



# State of Missouri regional COVID-19 hospitalized cases model

November 24, 2020

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

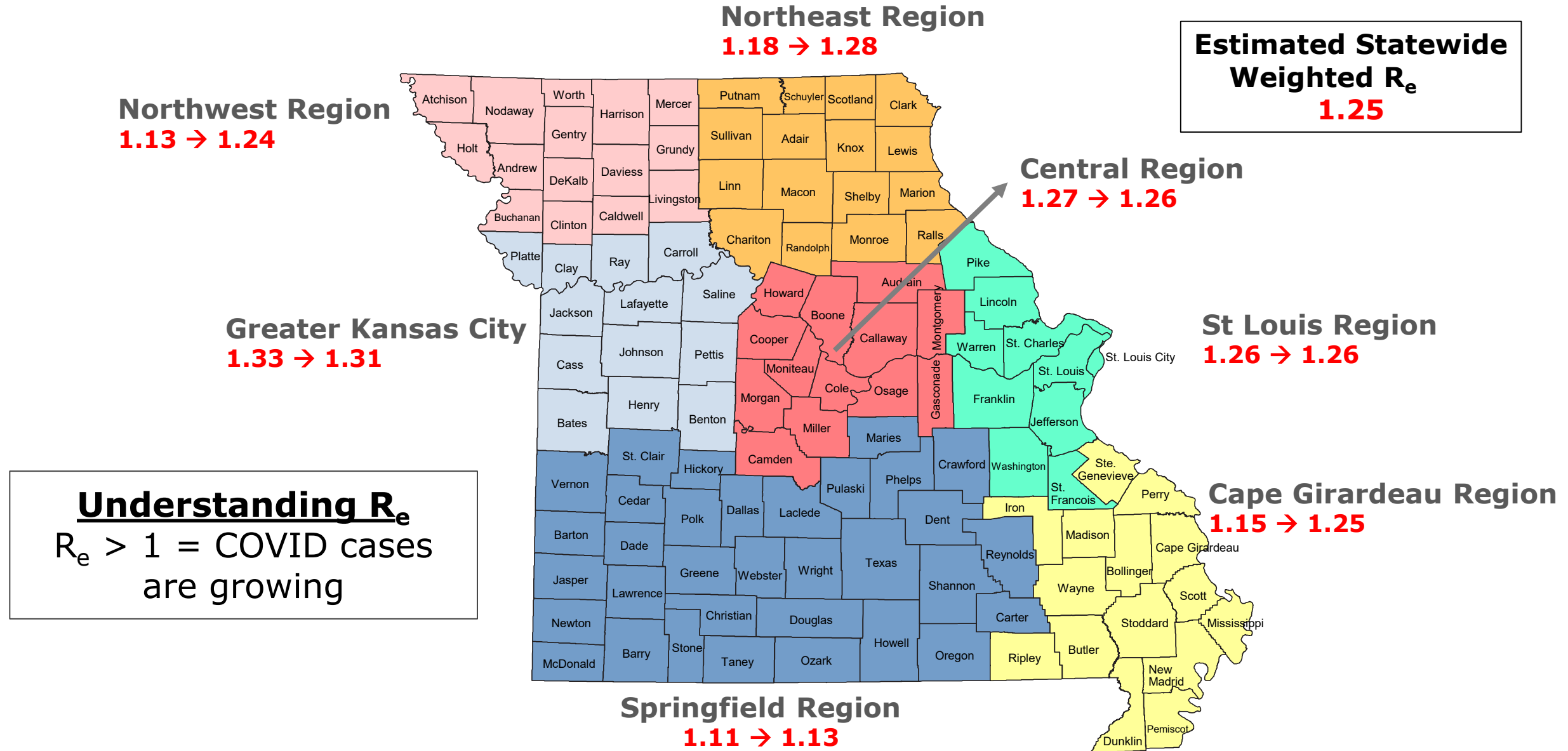
- Syndromic surveillance
- Healthcare system capacity (bed, PPE, and staff availability)
- Testing
- COVID-19 cases and deaths
- Economic and social impact
- Insights from U.S. states, nationally, and other countries
- Evidence from scientific literature
- Mathematical disease modelling

## 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.**

- “ $R_e$ ” rates near or above 1 in nearly every region means the disease is spreading statewide



# Central (Region F)



Overview		
Population	502,486	
Cumulative Cases	28079	
Cumulative Deaths	204	
7-day New Cases	3017	
WoW % Case Change	12.0%	

Reproductive Rate		
Pre-intervention	2.3	
Last Week	1.27	
Current Week	1.26	+/- 0.05
WoW % Change	-0.4%	

Bed / Ventilator Availability		
% ICU Beds Occupied	65%	
% ICU Beds Occupied C19	21%	
% ICU Beds Free	35%	
% Ventilators in use	37%	
% Ventilators available	63%	

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: 12/8/20 1:00 AM, + 2 more



# Greater Kansas City Area (Region A)



## Overview

Population	1,395,314	
Cumulative Cases	57893	
Cumulative Deaths	654	
7-day New Cases	6622	
WoW % Case Change	12.9%	

## Reproductive Rate

Pre-intervention	2.8	
Last Week	1.33	
Current Week	1.31	+/- 0.05
WoW % Change	-1.2%	

## Bed / Ventilator Availability

% ICU Beds Occupied	84%	
% ICU Beds Occupied C19	24%	
% ICU Beds Free	16%	
% Ventilators in use	27%	
% Ventilators available	73%	

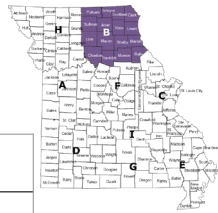
Base Case Kansas City Region

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

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 12/8/20 1:00 AM, + 2 more



# Northeast (Region B)



## Overview

Population	179,448	
Cumulative Cases	7618	
Cumulative Deaths	51	
7-day New Cases	1115	
WoW % Case Change	17.1%	

## Reproductive Rate

Pre-intervention	N/A	
Last Week	1.18	
Current Week	1.28	+/- 0.06
WoW % Change	7.9%	

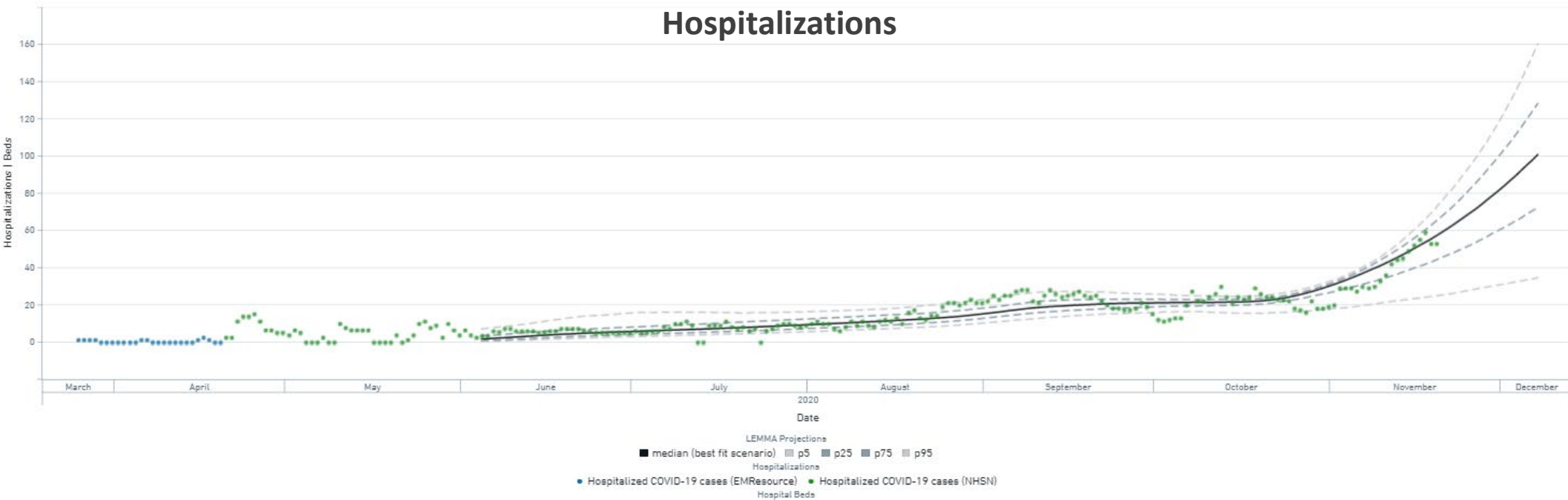
## Bed / Ventilator Availability

% ICU Beds Occupied	95%	
% ICU Beds Occupied C19	73%	
% ICU Beds Free	5%	
% Ventilators in use	33%	
% Ventilators available	68%	

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: 12/8/20 1:00 AM, + 2 more



# Northwest (Region H)



Overview		
Population	234,361	
Cumulative Cases	11143	
Cumulative Deaths	173	
7-day New Cases	1406	
WoW % Case Change	14.4%	

Reproductive Rate		
Pre-intervention	1.24	
Last Week	1.13	
Current Week	1.24	+/- 0.07
WoW % Change	9.5%	

Bed / Ventilator Availability		
% ICU Beds Occupied	72%	
% ICU Beds Occupied C19	34%	
% ICU Beds Free	28%	
% Ventilators in use	21%	
% Ventilators available	79%	

Base Case Northwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 12/8/20 1:00 AM, - 2 more

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



[Data updated 11/23/20]



# Southeast / Cape Girardeau (Region E)



## Overview

Population	363,478	
Cumulative Cases	20329	
Cumulative Deaths	212	
7-day New Cases	2576	
WoW % Case Change	14.5%	

## Reproductive Rate

Pre-intervention	2.61	
Last Week	1.15	
Current Week	1.25	+/- 0.05
WoW % Change	8.9%	

## Bed / Ventilator Availability

% ICU Beds Occupied	60%	
% ICU Beds Occupied C19	26%	
% ICU Beds Free	40%	
% Ventilators in use	40%	
% Ventilators available	60%	

Base Case Southeast Region

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

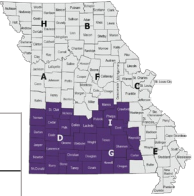
Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 12/8/20 1:00 AM, + 2 more

## Hospitalizations



[Data updated 11/23/20]

# Southwest / Springfield (Regions D,G, I)



## Overview

Population	1,221,847	
Cumulative Cases	53390	
Cumulative Deaths	695	
7-day New Cases	5188	
WoW % Case Change	10.8%	

## Reproductive Rate

Pre-intervention	2.36	
Last Week	1.11	
Current Week	1.13	+/- 0.06
WoW % Change	2.0%	

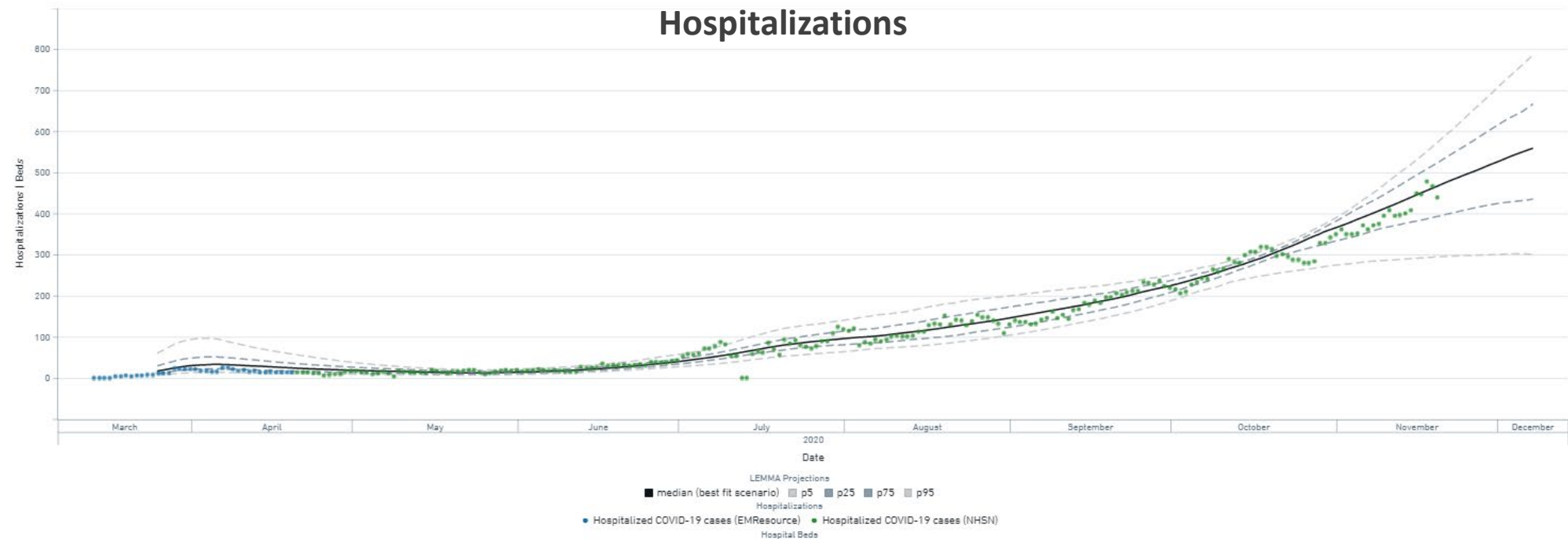
## Bed / Ventilator Availability

% ICU Beds Occupied	88%	
% ICU Beds Occupied C19	37%	
% ICU Beds Free	12%	
% Ventilators in use	30%	
% Ventilators available	70%	

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: 12/8/20 1:00 AM, + 2 more



[Data updated 11/23/20]

# Greater St Louis Area (Region C)



Overview		
Population	2,229,518	
Cumulative Cases	96445	
Cumulative Deaths	1572	
7-day New Cases	11804	
WoW % Case Change	13.9%	

Reproductive Rate		
Pre-intervention	3.39	
Last Week	1.26	
Current Week	1.26	+/- 0.03
WoW % Change	0.1%	

Bed / Ventilator Availability		
% ICU Beds Occupied	86%	
% ICU Beds Occupied C19	19%	
% ICU Beds Free	14%	
% 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: 12/8/20 1:00 AM, + 2 more



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.

```

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, [UMM](#)). However, these generally do not incorporate key local or regional inputs, such as variations in local population demographics, healthcare system

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 City

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

## 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)

