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## Man bites mosquito: human movement and the urban epidemiology of vector-borne disease

Some vector-borne diseases, such as dengue, thrive in urban environments. Eradication and control are significant public health challenges. The mosquito populations of metropolitan areas may be heterogeneously distributed in patches of high and low density. These mosquito population patches may remain stable over time, but people travel frequently and extensively, often in highly structured patterns. Here we investigate the role of this type of human movement in the epidemiology of vector-borne pathogens. We use a metapopulation model in which mobile humans connect static mosquito subpopulations. We focus on the impact of the size distribution of the mosquito subpopulations and the variability in people's travel patterns. We assess how these factors determine the contribution of each population subgroup to the basic reproductive number, the maintenance of the endemic equilibrium and long-term disease persistence. We conclude that hubs and reservoirs of infection can be places people visit frequently, even if only briefly. A few patches with large mosquito populations can make a city vulnerable to disease outbreaks. Variability in travel people's travel patterns can reduce this vulnerability, but may also enhance the rescue effect and so increase the persistence of endemic disease. Successful public health intervention may require identifying areas with large mosquito populations and a form of contact tracing that maps the recent movements of infected people to pinpoint the mosquito subpopulation from which they acquired the infection, and those to which they may have transmitted it.