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POLICY RESOURCE: Understanding, Measuring, and Controlling COVID-19 Spread in Missouri

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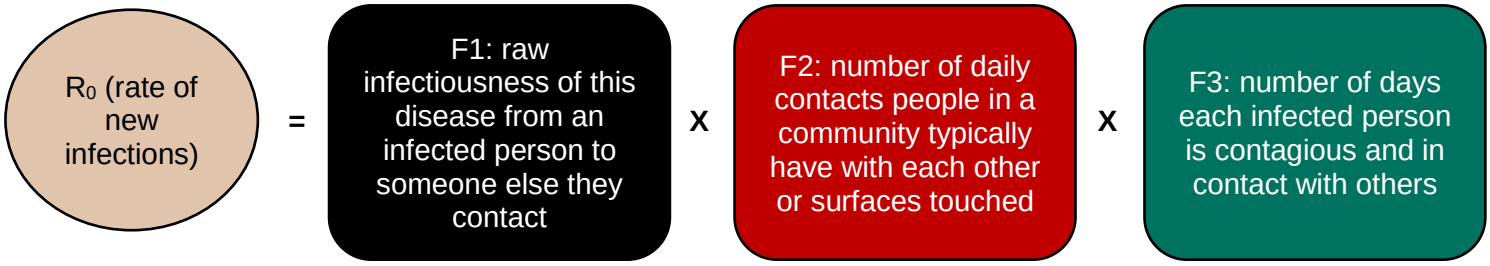
Introduction

As Missourians seek to understand the spread of COVID-19 and how it may be controlled, this document can be used by policymakers, key stakeholders, and interested citizens as a resource and tool. The amount of data and information circulating about the number of cases and spread of COVID-19 can make it difficult to assess the current status and plan policy responses. We have developed this document as a resource to explain key terms and concepts frequently used to describe the rapidly evolving situation.

Understanding How Quickly the Virus is Spreading

A fundamental equation from epidemiology explains the transmission of all infectious diseases and calculates the rate of new infections in a given area, the R_0 (often pronounced "R naught"). The R_0 is the result of a combination of factors that contribute to how quickly the virus is able to spreads through communities. The R_0 can be calculated by multiplying the raw infectiousness of the disease (F1) by the amount of interaction among people within a community (F2) and by the length of time that a typical person is contagious (F3) (Figure 1).

Figure 1. **Calculating the R_0 of Disease Spread**



The **first term (F1)** is the infectiousness of the virus itself. This number is specific to COVID-19, based upon how it travels (through the air, from others' coughs), and by its ability to survive outside a human body for several hours. The scientific community generally agrees on the infectiousness of the disease and has determined that is spread more readily than the seasonal flu. Stay-at-home policies and social distancing practices do not have an impact on this number.

The **second term (F2)** is the measure of the number of daily contacts people have with each other. This number is specific to communities and cultures and our habitual behaviors. In general, the less contact individuals have with others the lesser the spread of the virus will be in their community. It is the most modifiable by policies and has been the primary area of focus as policymakers look for ways to control the spread of the virus. Some of the policies that have been used in states across the US to reduce this number include:

- mandatory stay-at-home orders
- requiring businesses to implement social distancing measures including capacity limits
- requiring businesses to clean all surfaces with increased frequency
- requiring or recommending that everyone in enclosed public spaces wear a facial covering

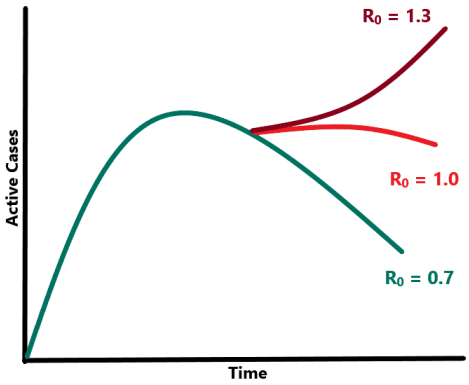
The **third term (F3)** is the number of days that each infected person is contagious and in contact with others. This number is in part dictated by the viral properties of COVID-19, which has a median infectious period of about 7 days. For those who develop symptoms, scientists estimate that 2 days elapse during which a person may be infectious without symptoms. Some people may be infectious without ever developing significant symptoms. However, policies may be able to significantly reduce the time period in which infected persons are in contact with others by:

- daily monitoring of symptoms for personnel in public-facing and high-risk settings
- frequent testing of personnel in public-facing and high-risk settings
- contact tracing of people who have tested positive
- requiring quarantine of all individuals identified as COVID-positive for 10-14 days

Measuring Our Control of the Virus Spread

Federal guidance on resuming state functions and gradually normalizing suggests that **it is necessary for us to choose a combination of policies and individual actions that keep the rate of new infections (R_0) below 1.** An R_0 of 1 or lower would indicate that our overall infection rate is holding steady or going down, while an R_0 over 1 would indicate that the overall rate of infections is rising and the spread of the virus is not under control (Figure 2). The only mechanisms currently available to government leaders and public health officials to control the spread of COVID-19 are policies that impact our interactions with others, and these policies are essential in keeping R_0 at 1 or lower and controlling the spread of the COVID-19 virus.

Figure 2. **Trajectories under Differing R_0 Values**



Even after Governor Mike Parson's stay-at-home order was implemented in Missouri, the absolute number of cases has continued to grow, as it is simply a cumulative total of cases in the state. Analysts instead look at the rate of change in COVID-19 cases. Comparing today's cases to a prior date can be misleading, as this percentage also inevitably increases over time. A better measure of the virus' current spread, which is a good short-run approximation of R_0, is to compare the most recent 7-day case growth to the case growth over the previous 7 days. By this method, the statewide R_0 has been approximately 1.05 over each of the last two weeks (Figure 2). If this rate continues, the weekly number of new infections will continue to grow. Any lessening of social distancing measures in Missouri (including the policies and behaviors detailed in F2 and F3 above) will likely cause R_0 to increase due to the increased number of interactions that people will have, therefore increasing the opportunity for the virus to spread.

Figure 3. **The Spread of COVID-19 in Missouri since April 12th**

	Total MO Cases	Weekly growth (Number of Cases)	Overall % Growth in Cases since April 12	% Growth in Cases from Prior Week	Ratio of New Cases to Prior Week's New Cases
April 12	4,159				
April 19	5,653	1,494	35.9%	35.9%	
April 26	6,961	1,308	67.4%	23.1%	0.876
May 3	8,344	1,383	100.6%	19.9%	1.057
May 10	9,796	1,452	135.5%	17.4%	1.050

The county-level statistics on the spread of COVID-19 vary across the state. In areas that are currently at a lower local R_0, and which have been able to control the spread within their communities, it is still expected that they would see an increase in spread and R_0 as the communities open businesses and public places. However, if the reopening of these communities is slow and strategic, and they are able to scale back if needed, there remains the opportunity to keep R_0 under 1 and the spread of the virus controlled.

Missouri Currently and Going Forward

Beginning March 23rd, many cities and counties throughout the state enacted stay-at-home orders; the governor declared a statewide order effective April 6th. In the past several weeks, significant numbers of other measures listed in the above bullets have been put into place. Efforts are ongoing to ensure that testing capability is commensurate with this demand. The strategy going forward is to gradually – and with constant monitoring of the data – attempt to shift the focus from the most restrictive policy to a combination of less restrictive policies.

Stay-at-home orders in combination with many other actions have resulted in a lowering of the statewide R_0, the rate of new infections, from about 2.5-3.5 new infections for each initial infection (the raw rate, without any intervention) to about 0.9 for the week ending on April 26th, but R_0 is now hovering at about 1.05 for the last two weeks. This explains Missouri's relative success in managing the disease so far. But Missouri's continued containment of the spread relies upon using a combination of other policies to keep the rate at or below 1. The State will rely upon several policies, as previously mentioned, but their efficacy will depend in large part on adherence by businesses and individual members of the public. As the State begins to allow businesses that were closed to reopen, and as people resume moving around and interacting more with others, it will be imperative that decision makers continue to monitor the spread of the COVID-19 virus and adjust policies accordingly when needed.