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Relative Efficacy of Resource Constrained Forward and Backward Contact Tracing in an Open Population

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Relative Efficacy of Resource Constrained Forward and Backward Contact Tracing in an Open Population

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We present a novel branching process model of disease spread in an open population (one which allows cases to arrive from outside the local community) with disease testing as well as forward and backward contact tracing. The local outbreak will never go extinct by chance due to the exogenous transmission. In the presented model contact tracing is resource constrained; not all cases identified can be contact traced and the probability of a case (found via testing) being traced decreases monotonically with the number of traced cases. Several well known diseases are used to parameterize the offspring distribution and for each disease we explore the relative efficacy of contact tracing as a non-pharmaceutical intervention (NPI). Relative efficacy is estimated by comparing to outbreaks with no intervention. Importantly, we show that testing and tracing does not guarantee a better outcome due to the stochastic nature of early disease spread. Additionally we discuss the the relative efficacy of a test and trace approach to NPI in terms of the disease parameters and the resource constraints.