Synergistic interventions to control COVID-19: mass testing and isolation mitigates reliance on distancing

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Shutdowns of non-essential businesses and stay-at-home orders are powerful, but socially costly, tools to control the pandemic spread of SARS-CoV-2. Mass testing strategies, which rely on widely administered frequent and rapid diagnostics to identify and isolate infected individuals, are emerging as a potentially less disruptive management solution. In this research, we assess the extent to which mass testing and isolation strategies can reduce reliance on socially detrimental non-pharmaceutical interventions, such as distancing and shut-downs. We develop a multi-compartmental model incorporating both preventative non-pharmaceutical interventions (NPIs) and testing and isolation to evaluate their combined effect on public health outcomes. Our model is designed to be a policy-guiding tool that captures important realities of the testing system, including constraints on test availability and non-random testing allocation. We show how the characteristics of the testing system, including test availability, test delays, and test sensitivity, may inform the implementation of preventative NPIs to achieve desired public health outcomes in the future. Our analysis shows that strategic changes in interventions can achieve similar public health outcomes with less reliance on non-pharmaceutical interventions, and emphasizes the importance of identifying and isolating unreported, asymptomatic infections. Changes in NPIs, including the intensity of lockdowns and stay at home orders, should be coordinated with increases in testing to ensure epidemic control. Further, we consider how vaccination may affect NPI and testing capacity requirements, demonstrating the importance of maintaining these additional interventions through vaccine rollout. Importantly, our results can be used to guide ramp-up of testing capacity, allow for the flexible design of combined interventions based on social and political context, and inform future cost-benefit analyses to identify efficient pandemic management strategies.

1. What is your pathogen? Multiple options possible (e.g. if working on coinfections)
   Coronavirus : Yes

2. On a scale of 1-5 is your work mostly eco/epidemiological or evolutionary? 1 (100% eco/epidemiological)

3. On a scale of 1-5 is your work mostly theoretical or experimental/empirical? 1 (100% theoretical or experimental)