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Estimating epidemic coupling between populations from invasion times

Understanding the mechanisms by which diseases are transmitted between human populations is critical in any efforts to understand and predict widely-spread epidemics and pandemics. Modeling and parameterizing transmission between populations is a difficult problem, however, since the process of transmission is largely unobservable, and information about transmission between populations is usually obscured by local dynamics. We present a method for estimating coupling between two populations modeled as *susceptible-infected-recovered* (SIR) systems, where an epidemic begins with a single infection in one population and later spreads to the second population. We show that the strength of coupling between the two populations can be estimated from the time taken for the disease to invade the second population. Confidence in the estimate is low when observing only a single invasion event, but is increased if numerous independent invasion events can be observed. The method we present considers a simple scenario, but is valuable progress in developing and verifying methods for estimating epidemic coupling between populations in an ever more connected global human population.