Decision Analytics for Business and Policy
Project Proposal

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I. Problem Definition

Problem statement

This project considers an Ebola outbreak in the Allegheny County, Pennsylvania. The goal is to set up Points of Dispense (PODs) at selected candidate sites, send shipments of vaccines from the Allegheny County Central Warehouse to PODs, and assign medical personnel to PODs, all while constraining the cost of these efforts *and* minimizing the average distance covered/time travelled for infected individuals to get vaccinated. This project also considers the alternative objective of minimizing the maximum distance/time travelled by an infected individual to get vaccinated.

Background

Ebola virus diseases (EVD) (sometimes called Ebola Hemorrhagic Fever) is a highly contagious disease caused by infection with an Ebola virus[1]. The U.S. Centers for Disease Control and Prevention (CDC) categorizes Ebola virus as a Category A select agent. This group includes high-priority agents that pose a risk to national security because they can be easily disseminated or transmitted from person to person; result in high mortality rates and have the potential for major public health impact; might cause public panic and social disruption; and require special action for public health preparedness. Because symptoms of EVD may appear consistent with many other illnesses (e.g., influenza, malaria), diagnosis and treatment of EVD could be delayed during an outbreak.[2]

II. Assumptions

We are approaching this as a stochastic problem, with the premise that the scale of the outbreak (Infection Rate) is random. Therefore the objective is to minimize *expected* total distance traveled while considering the expected total cost.

We assume that the associated costs must be committed to in two separate stages. The cost to establish each POD occurs in Stage 1, before the outbreak occurs. The costs to utilize each POD occurs in Stage 2, after the outbreak occurs. Stage 1 costs include POD setup costs. Stage 2 costs include paying medical professionals to administer vaccines and paying to transport the vaccines to each POD.

The FDA approved vaccine for the purpose of treating EVD is *rVSV-ZEBOV*[3]. The vaccines have been procured by the federal government, awaiting a formal request for the quantity required

[1] Ebola Virus Disease - WHO - <https://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease>

[2] Ebola – Occupational Safety & Health Administration, United States Department of Labour <https://www.osha.gov/ebola>

[3] Centers for Disease Control and Prevention <https://www.cdc.gov/vhf/ebola/index.html>

by the Allegheny County Department of Health. The quantity requested will be determined by the Infection Rates or the scale of the outbreak that is scenario dependent (stochastic in nature).

III. Work Distribution Plan

Group Member	Responsibilities
Ben Christensen	i. Formulation ii. Resolving potential computational bottlenecks in the formulation iii. Data Cleaning iv. Setting up the Gurobi Model v. Report Writing
Manzoor Mirza	i. Identifying relevant data sources ii. Data collection plan iii. Formulation iv. Data Cleaning v. Setting up the Gurobi Model vi. Report Writing
Harris Mansur	i. Formulation ii. Adding complexity to the formulation iii. Data collection plan iv. Data Cleaning v. Running the model vi. Report Writing
Raja Safiullah	i. Defining the problem and the background ii. Defining and rationalizing assumptions iii. Formulation iv. Data Cleaning v. Running the model vi. Report Writing