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Estimating the Effect of Contact Tracing During the Early State of an Epidemic

Contact tracing is an important intervention measure to control infectious diseases. We present a new approach that tracks contacts in a randomly mixed population, which allow us to precisely model the contact tracing process. The model resulting from this new approach allows us to study the effect of contact tracing and isolation of diagnosed patients on the control reproduction number and number of infected individuals. However, we found that case counts alone during an early stage of an outbreak before susceptible population have been depleted is not sufficient to identify key contact tracing parameters such as coverage probability (the fraction of contacts successfully tracked) and testing rate. We need the reason that a patient is tested for diagnosis, i.e., whether they are quarantined and showing symptom, or voluntarily tested due to symptom, or contact tracing while showing symptom. We then apply our model to estimate the effect of contact tracing on the basic reproduction number and epidemic size in Ontario, Canada.