Stochastic dynamics with self-exciting factor for Monkeypox transmission

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1. Abstract

We develop a stochastic human-rodent compartment model for Mpox transmission that combines diffusion noise with Hawkes self-exciting jumps in the human infection dynamics. Including Hawkes processes allows, for instance, to model the short but significant spikes in transmission happening after crowded events. For the coupled human-rodent system, we prove global existence, uniqueness and positivity of solutions, derive a basic reproduction number R_0 that guarantees almost sure extinction when $R_0 < 1$, and obtain explicit persistence-in-the-mean conditions for both infected rodents and humans, which define persistence thresholds for the joint dynamics. Numerical experiments show how clustered human transmission events, environmental variability and control measures shift these thresholds and shape the frequency and size of Mpox outbreaks.

References

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