The Impact of Smallpox Bioterrorism and Possible Responses

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> Team 150 Taos High School

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Executive Summary:

Bioterrorism is a potential, often unlooked for, threat. It has the capability to kill vast numbers of people in relatively short periods of time. The problem is that since bio-attacks are unexpected it is largely unknown what exactly would happen in the event of such an attack. To solve this problem it is necessary to model the problem in a computer simulation. The simulation would generate a hypothetical city in which an attack by bioweaponry occurs. Using the data from the model, an emergency response system could be prepared by the Centers for Disease Control.

Problem Statement:

Bioweaponry, now mostly out of date, can still be a devastating weapon to a population of organic beings, depending on the type of weapon, the chemical agent used therein, and the population it is used on. The problem is to create a model of a city stricken by an attack via smallpox.

Method:

To solve the problem we created a working Susceptible-Colonized-Infected-Recovered (SCIR) model showing the death rates and the spread of the disease using a NetLogo simulation. In an SCIR model there are four states that can describe each agent. First, the agents can be susceptible, meaning that they can be infected. Second, colonized means that the agent is infected, however, the disease is in its incubation phase and no symptoms are visible. Infected simply means the person is infected with the disease. After this stage the agent will either die or recover. When recovered they can not be reinfected.

For the project we created agents that center around common places where there is a

large concentration of people and create a means of transmission that will spread the smallpox across the agents and will include a death rate that will be one of the outputs of the simulation. We used smallpox statistics including incubation time, infection rate, death rate, and types of transmission to make our model fit the actual virus as closely as possible. We created a working SCIR model to simulate the effects of a bioweapon agent, smallpox, on a hypothetical human population, a city of our own creation. We modeled the effects of this bioweapon on a simulated civilian population to see if there is data to collect on the subject that can help in the medical field. Smallpox is no longer present in nature, but samples of it have been kept in laboratories for research purposes, which has led to theories that it could someday be used as a biological weapon. There is no cure or treatment for the virus, which makes it an ideal disease to use in our model and studies.

Verification and Validation:

Based on data collected concerning the smallpox virus our model can be considered invalidated. Our results do not match those of historical events. Likewise it does not perfectly simulate a city environment nor does it successfully replicate the propagation of smallpox. Realistically, a smallpox epidemic would spread primarily via relationships and to some extent through locations with considerable human contact. Our model currently spreads through human interaction.

Conclusion:

The purpose of this model was to recreate the spread of smallpox through a city environment. At this task it was unsuccessful. It modeled an unrealistic city with an unrealistic approximation of the smallpox virus. The experimentation did not solve the problem, it merely served as an educational tool. If this model were to be redone it should be done using a more accurate city model and virus spread patterns.

Products:

There were no products from this experiment as the results were invalid.

Achievement:

We learned a lot about code, syntax and modeling as well as the sheer complexity of the real world. We feel like we have gained considerable experience in scripting as well as the concepts involved in modeling. The supercomputing challenge has helped us towards a more complete understanding of the programming and use of the computers.

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Results:

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