

Evidence for infectious disease modelling: how do people change their mobility in response to epidemics

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Mathematical modelling of infectious diseases epidemics is widely-used to forecast epidemics and the impact of interventions. However, the mathematical model of infectious disease has wide variation and the model behaviors are also varied largely. To obtain the practical insight, the evidence-based mathematical modelling is required. One of the difficult parts of infectious disease modelling is human behavioral change in response to the changing epidemic situation over time. Human behavioral change in terms of mobility can be change their infection risk directly, understanding the dynamics of human behavioral change is required to model infectious disease epidemics. However, the decision-making of mobility against the changing epidemic situation is difficult to estimate due to the availability of data. Human mobility change against epidemic is the result of decision-makings with time-varying epidemic situations in the past. The usual records of mobility related to the transmission records only the result of decision-making but not its timing, therefore, it is difficult to understand which epidemic situation changed human mobility. In response to this, we proposed the use of reservation data to analyze the relation between epidemics and host behaviors [1] because reservation and cancellation dataset record the process of decision-making. To analyze the relation between epidemics and host behaviors, we defined a measurement of host decision regarding mobility avoidance in response to epidemic, mobility avoidance index, and measured it using an accommodation reservation dataset. Analyzing the time-series of measured mobility avoidance index, we discovered the several laws of decision-making regarding their behavior for avoiding infection risk [2]. Furthermore, we analyzed

when human decide their future mobilities against outbreaks of infectious diseases. Mobility is determined by the accumulation of daily decision-making in response to the changing epidemic situation and the final update of decision-making is important to model their mobility in response to epidemic situation. To understand this, we compared mobility avoidance index with the human movement data during COVID-19 outbreaks recorded in the mobile phone location data. We constructed the model describing the relation between accommodation reservation and mobile phone location data and estimated the timing of decision-making for mobility during COVID-19 outbreaks. Reference[1] K. Ito, S. Kanemitsu, R. Kimura and R. Omori, Future behaviours decision-making regarding travel avoidance during COVID-19 outbreaks, Sci Rep, 12: 19780, 2022.[2] R. Omori, K. Ito, S. Kanemitsu, R. Kimura and Y. Iwasa, Human movement avoidance decisions during Coronavirus disease 2019 in Japan, J Theor Biol, 585: 111795, 2024.

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