

Stochastic SIR-based Examination of the Policy Effects on the COVID-19 Spread in the U.S. States

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Abstract

Since the global outbreak of the novel COVID-19, many research groups have studied the epidemiology of the virus for short-term forecasts and to formulate the effective disease containment and mitigation strategies. The major challenge lies in the proper assessment of epidemiological parameters over time and of how they are modulated by the effect of any publicly announced interventions. Here we attempt to examine and quantify the effects of various (legal) policies/orders in place to mandate social distancing and to flatten the curve in each of the U.S. states. Through Bayesian inference on the stochastic SIR models of the virus spread, the effectiveness of each policy on reducing the magnitude of the growth rate of new infections is investigated statistically. This will inform the public and policymakers, and help them understand the most effective actions to fight against the current and future pandemics. It will aid the policy-makers to respond more rapidly (select, tighten, and/or loosen appropriate measures) to stop/mitigate the pandemic early on.

Keywords: Bayesian inference, COVID-19 pandemics, viral epidemiology, intervention analyses, mitigation strategies, SIR compartmental models