many sophisticated models of COVID-19 that make global or national projections (e.g., Imperial College, Harvard, [JHU](#)). However, these generally do not incorporate key local or regional inputs, such as variations in local population demographics, healthcare system

Northeast MO?

Low levels of daily COVID-19 hospitalizations in the Northeast and Northwest regions limit the ability to generate projections for these regions. In particular, the numbers of hospitalized cases have been so low that

knowledge of COVID-19 in each region effective transmission rates across projected into the future based upon future.

hospitals serve patients across Highway Patrol Troop and Healthcare and response planning. There are

patient referral and EMS patterns, Highway Patrol Troop C (i.e., the Greater St. Louis area) due to their engagement with the

St. Louis area

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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)

