NME

Network Modeling for Epidemics

1

Network Study Designs & Data

Study designs determine what you can observe

Which determines what you can model statistically

… And what you can't

Network data

Two key aspects to consider

- Network properties
  - ***Domain***: what type of network data is this?
  - ***Temporality***: cross-sectional or longitudinal measurement?
- Measurement properties
  - ***Sample***: what is the population of interest, and how was it sampled?
  - ***Instrument***: how was the information collected?

1. Domain *(Network properties)*

- Human social networks
  - Links can be contact/exchange/affect/role-based/genetic
  - Multi-level designs can include persons and places
- Animal networks
  - Links can be contact/movement/genetic
  - Multi-level designs can include animals and places
- Institutional networks
  - Links can be persons! (e.g., hospital transfers)
  - Or goods/money/etc.

2. Temporality *(Network properties)*

- Cross-sectional designs collect data at one time point
  - This does not prevent you from collecting retrospective data
    - For example, on the start and end of a previous partnership
  - So this can be used this for dynamic modeling
    - If durational information is collected

- Longitudinal designs collect data at more than one time point
  - Panel designs vs. continuous measurement
  - Open vs. closed cohort

3. Sample *(Measurement properties)*

- A **network census** is data on every node and every link
- Network sampling designs include:
  - Adaptively sampled networks
    - Link tracing designs (e.g., snowball, random walk, RDS)
  - Egocentrically sampled networks
    - Enroll population sample (“egos”)
    - Ask them about their partners (“alters”)
    - Optional: ask ego to report on alter-alter ties
  - Convenience samples
    - For example, online social networks

4. Instrument *(Measurement properties)*

How are your data collected?

- Traditional designs
  - Interview (for humans)
    - Interviewer administered (face-to-face or T/CAPI)
    - Self administered
  - Passive observation and recording (for other types of nodes)

- Electronic passive capture
  - Scraping (web data)
  - Sensor data

What network statistics can you observe?

- Degree
  - Mean degree
  - Degree distributions
- Nodal attributes
  - Types of nodes
  - Heterogeneity in degree by nodal attributes
  - Mixing by nodal attributes
- Triads
  - And all of their possible configurations
- Larger configurations (which ones are of interest?)
- Timing of ties
  - Start/End
  - Duration of active and completed partnerships
- Other attributes of ties
  - Type
  - Intensity
  - Direction
- Multiplexity
  - Multiple tie types joining nodes

Next module

Statistical Models for Networks – Theory

- Principles of statistical inference with network data
- Static models: ERGMs
- Temporal/dynamic models: TERGMs