THE SKY IS THE LIMIT
COVID-19 VACCINATION PROCESS

Renze Dijkstra, Nina Malbasic, Berend Markhorst, Daan Otto, Tara Zver
Prof. dr. Rob van der Mei, Dr. Dennis Moeke
AGENDA

01 Problem statement
02 Model
03 Data-driven Digital Application
04 Real life project
10,200,000

Number of people to vaccinate in medical hubs in the Netherlands
PROBLEM STATEMENT

LAB-TO-ARM
• From NL center point to medical hubs over the country

VACCINES
• Availability
• Type (one or two shots)

PRIORITY CLASSES
• Healthcare workers
• People 60+ (no medical condition)
• People between 18-60 (no medical condition)

GOAL
• Plan for vaccine distribution by minimizing the waiting time
Components of the model

1. Hub placement
   - Given maximum travel distance, where should hubs be placed
   - Using heuristic

2. Vaccine allocation
   - Available vaccines
   - Proportional/equal distribution

3. Nurse allocation
   - Available healthcare workers
   - Proportional/equal distribution
Considered approaches

- Vertex / Set Cover
- Facility Location Problem
- ILP & 2-OPT
- Vaccine allocation
- Nurse allocation
- Hub placement
- "Divide-and-conquer"
- Heuristic
- Cover Cap (ILP)
Every municipality has one hub

Find smallest hub (hub A)

Find nearest hub (hub B)

Distance constraint satisfied?

- Yes: Merge hubs A & B
- No: Hub A remains

Heuristic
Results: medical hubs are placed in large municipalities (Amsterdam, Rotterdam, Groningen etc)
Verification of the algorithm

Maximum travel distance = 40 km

Maximum travel distance = 60 km
Components of the Model

1. Hub placement
   - Given maximum travel distance, where should hubs be placed
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2. Vaccine allocation
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3. Nurse allocation
   - Available healthcare workers
   - Proportional/equal distribution
**IMPLEMENTED APPROACHES**

**PROPORTIONAL**
- Outbreak risk areas receive a higher number of vaccines

**EQUAL**
- Smaller medical hubs will be finished earlier
DATA-DRIVEN DIGITAL APPLICATION

Input parameters -> Models -> Output
Discussion and limitations of the model

1. Nurse capacity
   No data for the number of nurses in each municipality

2. One vaccine type
   No distinction between vaccines for each priority class

3. Storage and transportation
   All vaccines that are delivered to a hub are also going to be used

4. Smooth vaccination process
   Problems in reality
   Incorporate uncertainty

5. One hub per region
   No maximum capacity for the number of people a hub can take
Real life project

Won a national prize for COVID-19 vaccination logistics

Distribution of vaccines

Downscaling
THANKS!

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