EBOLA OUTBREAKS WITHIN POPULATIONS

Gadsden Middle School

Team 31

Starlogo- Programming language

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Ebola has come under great scrutiny since it has crossed continents. It has been studied for decades, with the first case occurring in Zaire in 1976 (Democratic Republic of the Congo - DRC). This outbreak occurred in Yambuku and surrounding area. The disease was spread by close personal contact and by use of contaminated needles and syringes in hospitals/clinics. There were 318 infected and 88% death rate. Currently, according to Chowell-Puente, the death rate from Ebola is at 50%. This is due to the understanding of how the disease is spread and more care taken at hospitals and clinics. This was used mathematically in our model. Fifty percent of those infected will die. The other half become immune.

The symptoms of Ebola vary symptoms start between 2 and 21 days the symptoms are fever, muscle pain, headache, and sore throat. The later symptoms are vomiting, diarrhea, rash and, kidney, and liver problems. There can be internal and external bleeding. People with symptoms must be diagnosing by hospital test. People are monitor for 21 day to prevent the spread of Ebola.

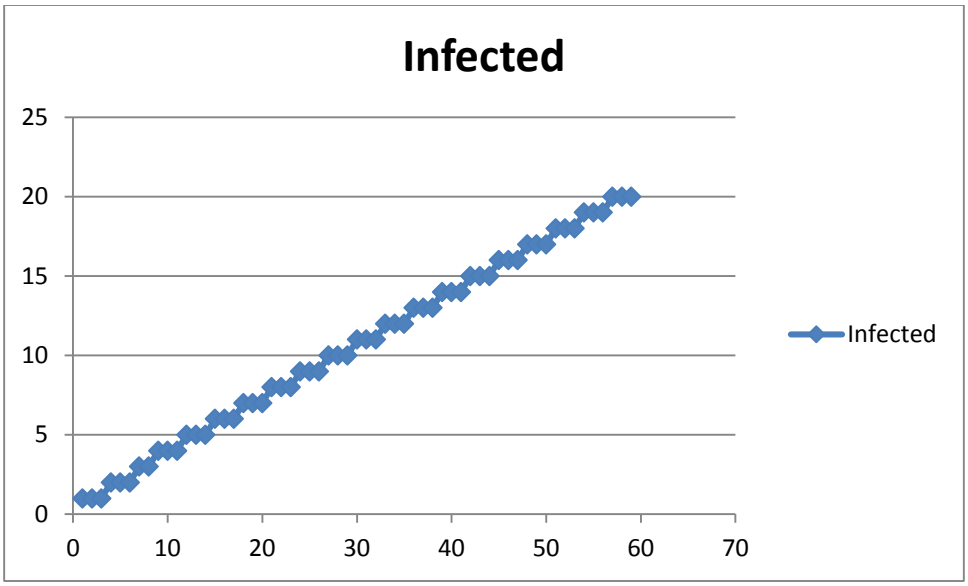
The key to slowing the spread of Ebola is tracking of those exposed. The monitoring of animals exposed to Ebola is also important. Health/care workers must make sure patients are in isolation and take precautions with infection control. In Africa, burial ceremonies are the main cause of transmission. People remain infectious as long as your blood and body fluids contain the virus, up to seven week of recovery.

According to Michaeleen Doucleff from public heath, the number of people that one sick person will infect is 2 before he dies or recovers. There are vaccines being developed from the blood of patents that recovered from Ebola.

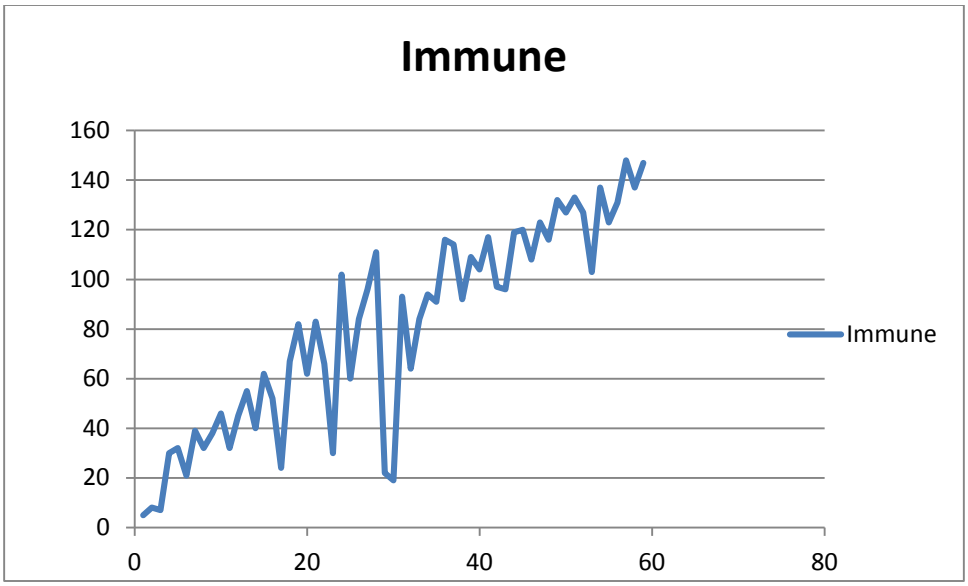
EBOLA- PROJECT

Our project is about the transmission, death rate, and recovery rate from Ebola. We took to account the recovery rate is fifty percent, the death rate is the other fifty percent. An agent that becomes infected in our model will randomly infect 2 people before they become recovered or die. This models the transmission rate we researched

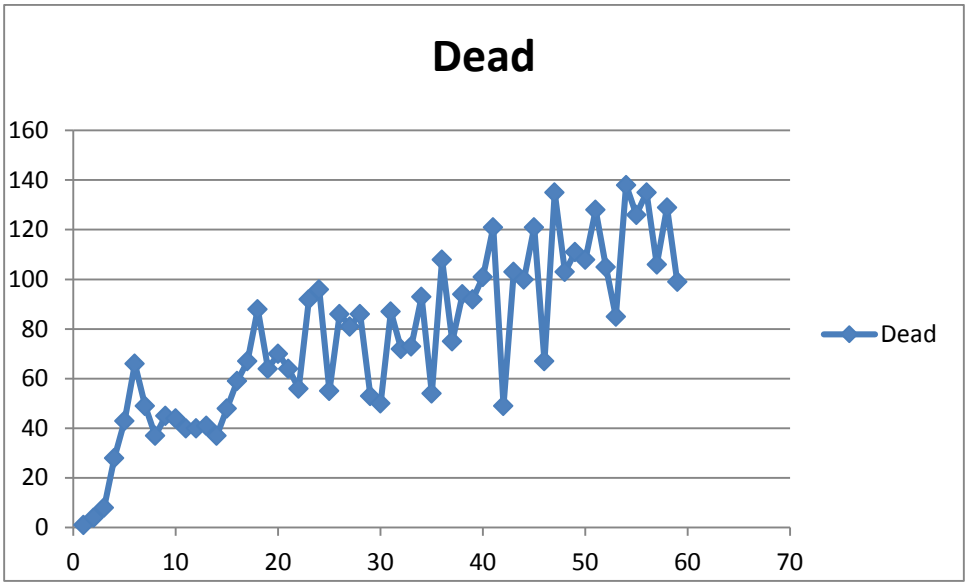
The infected agents were the control part of the model. We ran the model three times for the same number of infected agents, starting from one person infected up to 20 people infected within a population. There is a slider to see if the model exponential infection rate changes within a bigger or smaller population. We worked within a population of 400 healthy per square 100 mile radius, since the population is in "Spaceland", which each square patch will represent a square mile.



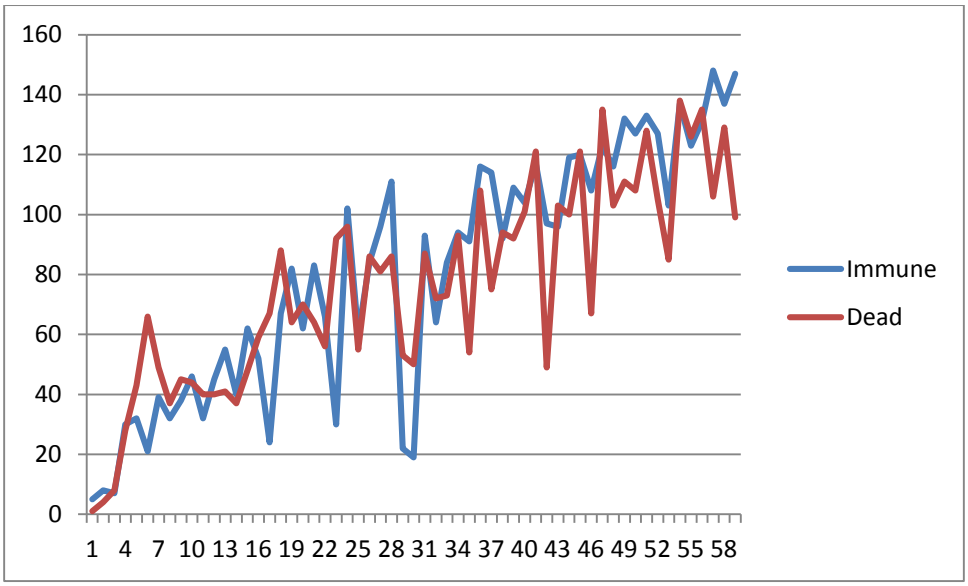
The biggest fluctuations between numbers of immune or those that died occurred when there are 10 to 15 people infected with in a population of 400 people. This is where the exponential rate of infection is most “unstable”, with less becoming immune. The amount dying seems to be increase more predictably, even though the program allows that fifty percent of the people that become infected will become infected, the other fifty percent become immune.

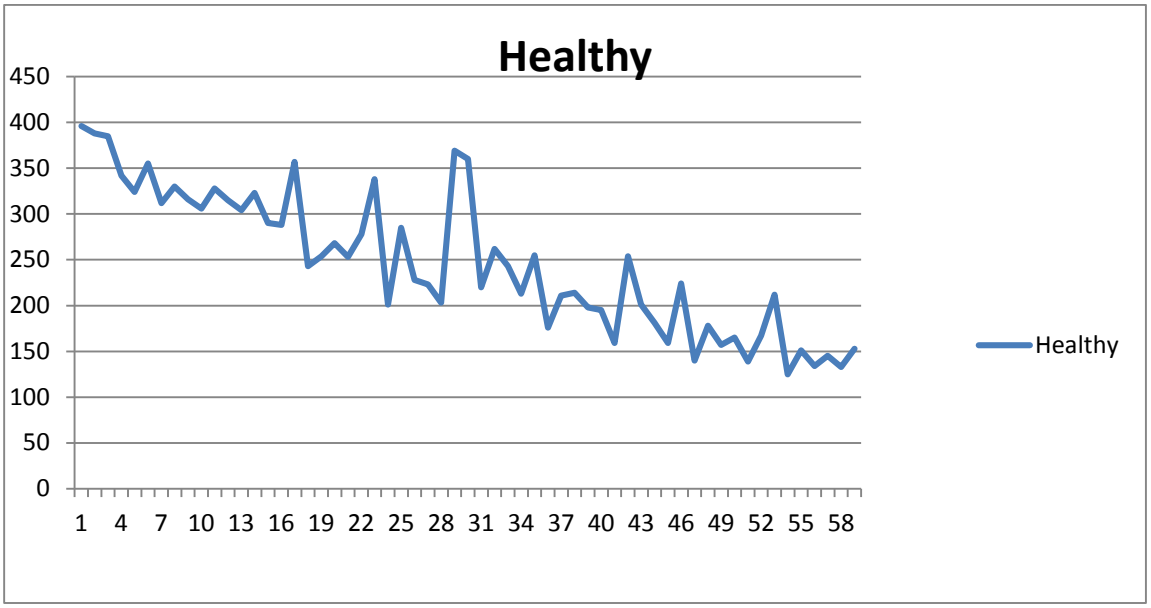


The biggest fluctuations between numbers of immune or those that died occurred when there are between 14 and 17 people are infected. This is where the exponential rate of death is “unstable”



When the data is plotted on a line graph, an observer will see that the effects are linear with, some areas where there are between 10 and 15 infected people, within a population of 400. There are slight variations before that number and after.





The linear rate of healthy decreases as the amount infected increases (understandably: very predictable). But the areas where the linear rate of infection is most "unstable" or non-linear is when there are between 16 and 28 agents infected.

The experiment was to find out if there was a point where the number of infected, immune or healthy is not increasing exponentially, or that they would the determined number of an outbreak of Ebola in a country. This model would have to run under the strain of Ebola in Sudan, which represents that fifty-three percent of the population will die from the infection. There are different strains and fatality rates.

The definition of an "outbreak is the occurrence of more cases of a disease than normally expected within a specific place or group of people over a given time." (Koo 2014). The model could not be run on a specific assigned number to determine outbreak. The outbreak must be in the areas that the data became unstable, beyond the amount expected. Under this information, the amount of infected that would be considered an outbreak must be when there are between sixteen and twenty-eight infected.

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