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

<table>
<thead>
<tr>
<th>What does the model tell us</th>
<th>What does it not tell us</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of plausible outcomes based on our current knowledge of COVID-19 in Missouri</td>
<td>What will happen in the future</td>
</tr>
<tr>
<td>Approximate date and magnitude of peak/s based on current understanding of policy interventions and human behavior and assumptions about future interventions</td>
<td>Date and magnitude of peak/s if there are major changes in planned policy interventions and human behavior</td>
</tr>
<tr>
<td>Approximate estimate of effective transmission rate across a region</td>
<td>Exact transmission rate in all parts of a region – there may be areas of higher and lower transmission within the region</td>
</tr>
<tr>
<td>Projected hospitalizations for regions in MO with sufficient data, i.e. Kansas City Area, Central, St. Louis Area, Southeast and Southwest</td>
<td>Projected hospitalizations in regions where daily COVID-19 hospitalizations are fewer than 15 because insufficient cases</td>
</tr>
</tbody>
</table>

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.

Understanding $R_e$

$R_e > 1$ = COVID cases are growing

* Data date range: 11/17/20 – 11/23/20
## Central (Region F)

### Overview

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>502,486</td>
</tr>
<tr>
<td>Cumulative Cases</td>
<td>28079</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>204</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>3017</td>
</tr>
<tr>
<td>WoW % Case Change</td>
<td>12.0%</td>
</tr>
</tbody>
</table>

### Reproductive Rate

- **Pre-intervention**: 2.3
- **Last Week**: 1.27
- **Current Week**: 1.26
- **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%

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

### Hospitalizations

[Graph showing hospitalizations over time]

[Data updated 11/23/20]
Greater Kansas City Area (Region A)

<table>
<thead>
<tr>
<th>Overview</th>
<th>Reproductive Rate</th>
<th>Bed / Ventilator Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>1,395,314</td>
<td>Pre-intervention</td>
</tr>
<tr>
<td>Cumulative Cases</td>
<td>57893</td>
<td>Last Week</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>654</td>
<td>Current Week</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>6622</td>
<td>WoW % Change</td>
</tr>
<tr>
<td>WoW % Case Change</td>
<td>12.9%</td>
<td>% ICU Beds Occupied</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>654</td>
<td>% ICU Beds Occupied C19</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>654</td>
<td>% ICU Beds Free</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>6622</td>
<td>% Ventilators in use</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>6622</td>
<td>% Ventilators available</td>
</tr>
</tbody>
</table>

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

[Data updated 11/23/20]
Northeast (Region B)

<table>
<thead>
<tr>
<th>Overview</th>
<th>Reproductive Rate</th>
<th>Bed / Ventilator Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Pre-intervention</td>
<td>% ICU Beds Occupied</td>
</tr>
<tr>
<td>179,448</td>
<td>N/A</td>
<td>95%</td>
</tr>
<tr>
<td>Cumulative Cases</td>
<td>Last Week</td>
<td>% ICU Beds Occupied C19</td>
</tr>
<tr>
<td>7618</td>
<td>1.18</td>
<td>73%</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>Current Week</td>
<td>% ICU Beds Free</td>
</tr>
<tr>
<td>51</td>
<td>1.28</td>
<td>5%</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>WoW % Change</td>
<td>% Ventilators in use</td>
</tr>
<tr>
<td>1115</td>
<td>7.9%</td>
<td>33%</td>
</tr>
<tr>
<td>WoW % Case Change</td>
<td>*</td>
<td>% Ventilators available</td>
</tr>
<tr>
<td>17.1%</td>
<td>*</td>
<td>68%</td>
</tr>
</tbody>
</table>

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

**Hospitalizations**

(Data updated 11/23/20)
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
- WoW % Change: 9.5% +/- 0.07

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

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

(Data updated 11/23/20)
Southeast / Cape Girardeau (Region E)

<table>
<thead>
<tr>
<th>Overview</th>
<th>Reproductive Rate</th>
<th>Bed / Ventilator Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Pre-intervention 2.61</td>
<td>% ICU Beds Occupied 60%</td>
</tr>
<tr>
<td>Cumulative Cases</td>
<td>Last Week 1.15</td>
<td>% ICU Beds Occupied C19 26%</td>
</tr>
<tr>
<td>Cumulative Deaths</td>
<td>Current Week 1.25 +/- 0.05</td>
<td>% ICU Beds Free 40%</td>
</tr>
<tr>
<td>7-day New Cases</td>
<td>WoW % Change 8.9%</td>
<td>% Ventilators in use 40%</td>
</tr>
<tr>
<td>WoW % Case Change</td>
<td></td>
<td>% Ventilators available 60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients</td>
</tr>
</tbody>
</table>

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

Base Case Southeast Region

Model Scenario: Base Case. From Date: Mar 9, 2020, To Date: 12/31/20 1:08 AM. 3 wave

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
- **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%

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

### Hospitalizations

[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%

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

[Data updated 11/23/20]
See FAQs for additional details

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)

- Susceptible → Exposed → Infectious → Removed
- Hospitalized:
  - Floor
  - ICU
  - Vent

DISEASE MODEL