



State of Missouri regional COVID-19 hospitalized cases model

April 13, 2021

Multiple data points inform Missouri's COVID-19 response

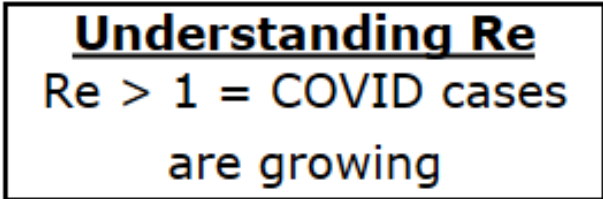
- Syndromic surveillance
- Healthcare system capacity (bed, PPE, and staff availability)
- Testing
- COVID-19 cases and deaths
- Economic and social impact
- Insights from U.S. states, nationally, and other countries
- Evidence from scientific literature
- Mathematical disease modelling

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

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)



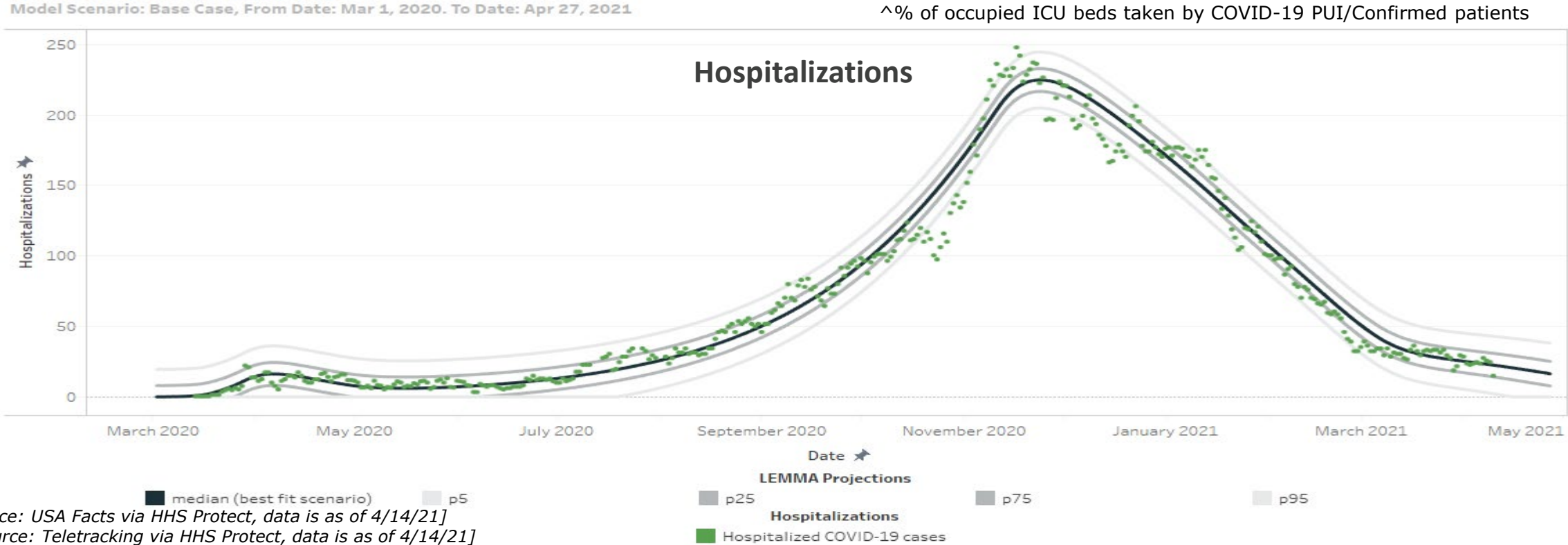
Overview	
Population	502,486
Cumulative Cases	51,792
Cumulative Deaths	632
7-day New Cases	237
WoW % Case Change	0.5%

Reproductive Rate	
Pre-intervention	2.3
Last Week	0.99
Current Week	0.96
WoW % Change	-3.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	65%
% ICU Beds Occupied C19	1%
% ICU Beds Free	35%
% Ventilators in use	25%
% Ventilators available	75%

Base Case Central Region

Model Scenario: Base Case, From Date: Mar 1, 2020. To Date: Apr 27, 2021



[* Source: USA Facts via HHS Protect, data is as of 4/14/21]
[** Source: Teletracking via HHS Protect, data is as of 4/14/21]
[*** Reproductive Rate data and the Region Projection chart are as of 4/13/21]

Greater St Louis Area (Region C)



Overview

Population	2,229,518
Cumulative Cases	210,921
Cumulative Deaths	3,338
7-day New Cases	2,805
WoW % Case Change	1.3%

Reproductive Rate

Pre-intervention	3.39
Last Week	1.17
Current Week	1.13
WoW % Change	-3.5%

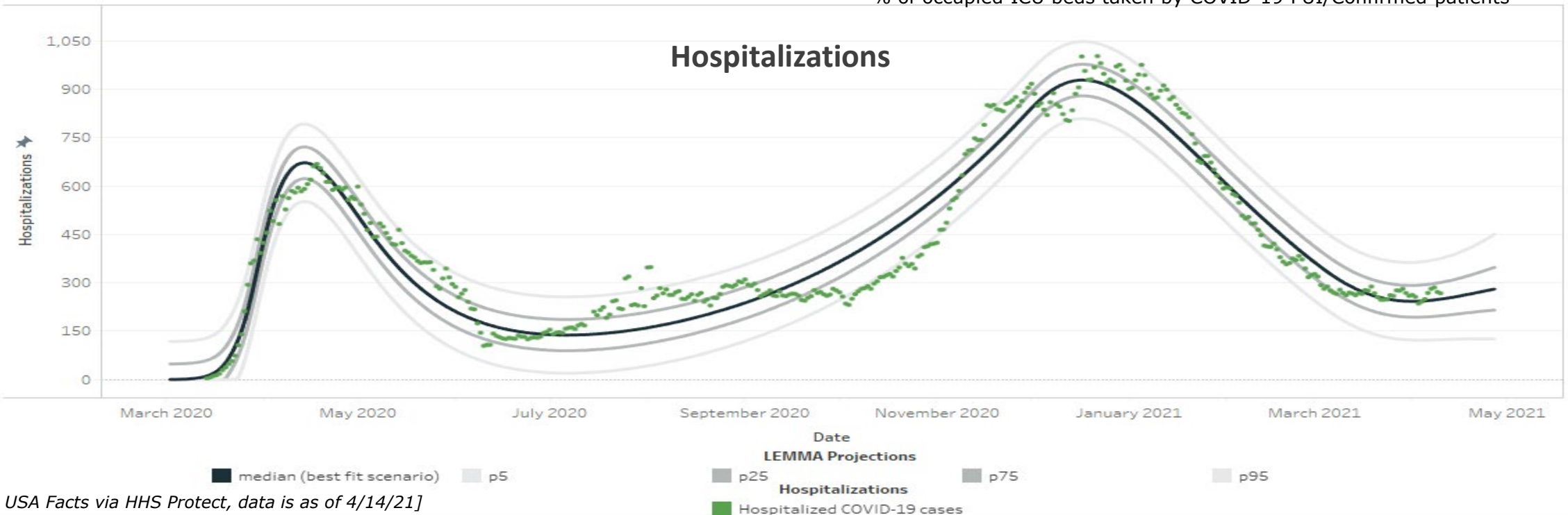
Bed / Ventilator Availability

% ICU Beds Occupied	82%
% ICU Beds Occupied C19	7%
% ICU Beds Free	18%
% Ventilators in use	34%
% Ventilators available	66%

Base Case St. Louis Region

Model Scenario: Base Case, From Date: Mar 1, 2020. To Date: Apr 27, 2021

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



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Greater Kansas City Area (Region A)



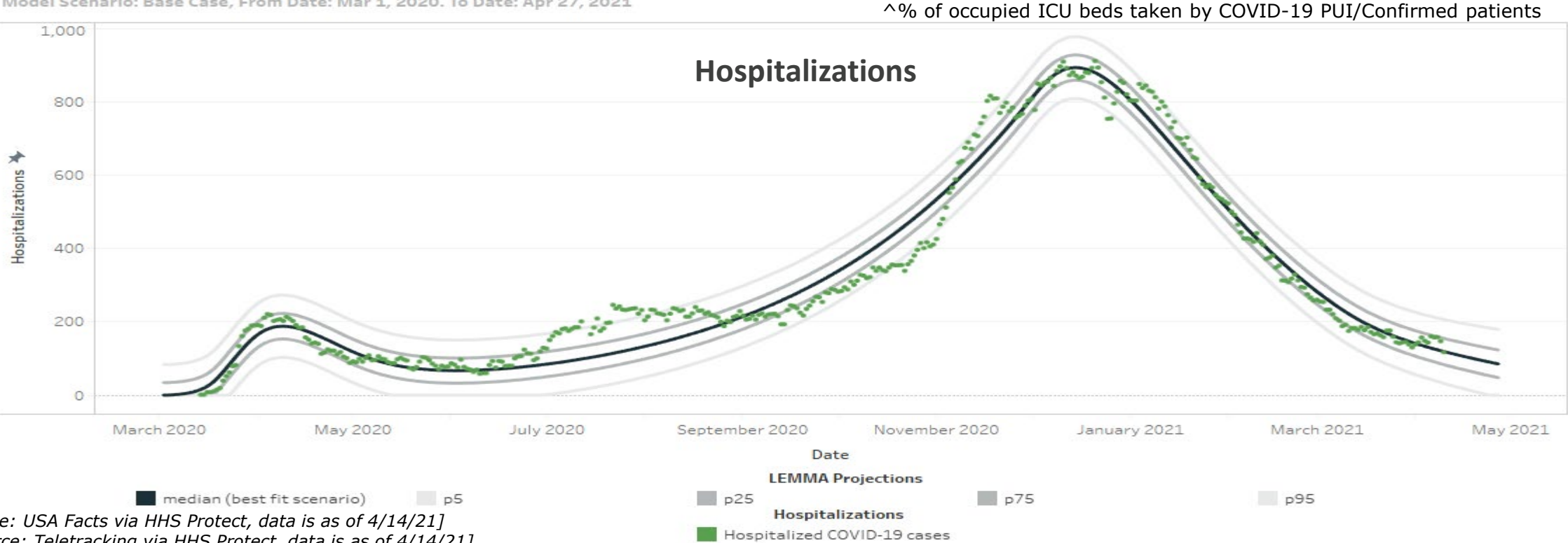
Overview	
Population	1,395,314
Cumulative Cases	127,988
Cumulative Deaths	1,655
7-day New Cases	943
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	2.8
Last Week	0.73
Current Week	0.88
WoW % Change	21.1%

Bed / Ventilator Availability	
% ICU Beds Occupied	74%
% ICU Beds Occupied C19	4%
% ICU Beds Free	26%
% Ventilators in use	19%
% Ventilators available	81%

Base Case Kansas City Region

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Northeast (Region B)



Overview

Population	179,448
Cumulative Cases	18,804
Cumulative Deaths	205
7-day New Cases	118
WoW % Case Change	0.6%

Reproductive Rate

Pre-intervention	N/A
Last Week	0.64
Current Week	0.62
WoW % Change	-3.0%

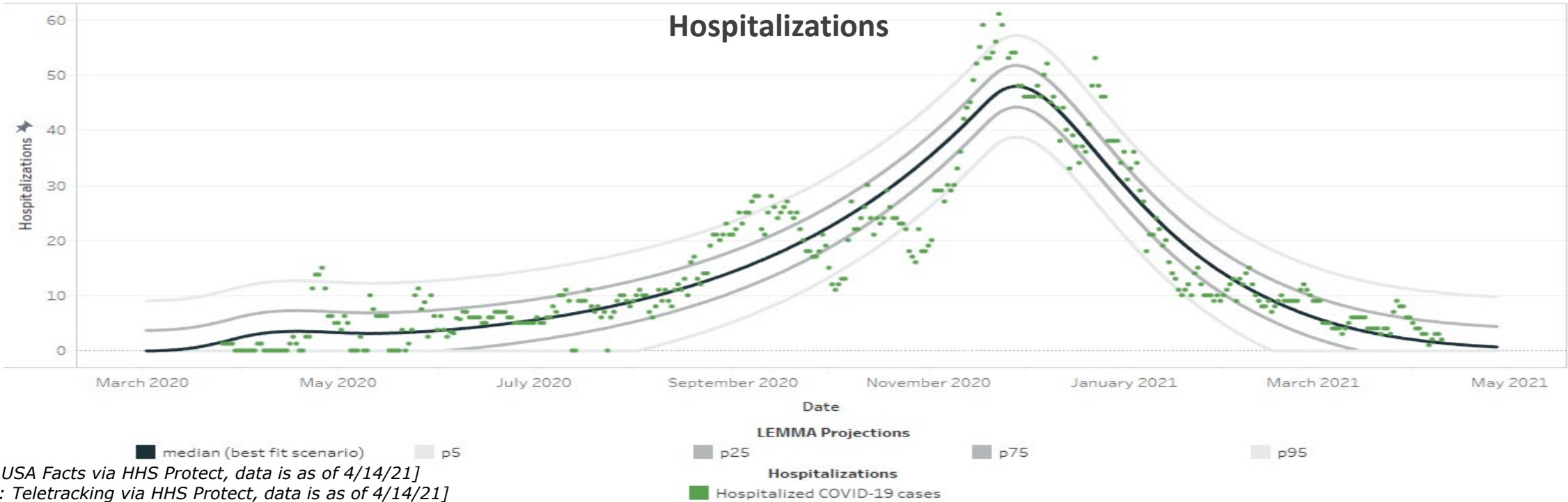
Bed / Ventilator Availability

% ICU Beds Occupied	42%
% ICU Beds Occupied C19	0%
% ICU Beds Free	58%
% Ventilators in use	5%
% Ventilators available	95%

Base Case Northeast Region

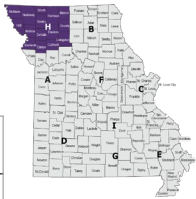
Model Scenario: Base Case, From Date: Mar 1, 2020. To Date: Apr 27, 2021

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



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Northwest (Region H)



Overview

Population	234,361
Cumulative Cases	24,109
Cumulative Deaths	433
7-day New Cases	100
WoW % Case Change	0.4%

Reproductive Rate

Pre-intervention	1.24
Last Week	0.79
Current Week	0.79
WoW % Change	-0.6%

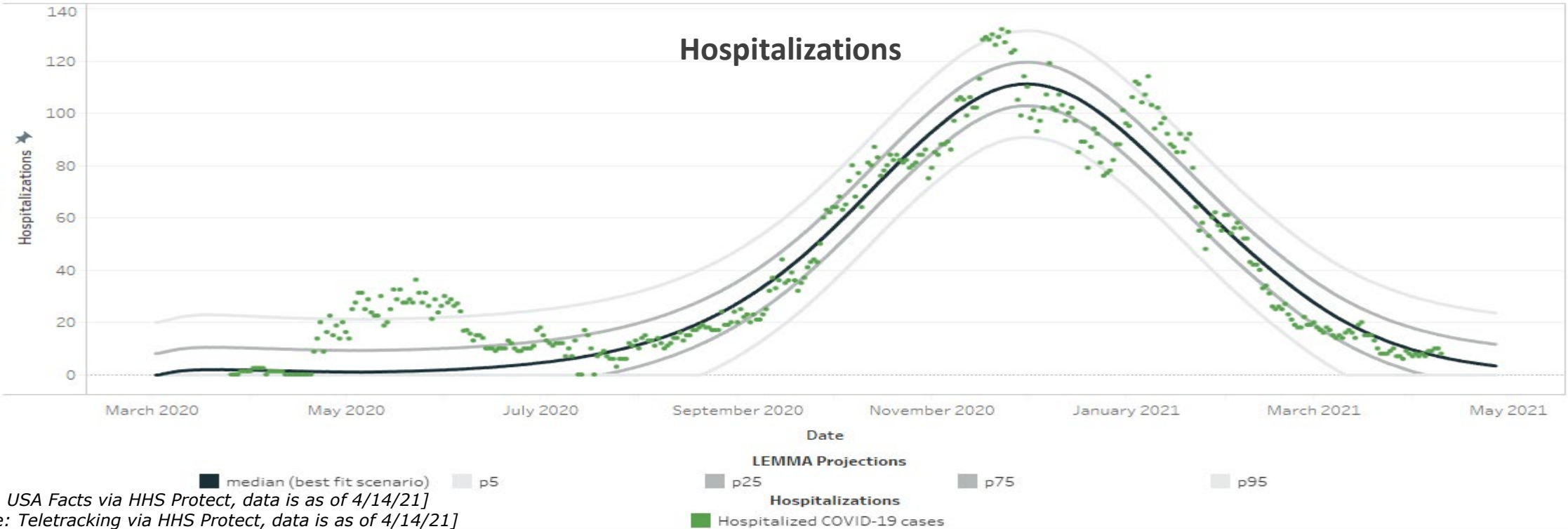
Bed / Ventilator Availability

% ICU Beds Occupied	72%
% ICU Beds Occupied C19	0%
% ICU Beds Free	28%
% Ventilators in use	12%
% Ventilators available	88%

Base Case Northwest Region

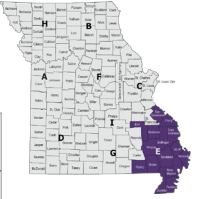
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Southeast / Cape Girardeau (Region E)



Overview

Population	363,478
Cumulative Cases	38,047
Cumulative Deaths	519
7-day New Cases	190
WoW % Case Change	0.5%

Reproductive Rate

Pre-intervention	2.61
Last Week	0.72
Current Week	0.71
WoW % Change	-1.9%

Bed / Ventilator Availability

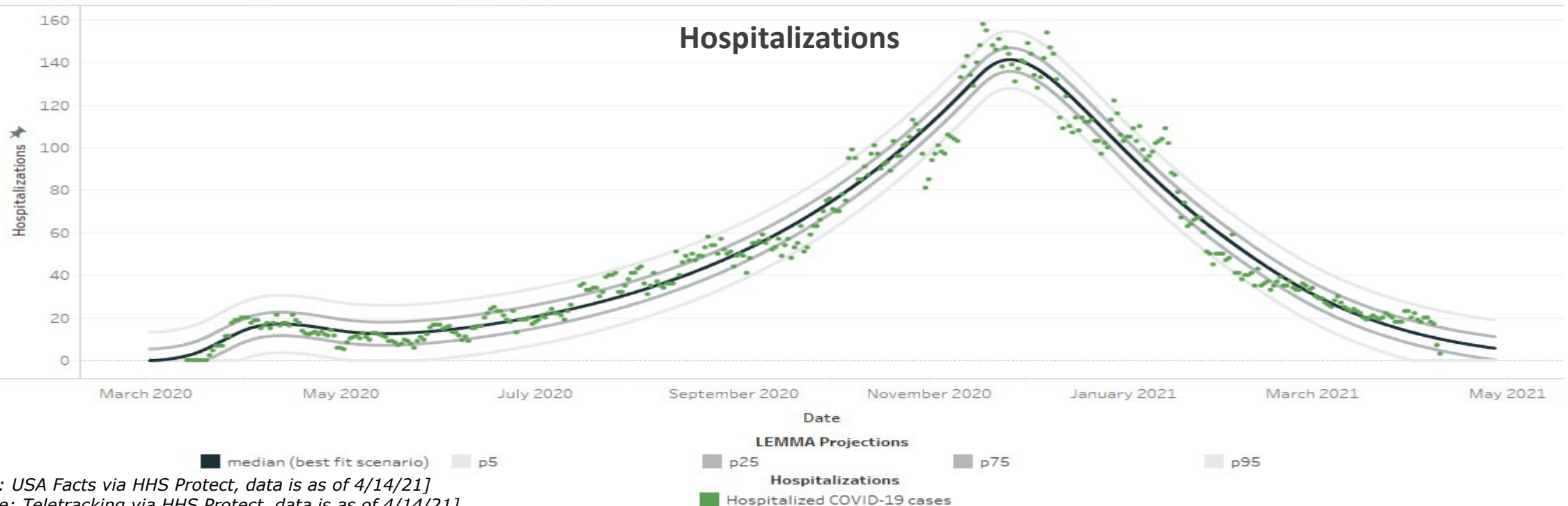
% ICU Beds Occupied	57%
% ICU Beds Occupied C19	0%
% ICU Beds Free	43%
% Ventilators in use	14%
% Ventilators available	86%

Base Case Southeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020. To Date: Apr 27, 2021

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

Hospitalizations

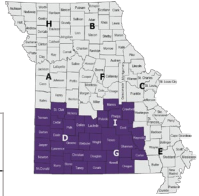


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Southwest / Springfield (Regions D,G, I)



Overview

Population	1,221,847
Cumulative Cases	113,213
Cumulative Deaths	1,840
7-day New Cases	626
WoW % Case Change	0.6%

Reproductive Rate

Pre-intervention	2.36
Last Week	0.84
Current Week	0.80
WoW % Change	-5.2%

Bed / Ventilator Availability

% ICU Beds Occupied	78%
% ICU Beds Occupied C19	6%
% ICU Beds Free	22%
% Ventilators in use	17%
% Ventilators available	83%

Base Case Southwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020. To Date: Apr 27, 2021

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See FAQs for additional details

Link here: <https://health.mo.gov/living/healthcondiseases/communicable/novel-coronavirus/pdf/modeling-faqs.pdf>

Version 2.0, As of March 30, 2021

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 --> EffectivelyVaccinated[Effectively Vaccinated]
    Infectious --> Hospitalized
    EffectivelyVaccinated --> Removed
    Hospitalized --> Removed
    Hospitalized --> Floor
    Hospitalized --> ICU
    Hospitalized --> Ward
  
```

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 uncertainty about how best to control the epidemic. Decision makers must make their decisions with the best available information at hand.

Mathematical models are commonly used tools to help us understand 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., see the Centers for Disease Control and Prevention's latest compilation

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
 - Vaccination rate by age and vaccine efficacy
- **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)

