Abstract

Modeling microbial exposures using time series of short contact events

Hands transport microorganisms through the environment, contributing to infectious disease transmission. This phenomenon is observed for enteric diseases, respiratory diseases, and nosocomial infections.   To understand the relative importance of this phenomenon, we typically rely on simplistic models of hand-surface interactions. For example, hand-surface interactions are frequently modeled using: 1) estimates of the probability that an event occurs (e.g., 10% chance a fomes is contacted by a hand), 2) a constant frequency of the contact event (e.g., a mouth is contacted by the hand 10 times per hour), or 3) a constrained sequence of events (e.g., a hand touches the surface, then the hand touches the mouth). Models rarely account for the sporadic and sequential nature of multiple individual contacts between hands and surfaces in the environment. To account for the full complexity of hand-environment interactions, we record people's activities using first person videography and convert – aided with Video Translation Software – the videography into a time series of individual contact events. Microbial sampling for fecal indicator bacteria on the person's hands and in their environment is integrated with the time series data to estimate microbial contamination of hands over time. The model is mechanistic, in that it estimates contamination as a function of individual contact events, and stochastic in that model parameters are randomly chosen from distributions obtained through literature review and/or expert opinion.   The model provides insight on the importance of rare – but high risk – contact events on hand contamination, and demonstrates stark differences in microbial transport across different settings and activities. Limitations and concerns with the model, as well as potential opportunities, will be discussed.