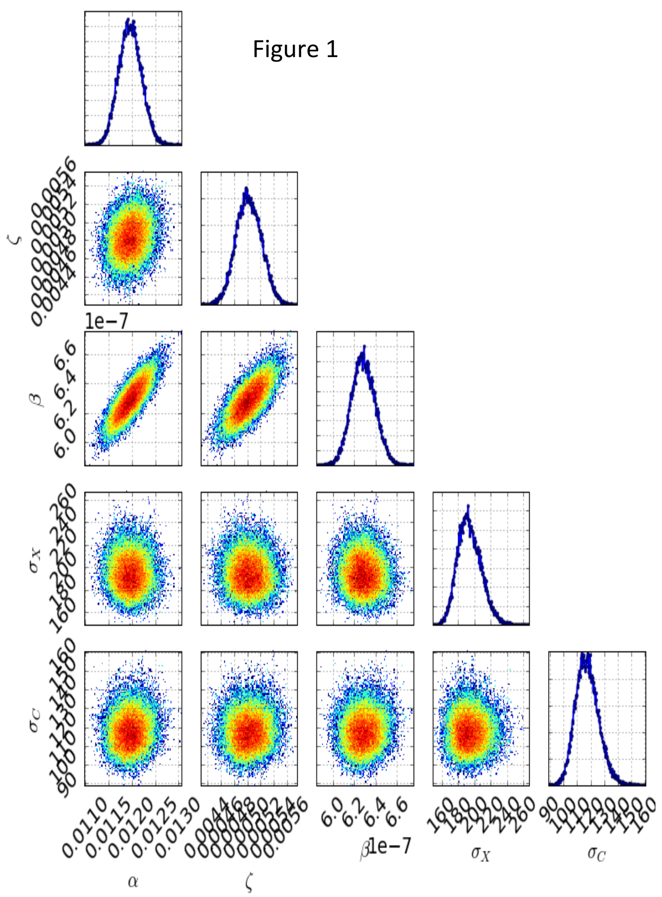
Sierra Leone & Guinea Cross Country Comparison



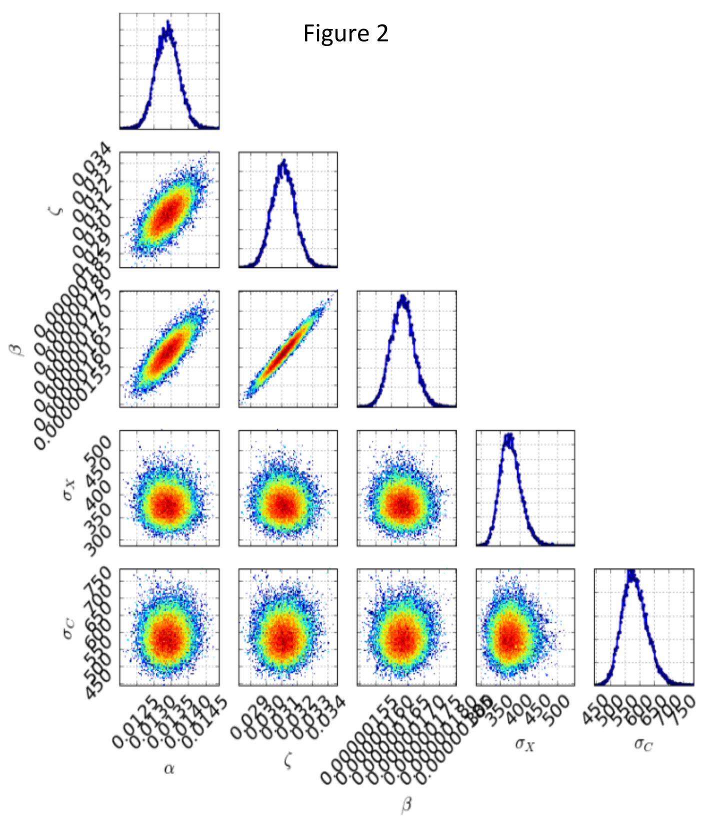


Figure 1 Denotes Correlation for Guinea | Figure 2 Denotes Correlation for Sierra Leone

A cross country comparison shows that Guinea had a fewer number of cases and deaths. In addition possessing a lower death rate than Sierra Leone for the given number of cases. However, Sierra Leone had a much closer uncertainty in regards to it's recovery rate. The circular patterns indicate variables that are not correlated, while the oval shapes show increased correlation. These The high correlation between infection rates and recovery rates indicate that the S0 model could be a better estimation (smaller uncertainties). As expected both recovery and death rates were positively correlated with infection rates. The results stick with scientific theory, such as death rates should not be correlated with recovery rates. They are both exits to the system that don't interact with one another.

The data posed some interesting results in respect to initial number of deaths and cases. Having initial levels of both outcomes shows the lag in the response to the outbreak at t0. A simple fix in the approach, but alters the rates at which deaths occur. Latent infection in developing countries can have disastrous effects due to the developing worlds resources to stop infection. Both countries experienced steady increase in the number of cases, but spikes in death rates caused estimation to be harder. This would indicate that a lack of preparedness can be drawn from the spikes. After these large spikes the recovery rate was able to keep the change in deaths down. However, early intervention prior to t=150 for Sierra Leone could have reduced the spike in deaths significantly. Population density and time it takes to react to such epidemics can also account for differing death rates and number of cases between countries.

Ebola Outbreak: An Epidemic Model

Reid Blouin May 3rd, 2016

Epidemic Model

Epidemic models provide insight into many infectious diseases. The use of empirical models allows us to draw conclusions from infection rates to predict interaction effects. Epidemic models use disease dynamics to describe (SIR). Susceptible, infected and recovered. Attaching parameters to subgroups to explain infectiousness *(β)* and recovery *(ζ)*.

$$S' = -\beta SI$$

$$I' = \beta SI - \zeta I$$

$$R' = \zeta R$$

Similar to predator-prey dynamics, SIR models deal with interacting terms in which each subgroup benefits from an interaction and the other is hindered. In my model the Susceptible population is effected by an infection rate. The goal of such implementations is to help understand the rate at which a population moves through an infected system and the resulting effect on the population.

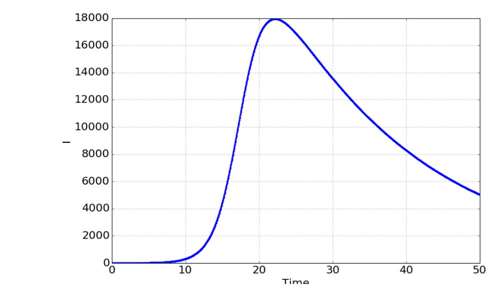
Goals of this Paper

In this study, I address how a modified SIR model can be used to model the outbreak of Ebola. My data set includes total number of cases and total number of deaths in ten countries (1). Figure 4 shows an initial pyndamics implementation of graphical representation. I hope to explain the relationship between the number of cases and the number of people who have died. Using this data I will attempt to explain the relationship between infection, death and recovery. A cross country comparison will allow me to examine the difference between countries in respect to death, infection, and recovery.

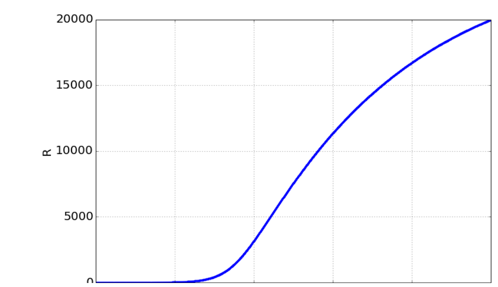
I would also like to include that my reasoning behind researching this topic is due to my sister. She is currently leading education trips that focus on vaccination in developing countries. It is an extremely important task and the benefits to society are truly amazing. –Reid

1.) Italy, Guinea, United States of America, United Kingdom, Nigeria, Senegal, Mali, Sierra Leon, Spain

http://docs.hdx.rwlabs.org/west-africa-ebola-outbreak-visualization/



1.)



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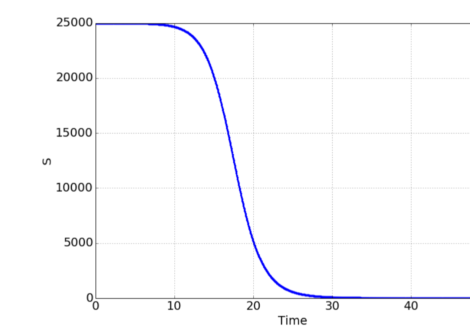

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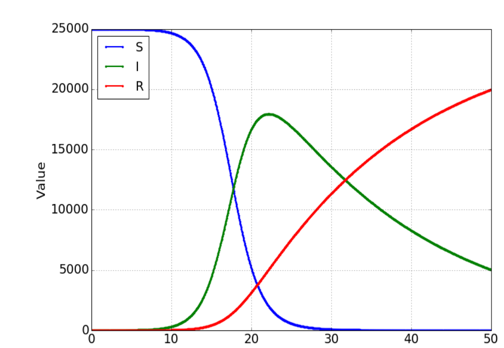


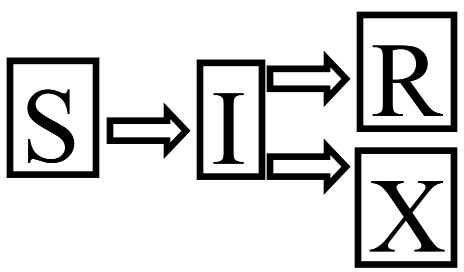
4.)

Fig 1-3 a simple SIR Model. While Figure 4 shows the relationship between the subgroups and one another.

Literature: What does it Say?

The West Africa Ebola outbreak devastated multiple countries. At the height of the epidemic Ebola was 67 times greater than the next closest outbreak. In many countries the death rate was close to 50% of the cases recorded. In some cases the death rate was over 66%. Reducing the infection rate was a 19 month battle from the World Health Organization. Despite the shear size of the epidemic it has revealed much about the virus and its repercussions on the human body.

Basic Model and Flow



$$S' = -\beta SI$$

$$I' = \beta SI - \zeta I - \alpha I$$

$$R' = \zeta R$$

$$X' = \alpha I$$

β=Infection Rate

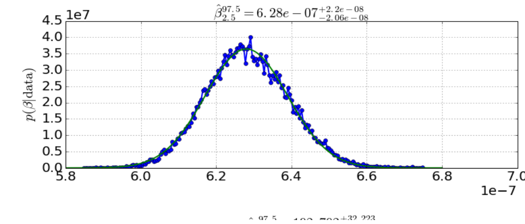
ζ=Recovery Rate

α=Death Rate

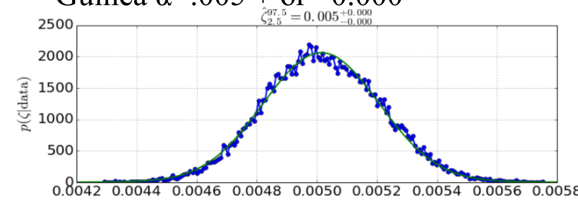
Model Overview

The infection rate resembles the predator prey model as it has a negative effect for one group and a positive for the other. The relationship between the parameters will be used to help predict the number of cases (C=I+R+X) and the number of deaths which is a function of the number of infected people and real data. A cross country comparison will help with analyzing the differences between various countries.

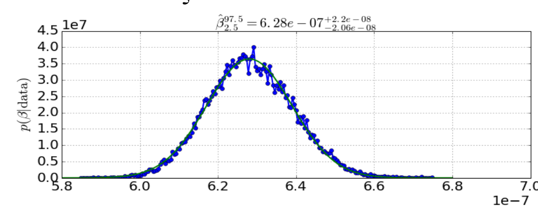
Guinea β=6.28e-7 +2.02e-8 –2.08e-8



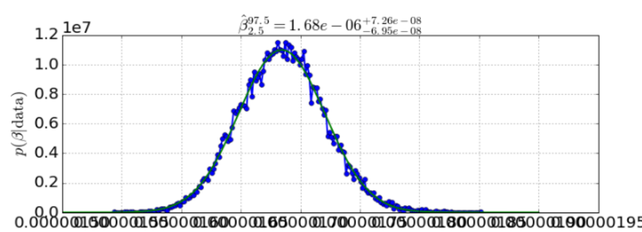
Guinea α=.005 + or –0.000



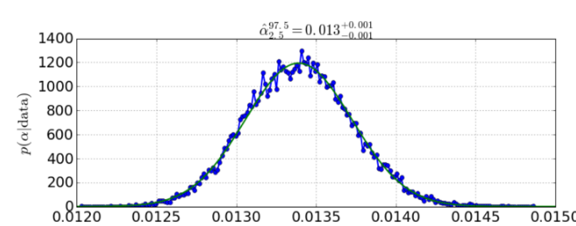
Guinea ζ=0.12+ or –0.000



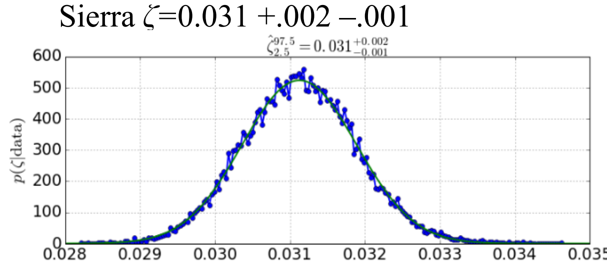
Sierra β=1.68e-06 +7.26e-8 –6.95e-



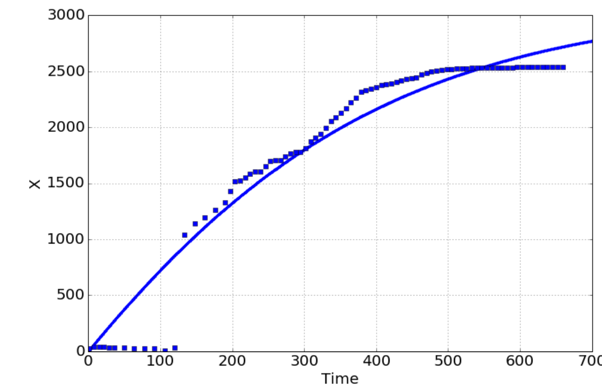
Sierra α=.013 + .001 –.002

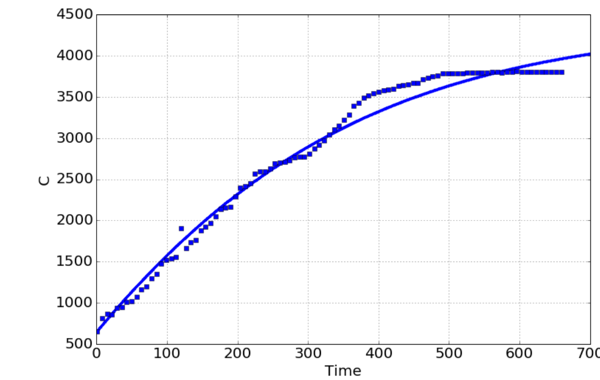


Sierra ζ=0.031 +.002 –.001



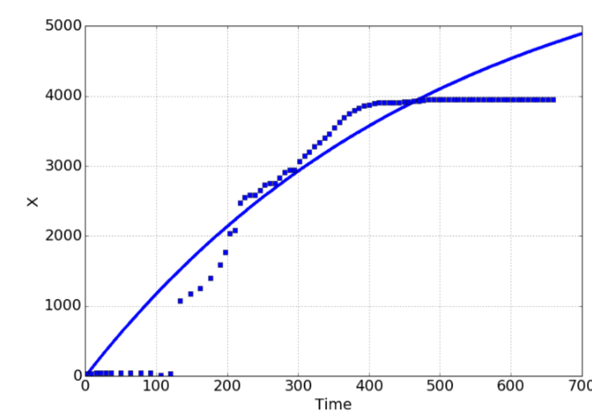
Guinea Predicted Deaths & Cases

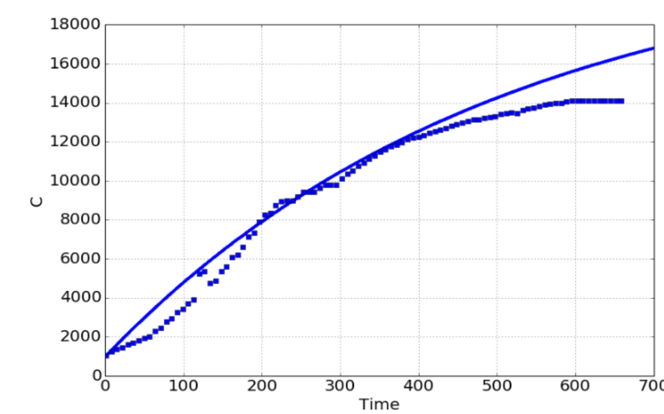




The graphs above show the predicted number of cases and deaths for Guinea. Time is reported in days with a sample being taken every seven days to track the spread of the virus. The best fit parameters did a fairly good job explaining the variation in the data. Despite a low infection coefficient, the spread of virus is represented to show serious damage to the populations of these developing areas. In addition, an important notation is that the recovery rate is higher than the death rate. Which would indicate that more individuals move towards the recovered populist than the death pool.

Sierra Leone Predicted Deaths & Cases





The graphs above show the predicted number of cases and deaths for Sierra Leone. Time is reported in days. The data shows that the death rate is highly concentrated, but falls off after four hundred days. This pyndamics implementation differed as I used an S0 model to help scale infection rates with the susceptible population level. This was an easier manor in which to help explain the relationship between the number of cases and the susceptible population. A less constant growth in deaths would indicate death rates were harder to predict. The spikes show the devastation. Such explanations in infection rates show the importance of studying