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Stochastic Optimal Control of Epidemic Transmission

Communication Info

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- (4) Stochastic maximum principle

Abstract

The primary aim of this study is to evaluate the impact of mask usage and active screening/testing in controlling the spread of COVID-19 once transmission has already begun. Unlike many works that prioritize costly measures such as travel restrictions or vaccination campaigns [1], this article highlights the often-overlooked role of basic interventions. To this end, we formulate a stochastic SEIR model that accounts for four compartments: susceptible, exposed, infected, and recovered individuals [2]. Two control variables are incorporated to represent mask-wearing and active screening/testing. By applying an adapted version of Pontryagin's maximum principle designed for stochastic systems [3], we investigate the optimal strategies for implementing these measures. The optimality system is solved using the Forward-Backward Sweep Method (FBSM) in combination with a tailored Runge-Kutta scheme for stochastic differential equations. Our findings indicate that, even after the onset of community transmission, the combined application of mask use and active screening/testing substantially reduces the numbers of exposed and infected individuals, thus providing a cost-effective approach for resource-constrained settings [4].

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