



## **"Tracking Disease Progression in Public Health: Advanced Markov Chain Models for Longitudinal Studies "**

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**Time: Noon - 1:00 PM**

**Room: LEC 303 or Zoom**



**Zoom**



# Research Seminar

## Tracking Disease Progression in Public Health: Advanced Markov Chain Models for Longitudinal Studies

**Dr. Joonha Chang**

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### Abstract:

Longitudinal studies are commonly employed for tracking disease progression in public health, but modeling them is notoriously difficult due to irregular patient follow-up times, varying numbers of observations, and dynamic risk factors that change over time. While non-homogeneous continuous-time Markov chains (NH-CTMCs) are uniquely equipped to handle the messy, continuous-time nature of this data, they remain heavily underutilized due to severe computational bottlenecks. In this talk, we address these hurdles by presenting newly derived, highly efficient 2-state and 3-state NH-CTMC models that bypass traditional mathematical restrictions to enable fast, exact inferences on disease transitions. We also extended this framework using latent modeling to capture hidden patient subgroups that may follow different clinical trajectories. To demonstrate the real-world utility of overcoming these longitudinal complexities, we applied our models to the Dietary Approaches to Stop Hypertension (DASH) study. We will illustrate how this framework well-quantifies the impact of dietary interventions on a patient's blood pressure progression, concluding with future directions for scaling these dynamic models for wider public health applications.