National Infrastructure Simulation & Analysis Center

EpiSims - Public Health Sector Management Tool

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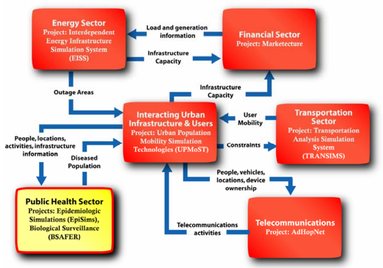


EpiSims

Public Health Sector/Consequence Management Tool

Developing and deploying advanced technology to analyze interactions between public health and other urban infrastructures such as:

- ***Water and Food Distribution***
- ***Communications***
- ***Energy***
- ***Transportation***

Satisfies the following requirements:

- ***Enables exploration of a wide range of response strategies***
  - ***Feasibility, including demands on***
  - ***Consequences across a realistic social network***
- ***Provides results quickly***
- ***Operates at the scale of large urban areas***

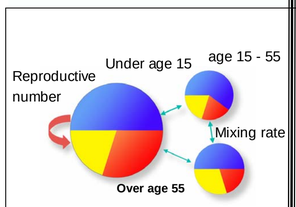
Unique Technology

Conventional Model:

- ***Ordinary rate equations***
- ***A few demographic categories***
- ***Assumptions about subpopulation mixing***
- ***Reproductive numbers not directly observable***

EpiSims:

- ***Individuals interactions***
- ***Full census demographics***
- ***Contact rates independently calculated***
- ***Reproductive number emerges from simulation***



Age	30	28	5
Income	$26K	$22K	$0
Status	worker	worker	student
Car	1	1	0

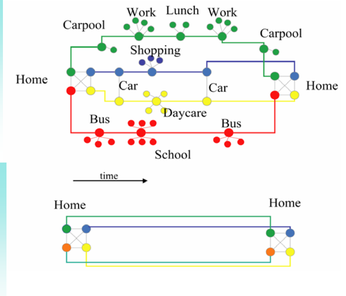
What is EpiSims Good For?

1. ***Assess mitigation strategies***
2. ***Identify demographic / geographic critical paths for disease spread***
3. ***Support tabletop exercises***
4. ***Evaluate logistical support required for responders***
5. ***Determine optimal sensor deployment***
6. ***Develop requirements for effective vaccine***
7. ***Provide decision support for medical surveillance systems***

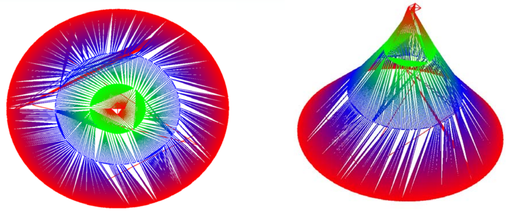
Approach: Individual-Based Simulation

Synthetic people go about their daily activities, coming into contact with others at particular real locations in the city.

People's activities change depending on their state of health, awareness of risks, and public health policy decisions

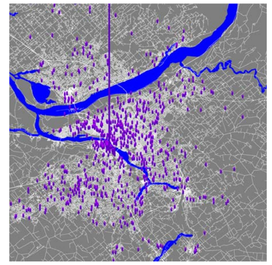


Contacts among people form a social network. Here is part of one such network - contacts of a family of four (inner, topmost red circle), contacts of those contacts (green circle), etc.



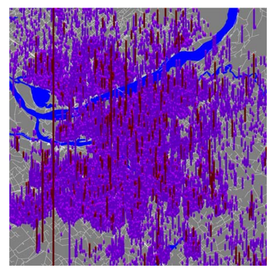
In EpiSims, disease spreads through the social network from synthetic person to person at rates depending on demographics of the people, duration of contact, and type of activity during contact. Traditional models replace these networks with uniform, regular structures and remove all demographic information.

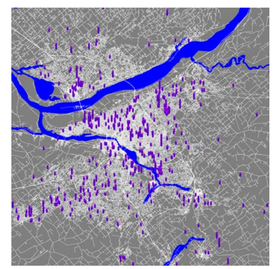
Typical Results

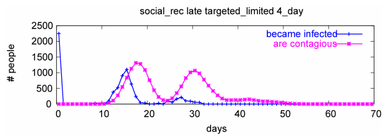


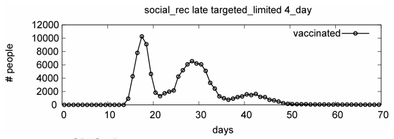
Geographic distribution of exposed 4 hours after a smallpox attack

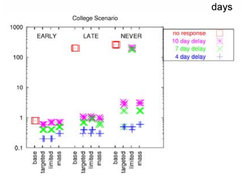
Distribution of infected (purple) and contagious (red) after 40 days: no response (above) ortargeted vaccination (below)











Assessing response strategies, comparing casualties under various policies and delays in implementation.

NISAC's core partners are Sandia National Laboratories and Los Alamos National Laboratory.
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