

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

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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?