



State of Missouri COVID-19 analytics update

June 3rd, 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



AS OF 5/28/2020

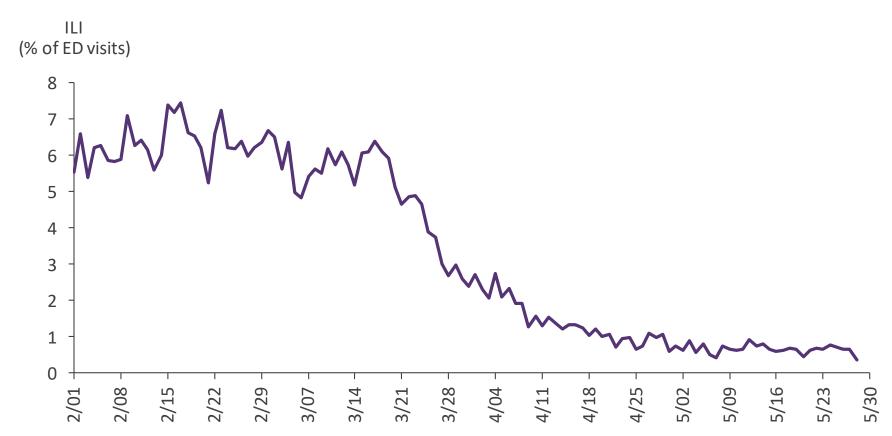
Syndromic surveillance: Total emergency department visits

Daily Total Emergency Department (ED) visits in Missouri ESSENCE, February 1, 2020 – May 28, 2020



Syndromic surveillance: ILI as a percentage of Total emergency department visits

Missouri Percentage of Emergency Department (ED) Visits for Influenza-Like Illness (ILI) in ESSENCE Participating Hospitals (02/01/2020 – 05/28/2020



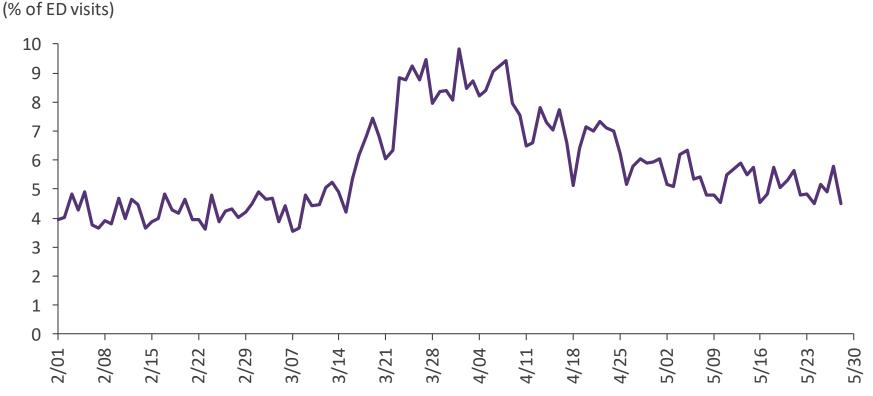
Note: ILI is queried in ESSENCE using Influenza or (Fever Plus and (Cough or SoreThroat) and not NonILI Fevers)

COVID-like illness

Syndromic surveillance: COVID-like illness as a percentage of Total emergency department visits

Missouri Percentage of Emergency Department (ED) Visits for COVID-like Illness in

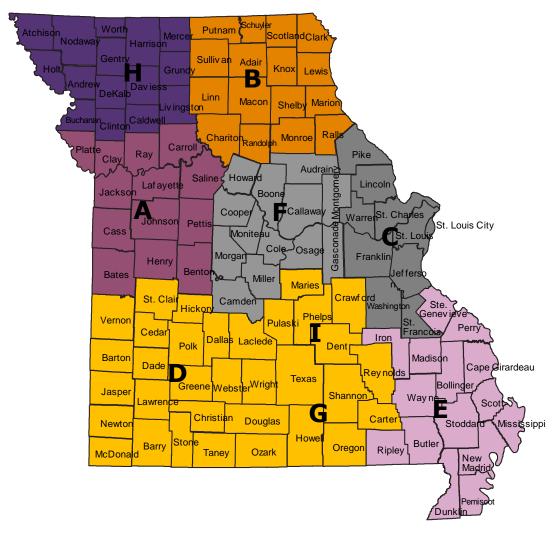
ESSENCE Participating Hospitals (02/01/2020 – 05/28/2020)



Note: COVID-like illness is queried in ESSENCE using ^fever^, and, (^cough^,or,^shortness of breath^,or,^difficulty breathing^)

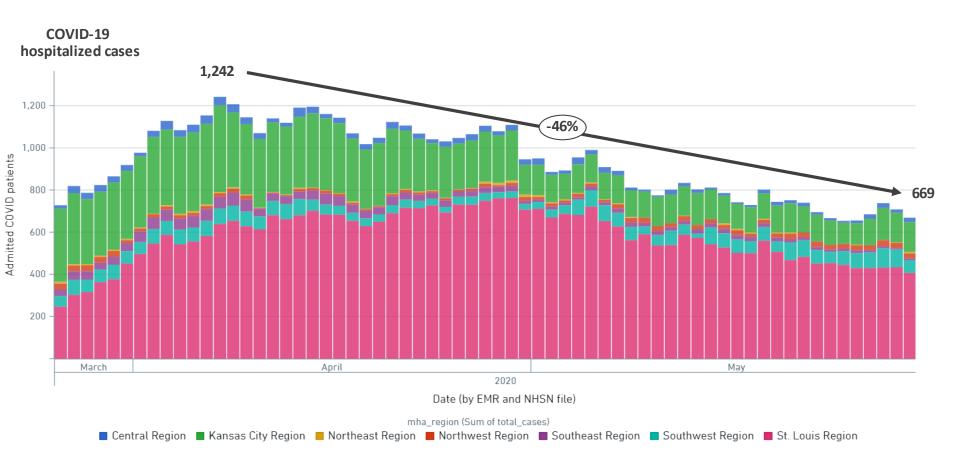


Healthcare system data is analyzed by region



- Based on Missouri's Highway Patrol
 Troop and Healthcare Coalition
 boundaries, historically used for healthcare preparedness and response planning
- Regions D, G, and I are combined into one Southwest region to reflect patient referral and EMS patterns, and their engagement with the Southwest Healthcare Coalition
- While Perry County and Ste.
 Genevieve County reside in
 Highway Patrol Troop C, their data is reported through the Southeast
 Region due to their engagement with the Southeast Healthcare
 Coalition

COVID-19 positive and PUI hospitalized cases by region

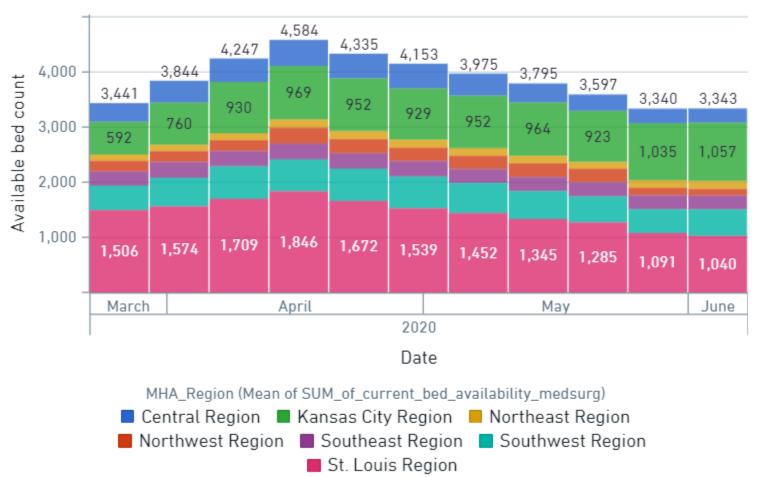


Note: # of hospitals reporting varies from day-to-day and may alter data on COVID-19 hospitalizations. Data from the most recent 72 hours are excluded because of variability in reporting from hospitals. Percentage decrease is calculated from the peak of 1,242 hospitalizations on April 7 through May 29. Data does not include COVID-19 hospitalizations on the KS side of the Kansas City metro.



Medical and surgical bed availability by region



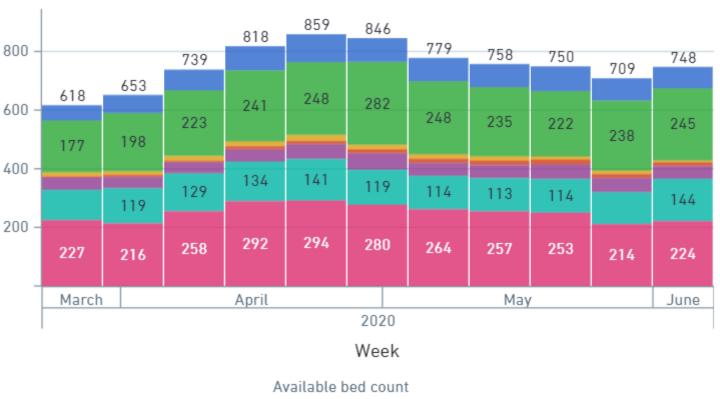


Note: # of hospitals reporting varies from day-to-day and may alter data on bed availability. Data does not include hospitals on the KS side of the Kansas City metro.



ICU bed availability by region





Available bed count

Central Region Kansas City Region Northeast Region

Northwest Region Southeast Region

St. Louis Region

Note: # of hospitals reporting varies from day-to-day and may alter data on bed availability. Data includes all types of ICU beds (adult, pediatric, NICU, negative airflow). Data does not include hospitals on the KS side of the Kansas City metro.



COVID-19 testing: Cumulative test volume and results by test type



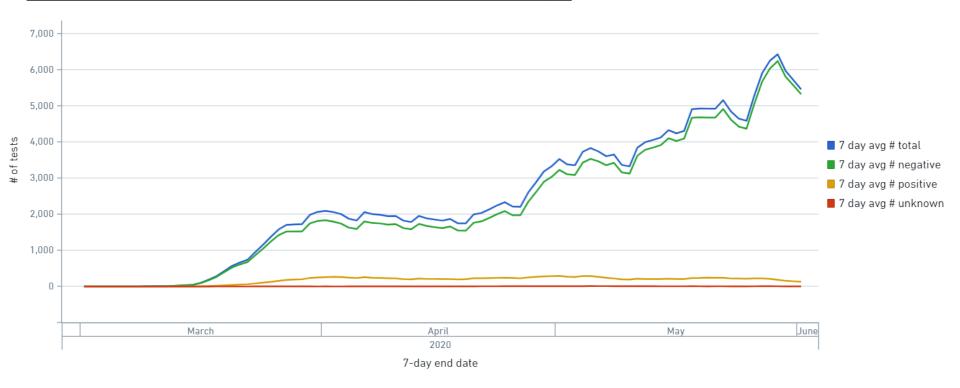
A **PCR** test is a diagnostic test that looks for the viral RNA in the nose, throat, or other areas in the respiratory tract to determine if there is an active infection with SARS-CoV-2, the virus that causes COVID-19. A positive PCR test means that the person has an active COVID-19 infection.

A **Serology** test looks for antibodies against SARS-CoV-2 in the blood to determine if there has been an infection in the past. Antibodies are formed by the body to fight off infections. A positive antibody test means that the person was infected with COVID-19 in the past or recently, and that their immune system developed antibodies to try to fight it off.

Note: Antigen testing has recently been approved by the FDA. More details will follow when antigentesting becomes more wides pread. Source: Missouri Department of Health & Senior Services

COVID-19 testing: PCR testing volume and results, 7-day rolling average

of tests conducted and results (rolling 7-day average)

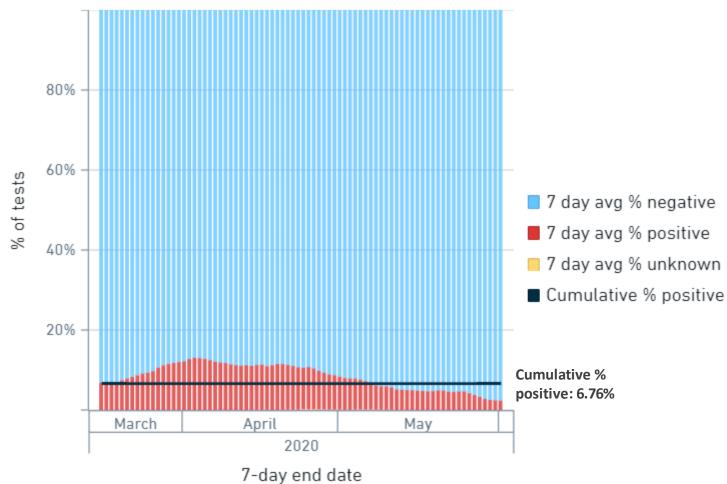


Note: Due to reporting lags from some labs and for negative results, total testing volumes from the most recent 3-5 days often are underreported



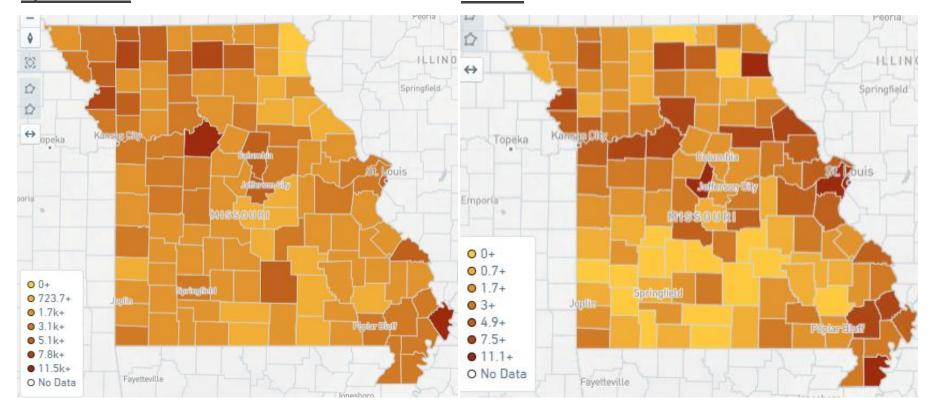
COVID-19 testing: PCR positivity rate

Average 7-day PCR testing results (% negative, % positive, % unknown)



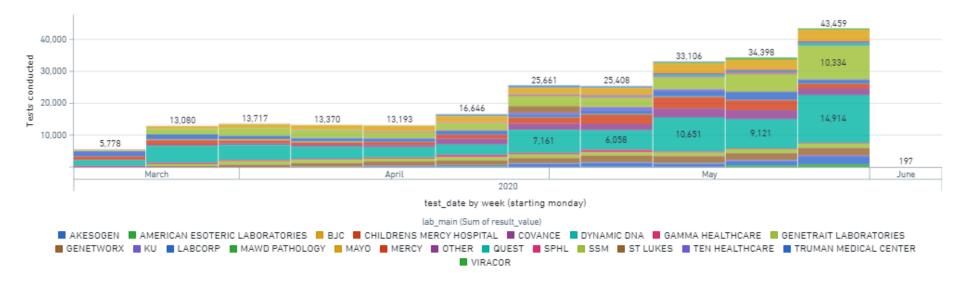
COVID-19 testing: PCR test volume and % positivity by county

PCR tests conducted / 100k population: Positive tests (% of total): 3,885 tests 6.76%



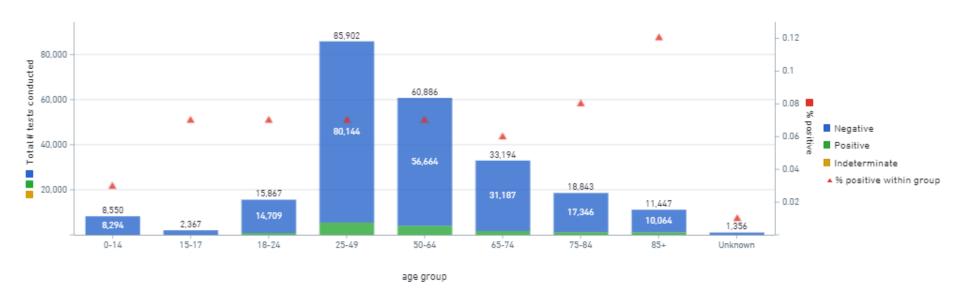
COVID-19 testing: Weekly lab PCR testing volume

PCR Tests by Lab, by Week



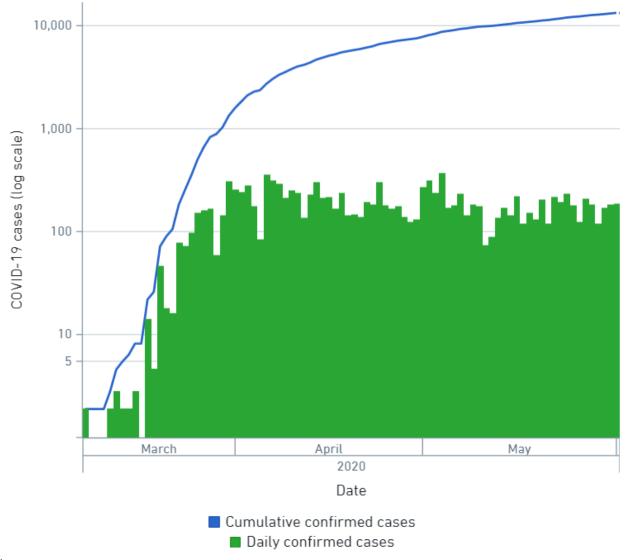
COVID-19 testing: Age distribution of PCR test results and volume

Cumulative PCR testing volume and results by age group



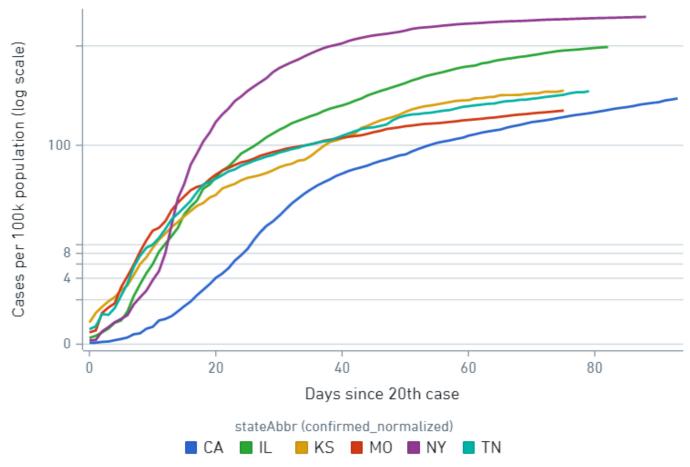
COVID-19 cases: Overview

COVID-19 cases in Missouri



COVID-19 cases: Missouri compared to other states (cases / 100k population)

COVID-19 cases by State -- days since 20th case (per 100k population)

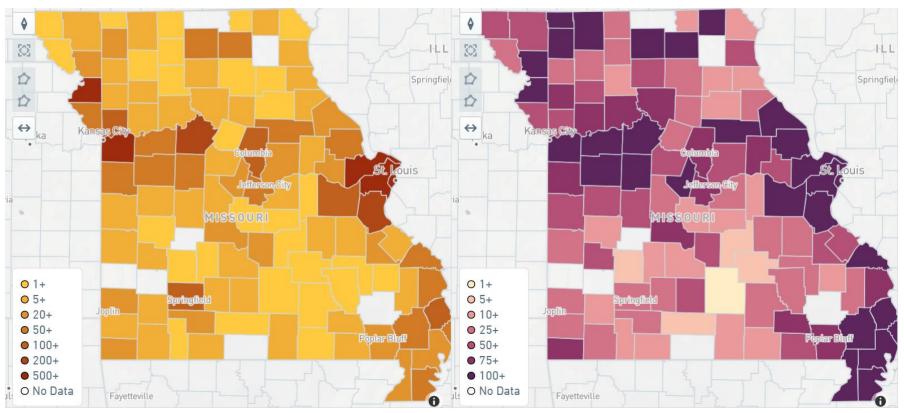




CASES AS OF 6/2/2020

COVID-19 cases: Cumulative by county

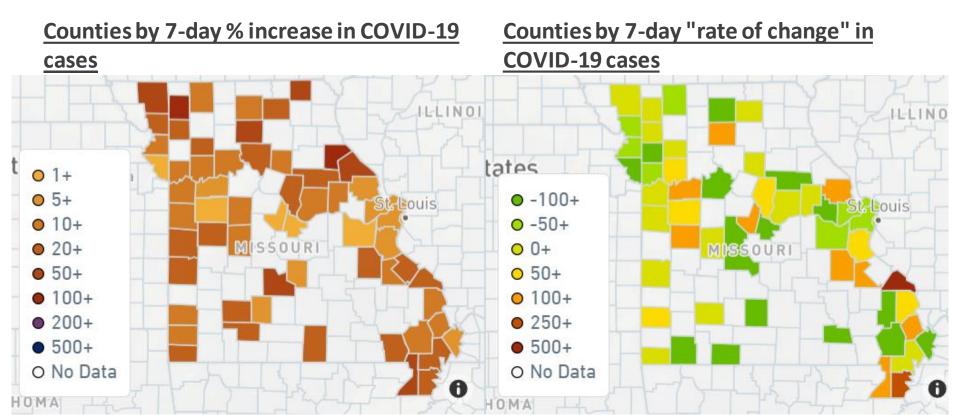
Total cases: 13,327 Cases / 100k population: 225



- 109 counties have 1 or more cases of COVID-19
- Total cases concentrated in St. Louis and Kansas City area
- Highest case count / 100k in Saline county (1,171), followed by Sullivan county (964),
 Buchanan county (800), and St. Louis City (604)

CASES AS OF 6/2/2020

COVID-19 cases: New case growth



Note: This table reflects only Counties that have at least five confirmed COVID-19 cases

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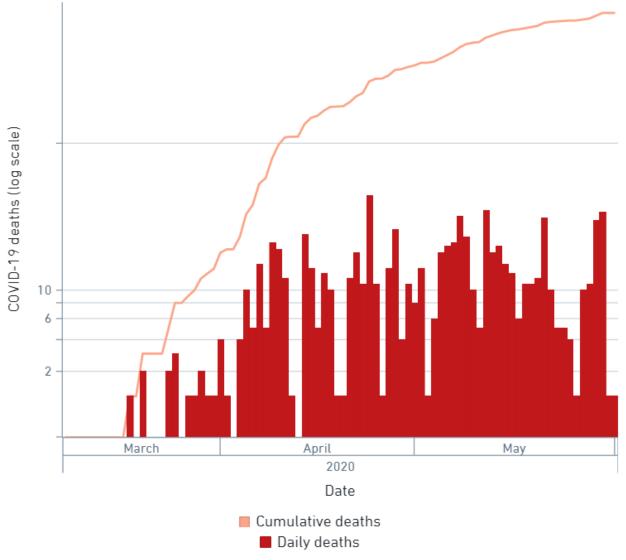
Note: The "7-day rate of change" reflects number of new cases in past 7 days relative to prior 7 days

(8-14 days ago)

VERY PLAN

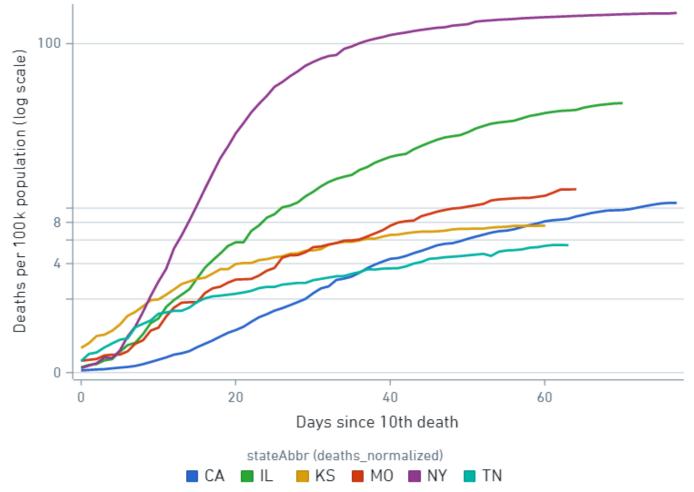
COVID-19 deaths: Overview

COVID-19 deaths in Missouri



COVID-19 deaths: Missouri compared to other states (deaths / 100k population)

COVID-19 deaths by State -- days since 10th death (per 100k population)



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.

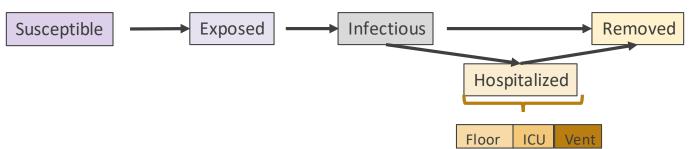
Regional COVID-19 transmission models help inform local policy, public health, and business decisions

- 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

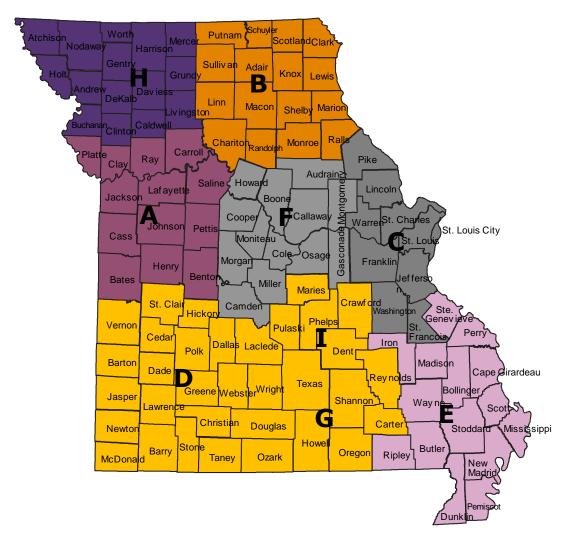
State of MO, WUSTL, and MHA have developed a regional model of hospitalized COVID-19 cases

- 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)



Projections were made for each Emergency Response region with sufficient data



- Low levels of daily COVID-19
 hospitalizations in the Northeast
 and Northwest regions limit the
 ability to generate projections for
 these regions
 - Northeast: Average of 4 daily confirmed or suspected COVID hospitalizations from 3/26 to 6/1
 - Northwest: Average of 17 daily confirmed or suspected COVID hospitalizations from 3/26 to 6/1
- Projections were made for all other regions

Greater Kansas City area (Region A)

Overview

Population: 1,395,314 # of COVID-19 cases: 2,721 # of COVID-19 deaths: 65 ICU Bed Availability*: 241 Medical / Surgical Bed Availability*: 1,051

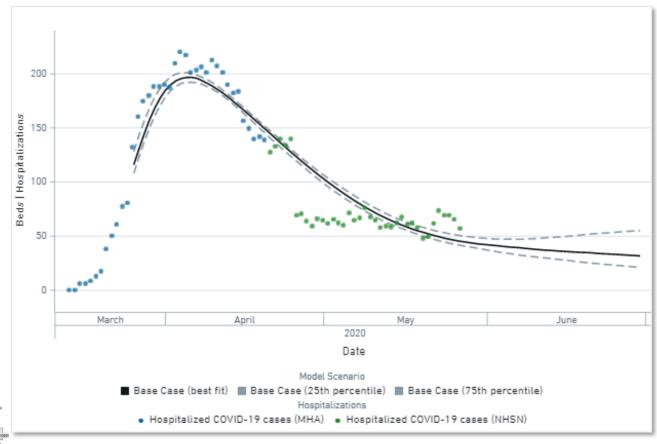
Reproductive rate

Pre-intervention: 2.77 ± 0.14

Today: 0.99 ± 0.13



Projected COVID-19 hospitalizations



Greater St. Louis area (Region C)

Overview

Population: 2,229,518 # of COVID-19 cases: 8,117 # of COVID-19 deaths: 660 ICU Bed Availability*: 212 Medical / Surgical Bed Availability*: 1,062

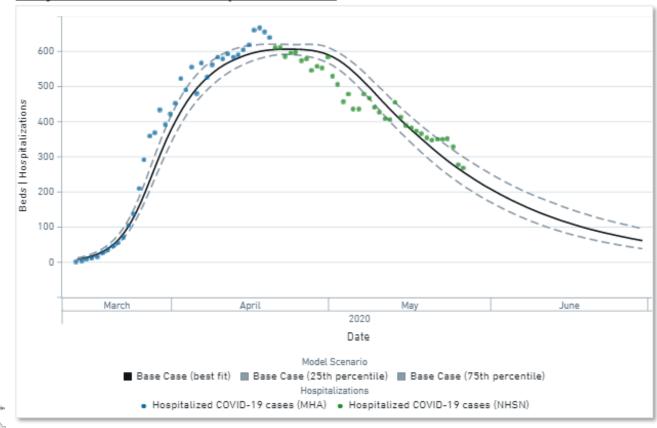
Reproductive rate

Pre-intervention: 3.38 ± 0.15

Today: 0.78 ± 0.10



Projected COVID-19 hospitalizations



Southwest / Springfield (Regions D,G, I)

Overview

Population: 1,221,847 # of COVID-19 cases: 409 # of COVID-19 deaths: 13 ICU Bed Availability*: 113 Medical / Surgical Bed Availability*: 430

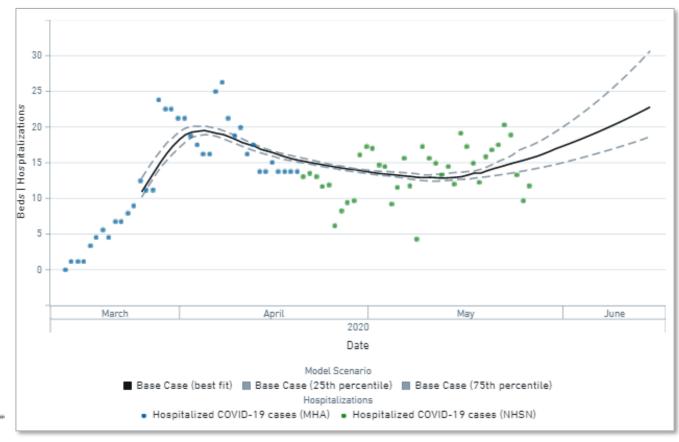
Reproductive rate

Pre-intervention: 2.33 ± 0.17

Today: 1.16 ± 0.10

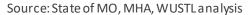


Projected COVID-19 hospitalizations



(*) Daily average during week of 5/26-6/1

Note: Due to low levels of hospitalized COVID-19 cases, modelling projections are highly sensitive to slight shifts in observed data and must be interpreted with extra caution.





Southeast / Cape Girardeau (Region E)

Overview

Population: 363,478 # of COVID-19 cases: 602 # of COVID-19 deaths: 24 ICU Bed Availability*: 48 Medical / Surgical Bed Availability*: 252

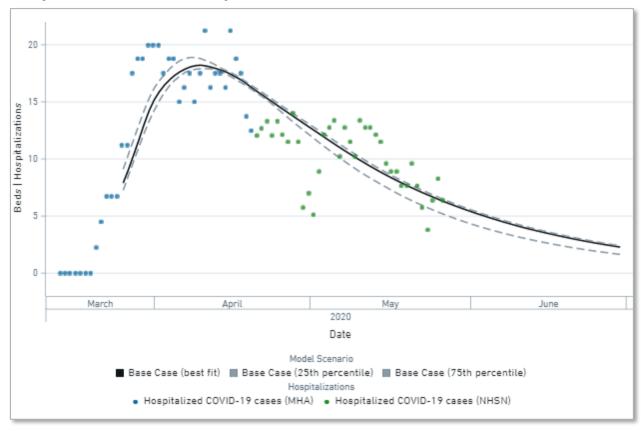
Reproductive rate

Pre-intervention: 2.61 ± 0.15

Today: 0.81 ± 0.03



Projected COVID-19 hospitalizations



(*) Daily average during week of 5/26-6/1

Note: Due to low levels of hospitalized COVID-19 cases, modelling projections are highly sensitive to slight shifts in observed data and must be interpreted with extra caution.





Central (Region F)

Overview

Population: 736,847

of COVID-19 cases: 453 # of COVID-19 deaths: 5 ICU Bed Availability*: 74 Medical / Surgical Bed

Availability*: 252

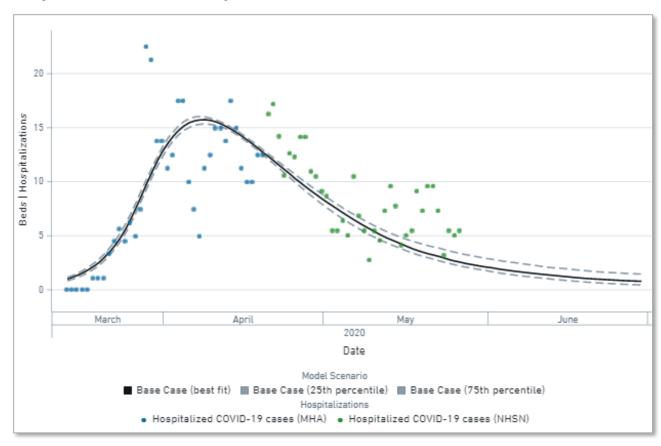
Reproductive rate

Pre-intervention: 2.26 ± 0.08

Today: 0.81 ± 0.11



Projected COVID-19 hospitalizations



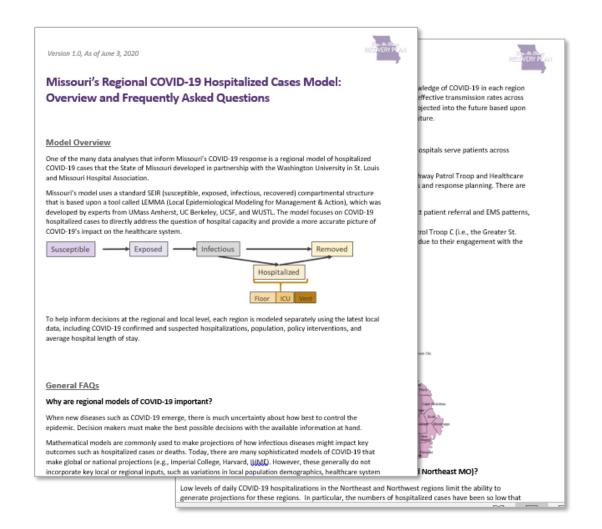
Note: Due to low levels of hospitalized COVID-19 cases, modelling projections are highly sensitive to slight shifts in observed data and must be interpreted with extra caution.





^(*) Daily average during week of 5/26-6/1

COVID-19 Regional Hospitalized Cases Model FAQs on DHSS website has further details



Appendix



Guidance on interpreting analyses – Syndromic surveillance



Chart: Daily total emergency department visits

What it tells you: Daily emergency department visits for all conditions across the state over time Why it's important: Shows day to day surges in emergency department visits (driven by acute and cyclical demand) as well as larger trends in demand over time

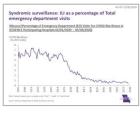


Chart: Missouri Percentage of Emergency Department (ED) Visits for Influenza-like Illness

What it tells you: Daily emergency department visits for Influenza-like illnesses as a percent of total daily emergency department visits across the state over time (symptoms include "fever", "cough", or "sore throat"). COVID-19 infected patients may report such symptoms

Why it's important: Shows how much of state-wide emergency department demand is being driven by Influenza-like illnesses

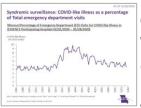


Chart: Missouri Percentage of Emergency Department (ED) Visits for COVID-like Illness

What it tells you: Daily emergency department visits for COVID-like illnesses as a percent of total daily emergency department visits across the state over time (symptoms include: "fever" and "cough" or "shortness of breath" or "difficulty breathing")

Why it's important: Shows how much of state-wide emergency department demand is being driven by COVID-19

Guidance on interpreting analyses – Healthcare system capacity



Chart: COVID-19 positive and PUI hospitalized cases by region

What it tells you: Shows daily confirmed and suspected COVID-19 hospitalizations over time; broken out by hospital region. Due to reporting lags, data from the most recent 24-48 hours often are underreported

Why it's important: Shows the demand placed on the hospital network by COVID-19 over time

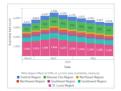


Chart: Medical and surgical bed availability by region

What it tells you: Shows medical and surgical bed availability across the state over seven day periods; broken out by hospital region

Why it's important: Gives insight into localized hospital resources across the state and how they have changed over time

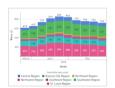


Chart: ICU bed availability by region

What it tells you: Shows ICU bed availability across the state over seven day periods; broken out by hospital region

Why it's important: Gives insight into localized hospital resources across the state and how they have changed over time



Guidance on interpreting analyses – Testing (1/2)

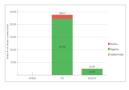


Chart: Cumulative test volume and results by test type

What it tells you: Shows overall testing volume and results by test type. Reports separately volumes for antigen testing, PCR testing, and serological testing

Why it's important: Shows volume of each of the primary types of COVID-19 testing in Missouri

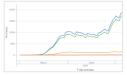


Chart: PCR testing volume and results, 7-day rolling average

What it tells you: Shows daily testing volume and results, smoothed over a 7-day period; each point on the curve represents the average volume of tests conducted over the previous seven days. Broken out into four curves (total tests in blue, negative tests in green, positive tests in yellow, unknown results in red). The 7-day rolling average is used to smooth out day-to-day variations in testing results. Due to reporting lags from some labs and for negative results, total testing volumes from the most recent 3-5 days often are underreported

Why it's important: Shows volume and results of tests over time normalized for weekend volume drops

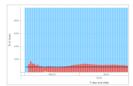


Chart: PCR positivity rate, 7-day rolling average

What it tells you: Shows breakdown of testing results over 7-day periods over time (% negative in blue, % positive in red, % unknown in yellow). Cumulative percent positive represented as a black line. The 7-day rolling average is used to smooth out day-to-day variations in testing positivity results

Why it's important: Gives indication of how testing results change over time; lower positivity rates suggest lower presence of COVID-19



Guidance on interpreting analyses – Testing (2/2)

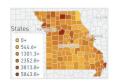


Chart: PCR tests by county per 100k population

What it tells you: Heat-map of cumulative tests conducted by county; normalized for population Why it's important: Shows concentration of where more and less testing is being conducted across the state relative to the population density of counties

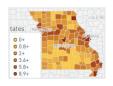


Chart: Positive test rate by county

What it tells you: Heat-map of PCR testing positivity rate by county

Why it's important: Shows concentration of where more and less PCR tests are returning positive

results by county



Chart: Weekly lab PCR testing volume

What it tells you: Shows testing volume conducted in bars over seven day periods; bars broken out by labs where tests are conducted. Due to reporting lags, total testing volumes from the most recent week are often underreported

Why it's important: Provides testing volume conducted by lab through time

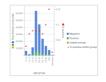


Chart: Test volume and results by age

What it tells you: Shows Missouri's cumulative testing breakdown by age with colored results (blue bars are negative results, green bars are positive results, yellow bars are indeterminate results); mapped against left y-axis. Also shows percent positivity for each age demographic (red triangles); mapped against right y-axis. Default states are CA, NY, TN, KS, MO, but states can be adjusted **Why it's important:** Shows concentration of testing and positive results by age group



Guidance on interpreting analyses – Cases (1/2)



Chart: COVID-19 Cases in Missouri

What it tells you: Shows the daily new case count (green bars) over time; also shows the cumulative number of cases (blue line) over time. Note – cumulative cases will be much higher than current cases as individuals recover from infection over time. Both data sets shown on a logarithmic scale **Why it's important:** Shows how the pandemic has grown over time at a state-wide level



Chart: COVID-19 Cases by State -- days since 20th case (per 100k population)

What it tells you: Shows the cumulative number of cases over time since reaching 'critical-mass' of various states on a logarithmic scale, normalized for population; Missouri shown as red line. Other states shown are CA, IL, KS, NY, TN

Why it's important: Shows how Missouri's COVID-19 case growth compares with other states on a relative basis



Chart: Positive COVID-19 Cases by County

What it tells you: Cumulative case heat-map. Darker counties have a higher cumulative case count **Why it's important:** Shows where the volume of cases has been highest over the course of the pandemic



Chart: Positive COVID-19 Cases by County (per 100k population)

What it tells you: Cumulative case heat-map; normalized for population. Darker counties have a higher cumulative case count

Why it's important: Shows where the volume of cases relative to the population of local residents has been highest over the course of the pandemic

Guidance on interpreting analyses – Cases (2/2)

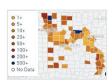


Chart: Counties by 7-day % increase in COVID-19 cases

What it tells you: Heat-map of seven day growth in cases by county compared to the previous week's cumulative case count; filtered to show only counties with at least 5 cases and at least 1% growth in cases. Minimum case count filter can be adjusted

Why it's important: Gives mid-term indication of potential outbreaks and hot-spot sustainment

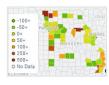


Chart: Counties by 7-day "rate of change" in COVID-19 cases

What it tells you: Heat-map of seven day 'rate of change' in cases by county, where 'rate of change' refers to the number of new cases in the past 7 days relative to prior 7 days (8-14 days ago); Negative numbers indicate slowing rates of growth; filtered to show only counties with at least 5 cases. Minimum case count filter can be adjusted.

Why it's important: Shows where case growth is growing and declining on a relative (to each county) basis over time

Guidance on interpreting analyses – Deaths



Chart: COVID-19 Deaths in Missouri

What it tells you: Shows the daily new death count (red bars) over time; also shows the cumulative number of deaths (orange line) over time. Both data sets shown on a logarithmic scale

Why it's important: Shows fatality impact on Missouri over time



Chart: COVID-19 Deaths by State -- days since 10th death (per 100k population)

What it tells you: Shows the cumulative number of deaths over time since reaching 'critical-mass' of various states on a logarithmic scale, normalized for population; Missouri shown as red line. Default states are CA, IL, NY, TN, KS, MO, but states can be adjusted in the parameters box (upper left hand corner)

Why it's important: Shows how Missouri's COVID-19 death count compares with other states on a relative basis

