

**Title**: An agent based approach for modeling dynamics of contagious disease spread

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**Journal**: International Journal of Health Geographics, 5 August 2009

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**Summary**:

* Background
  + Analyze infectious disease over spatial and temporal domain
  + Classic epidemic spread models fail to model spatial aspects and effects of individual behavior
  + Agent Based Modeling
    - Each agent is an individual
    - Spread of communicable disease in urban environment using GIS
    - Disease diffusion through human contact
* Methodology
  + Implemented with Repast Simphony and Java Libraries, 4 georeferenced inputs
  + Adopted the Susceptible-Exposed-Infections-Removed (SEIR) model
  + Assumes that recovered individuals cannot be re-infected
  + Assumes movement is either stationary (home, school, workplace) or mobile (commuting through public transit)
  + Every individual has an infectious perimeter, in which other individuals can be infected
* Results
  + Simulated in Burnaby, British Columbia, Canada for a large measles outbreak
  + Ran 4 scenarios with various starting numbers of infected individuals and time periods
  + Also ran scenarios with changing rates of infection, based on population density
    - Change in infection rate seems to have little effect on results
  + Ran scenarios with changing time spent on commute, work, and leisure activities
    - Little effect on results
* Conclusions
  + Pros:
    - Successfully generated various scenarios of an outbreak
    - Realistic geographic urban settings
    - Incorporated movement in the agent entities
  + Cons:
    - Simulated in a closed population, agents could not leave the area
    - Infection rate was based on population density, lacking social network implementation
    - Did not incorporate possible interventions/vaccines/protocols
    - Many typos!

**Discussion Questions**:

* + General Thoughts:
  + Lack of attention to infection rate among families
  + What was noteworthy about this paper?
    - Combining geographic aspects with disease spread is very new
    - Methods were easy to understand
    - Illustration of using software to model infection spread through a city
  + How should time lags/latency periods be incorporated into our models?
    - Is it necessary for heroin addict models?
    - Built into the addiction score as a random variable instead of a fixed lag
  + Sensitivity analysis was too simple
  + Incorporating different types of agents with varying risk would have been more useful than changing commute/work/leisure time
  + Population assumptions were not realistic
* Quality of the Paper:
  + Translation was poor, awkward language
  + Easy to follow otherwise, good flow
  + Explanations were clear
  + No Aha! Moments
  + Expository, case study paper
  + Would have been nice to see computation times

**Thoughts on Our Related Work:**

* We may want to write a similarly styled paper for our theoretic work
* Repast Simphony software looks interesting
* Modeling burst of opioid activity in small towns across America
  + Would require ethnographic study, analysis of social networks
  + Could such a specific model be projected onto other states?
  + Study the brain influence/psychological background in order to generalize the model
  + Do we need to understand the social framework in order to extrapolate the parameters?
* Would it be useful to incorporate geographic data for the location allocation model?
* Opioid Agent Based Model
* Geographical Networks
  + - Neighboring counties based on traffic patterns
  + Multi-Layer Agents: users and suppliers
    - Vectors of heroin/opioid use
    - Financial component of selling heroin, does the model need to account for market forces?