Paper ID:	1571067968
Paper Title:	Data-Driven Modeling of Seasonal Dengue Dynamics in Bangladesh: A Bayesian-Stochastic Approach
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Abstract

Bangladesh's worsening dengue crisis, fueled by its tropical climate, poor waste management infrastructure, rapid urbanization, and dense population, has led to increasingly deadly outbreaks, posing a significant public health threat. To address this, we propose a nonlinear, time-nonhomogeneous SEIR model incorporating seasonality through a novel transmission rate function. The model parameters are estimated using Bayesian inference with the Metropolis-Hastings algorithm in a Markov Chain Monte Carlo (MCMC) framework, calibrated with real-life dengue data from Bangladesh. To account for stochasticity and better assess outbreak probabilities, we extend the model to a time-nonhomogeneous continuous-time Markov chain (CTMC) framework. Our model provides new insights that can guide policymakers and offer a robust mathematical framework to better combat this crisis.