Public Policy and Managing Bioterrorism

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The purpose of this research is to illustrate the possible effects of bioterrorism attacks on a population through the construction of mathematical models. The data created by these mathematical models will allow one to observe the potential harmful effects of bioterrorism, and the impact of various possible public health policy decisions.

RATIONALE AND SIGNIFICANCE

The potential for a bioterrorist attack is significant, and this type of information will provide authorities and public health officials with predictions of possible outcomes dependent on the policy procedures that are chosen and implemented.

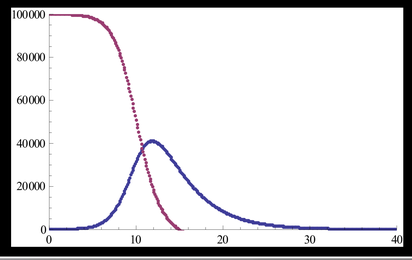
METHODS

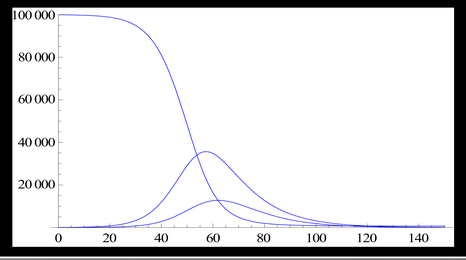
This research chose to model the smallpox virus, the avian flu, and the swine flu as potential bioterrorism agents. The mathematical models are SIR types of models that compartmentalize individuals in a closed population into various subpopulations such as susceptible(S), infected (I), and removed (R). Through the use of differential equations, mathematical models can be created to simulate the effects of an infectious agent on a closed population that mixes homogeneously. The study used SIR and SEIR models that included vaccination rates, removal rates, and incubation periods. The data was also used to calculate the reproductive ratio of each agent, determining whether or not an epidemic would occur in a population.

RESULTS

The results of this research showed that the number of initially infected individuals had little effect on the severity of the outbreak. Both the removal rate and vaccination rates can be used to reduce the maximum number of individuals infected. The vaccination rate had the largest influence on reducing the infected individual, and all three infectious agents produced a reproductive ratio that indicated the potential for an epidemic to occur in the population.

SIR and SEIR Sample Graphs



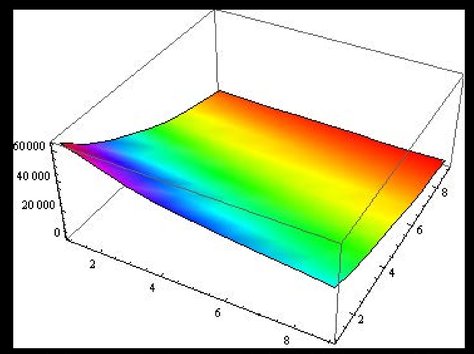


Reproductive Ratios

Agent	N	β	r	R_0
Smallpox	100,000	.00001	.9	1.11
Influenzas	100,000	.000014	.9	1.56

Removal vs. Vaccination Rates

Maximum Infected



Removal Rates

Vaccination Rates

Influenza Outbreak with Initial Infected of 25

CONCLUSIONS

The mathematical modeling of the smallpox virus, avian flu, and swine flu shows that these potential bioterrorist agents could be devastating to a population, resulting in an epidemic. Measures such as vaccination and removal policies must be implemented by public health officials in order to control an outbreak of this nature. Proactive policies, such as vaccinations, are shown to be most effective in minimizing the harm to the population. However, a combination of both proactive and reactive measures should be implemented in order to majorly reduce the number of infected individuals. Government and state officials need to take the proper steps in beginning to further prepare populations for attacks of this nature.