The Movement of the Plague

New Mexico

Supercomputing Challenge

Final Report

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Team 18

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Table of Contents:

Executive Summary: Pg. 3 Introduction: Pg. 4 Description: Pg. 5 Results: Pg. 6 Conclusions Pg. 6 Recommendations: Pg. 7 Acknowledgements: Pg. 7 References: Pg. 7 **Executive Summary:**

Plagues are a worldwide problem. They have happened over the course of humanity, and will continue to happen until a miraculous drug is found. The reason people are so scared of plagues, is that there have been many setbacks in the world of medicine, like the invention of the airplane, which can take people from one side of the world to the other. Although the leaps and bounds forward can arguably meet or even exceed the drawbacks, many people are still worried about a plague striking the earth.

Our goal was to create a real life model demonstrating the spreading power of a single virus, spreading through fomes like airplanes, trains, and migrants across borders. We were not able to create a model in time, but we received valuable information from people like the CDC and the US Department of Transportation. We were told to limit our scope multiple times by our mentors saying "We want to build a small model, not solve the world's pandemic problem." We were then advised to either track a package as a fomite or use our simulation to compare against an actual plague that we had access to the spread data and the infection rates.

Even though we could not complete our code in time, we received valuable data that we can use to show people that sometimes even the most innocent item can spread a virus.

INTRODUCTION:

Anyone who has ever been on an airplane knows the drill-- find your seat, sit down, maybe kindly ask the person sitting in the aisle seat to move so you can get by. After an hour of nothing interesting, you reach for an airline magazine. You realize that someone has put their gum in the seatback pocket! What a disgusting person. You rub your eyes in exasperation. Little do you know that that person had a deadly disease, and you just passed in on to you when you rubbed your eyes. That baby that just started a coughing attack--does he have a cold or the new bird flu? A plane is a germaphobe's worst nightmare, from the friendly stewardess that shakes your hand to the sick person that coughs in your face. Planes are the businessman's number one priority for getting places. People touch things that have been touched dozens of times before. It used to be hard for a plague to spread. It had to survive a wagon trail for weeks on end. By that time, the person is usually dead or left on the side of the road. Now, with planes, trains, and automobiles, plagues can get from China to the US in under a day (an average ride leaves Dallas at 1:00 PM CST and lands in Hong Kong at 10:00 PM HKT). Imagine if a politician kisses a hundred babies a day and shakes a hundred hands a day. A plague would be having a blast, jumping from person to person, infecting everyone, and then killing them all. Plagues can kill, but they can also be easily dealt with. If a plague kills everyone within two seconds of getting the plague, then how can it spread? If a plague is found before it does any major damage, then what is stopping us from eradicating it quickly? Plagues are a tricky bunch, or cluster, or whatever they happen to be, but if we can figure out where they are and where they can go, we can stop them in their tracks (gathered from CDC reports of viruses over time, mainly http://www.cdc.gov/h1n1flu/cdcresponse.htm) Many plagues are running around at this very moment, but none of them really serious. If a plague comes that we cannot kill, we could be dead in a year, maybe even months (Spanish Flu: Death as quick as one day from first symptom signs http://www.flu.gov/pandemic/history/index.html). The most noticeable thing that we realized while researching this project, most likely because we live only fifty miles from the border, is that it only takes one person sneaking across the border to spread a virus to the United States, or anywhere else in the world (http://www.ncbi.nlm.nih.gov/pubmed/19061761)

Background:

We researched by getting charts and data from many government resources and major transportation hubs. We talked to Cynthia Vega's (DFW airport's manager of media relations) assistant. She expressed warmth at what we were doing and gave us an updated list of statistics and then redirected us to the airport fact sheet:

(http://www.dfwairport.com/visitor/P1_009559.php). We also used historical archives of past pandemics (http://www.flu.gov/pandemic/history/index.html) to further see what the mean death rate and infection rate was. The main plague we focused on was the swine flu (H1N1), because it was recent and we had lots of information on what the CDC did exactly as it happened (http://www.cdc.gov/h1n1flu/cdcresponse.htm). We figured out that the death rate in the normal swine flu was about 5%. We also were working on the more recent strain (H3N2v) and the new bird flu (H7N9) in Asia. The CDC has said that there is a 25% death rate on this new strain of avian flu and is now recognized as the "deadliest flu strain ever". The exact statistics (number of people infected to number of people dead) were not out at the time of this writing, but we were able to see the likelihood of a new variant strain (approximately a 4% chance)

DESCRIPTION:

Scope: We originally planned to have a complete model including recent events leading up to the plague (that's why our project was originally called the Entropy of the Plague, because we were hoping to have a massive model, like if a depression was more likely to cause unhygienic tendencies, causing a more likely spread of an infection.) but were told to limit the scope of our work considerably because a project like that was a lifelong project.

Materials and Methods: We used Net Logo to start our code, but the main part of our work was done by calling certain major airports and government agencies (USDOT, FAA, DFW Stats and Revenue Office). People mostly gave us links to see the public information

(<u>http://www.transtats.bts.gov/Data_Elements.aspx?Data=1</u>) but some people gave us more recent facts (FAA customer representative said that some airports in China are closed due to the H7N9 scare). We were planning to add that data into our code to make a realistic simulation of travel, but we could not get the correct coding in.

breed [traveler]

breed [not-traveler]

This is one of our brainstorms for how to create our types of people, our travelers who are the main fomes and the non-travelers who spread the disease locally. If we were to continue, we would try to create a type of frequent traveler and a non-frequent traveler.

RESULTS: We had no data from our model as we were not able to complete our model in time. We learned many things that were both interesting and downright scary. One of the more scary things is that the CDC actually said: "The next plane could bring a pandemic." This was said early in 2014 because of the new H7N9 bird flu outbreak in China

(http://freedomoutpost.com/2014/01/next-plane-bring-pandemic-cdc-says-bird-flu-isnt-justchinas-problem/).



CONCLUSIONS:

We believe that plagues are more dangerous now, with more medical technology, than even back in the black plague days. The invention of the airplane has made a plague's journey a much easier one. A plague can hop from one side of the world to the other in less than a day, and without any type of early detection system, plagues could spread rampant. We believe that the most original accomplishment is limiting our scope enough to get the information we needed in the time we needed. If our model was working, we would have a comparison chart of a plague with the same infection rate and same death rate as a previous plague, and see if the dead and infected have risen or lowered. We would do that several times and see if today is really a better environment for plagues. RECOMMENDATIONS: Between now and competition, we are going to try and make our code look presentable and see if we can get at least something to show up on the screen. Next time, we would try to limit our scope early on, so we can have time to finish our coding, and receive data that can be presented in our report.

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REFERENCES: Contagion © Warner Bros. Inc. 2011

Air Travel Passengers per Year in the US: "Passengers, All Carriers - All Airports" <u>http://www.transtats.bts.gov/Data_Elements.aspx?Data=1</u>