

# THE SKY IS THE LIMIT



  
vrije Universiteit

 **TKI DINALOG**  
Dutch Institute for Advanced Logistics

**CWI**

**GGD  
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**HAN** UNIVERSITY  
OF APPLIED SCIENCES

# COVID-19 VACCINATION PROCESS

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VU 

  
BUSINESS  
ANALYTICS

# AGENDA

01

PROBLEM  
STATEMENT

03

DATA-DRIVEN DIGITAL  
APPLICATION

02

MODEL

04

REAL LIFE PROJECT



# 10,200,000

Number of people to vaccinate in medical hubs in the Netherlands



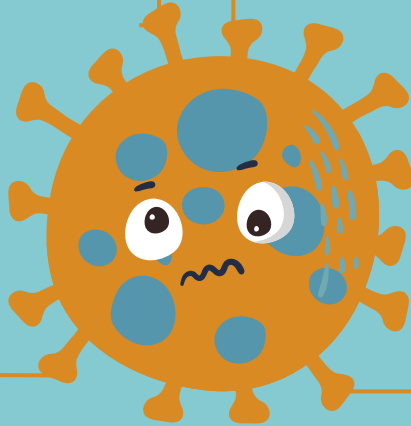
# PROBLEM STATEMENT

## 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



## HUB PLACEMENT

Given maximum travel distance,  
where should hubs be placed

USING HEURISTIC



## VACCINE ALLOCATION

Available vaccines

PROPORTIONAL/  
EQUAL DISTRIBUTION



## NURSE ALLOCATION

Available healthcare workers

PROPORTIONAL/  
EQUAL DISTRIBUTION

# CONSIDERED APPROACHES

ILP & 2-OPT

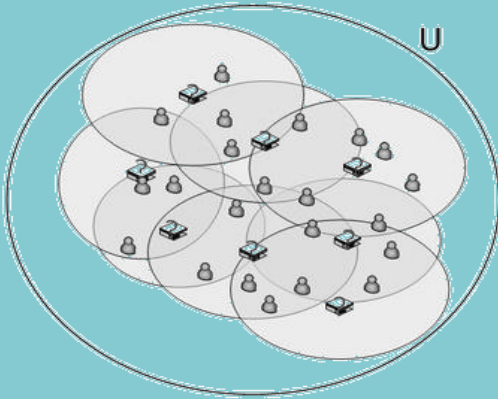
Vertex / Set Cover

Facility Location Problem

Heuristic

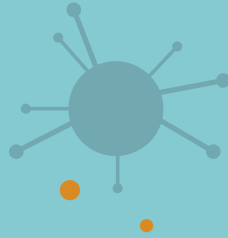
“Divide-and-conquer”

Cover Cap (ILP)

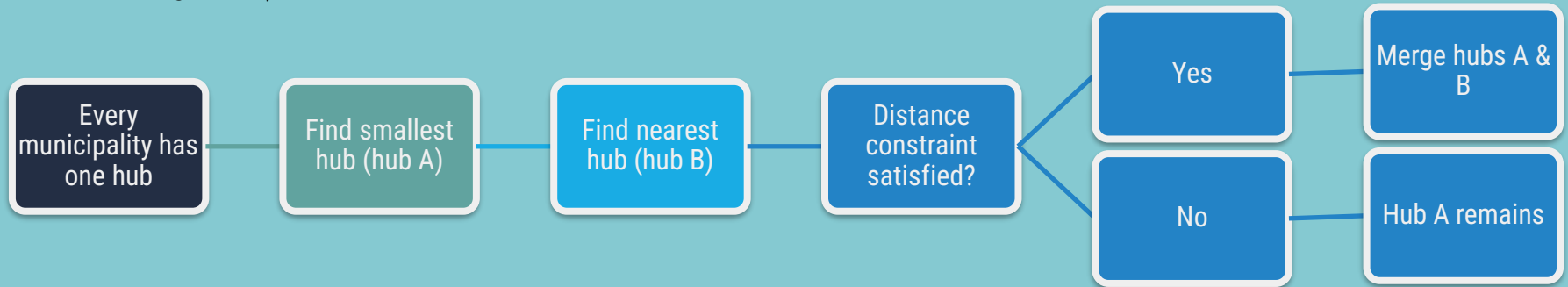




# CHOSEN APPROACH



- Heuristic
- Results: medical hubs are placed in large municipalities (Amsterdam, Rotterdam, Groningen etc)

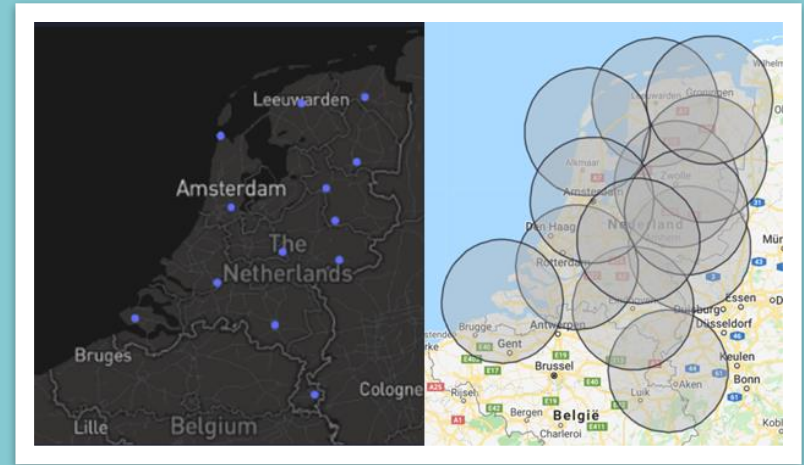


# VERIFICATION OF THE ALGORITHM

Maximum travel distance = 40 km



Maximum travel distance = 60 km



# COMPONENTS OF THE MODEL



## HUB PLACEMENT

Given maximum travel distance,  
where should hubs be placed

USING HEURISTIC



## VACCINE ALLOCATION

Available vaccines

PROPORTIONAL/  
EQUAL DISTRIBUTION



## NURSE ALLOCATION

Available healthcare workers

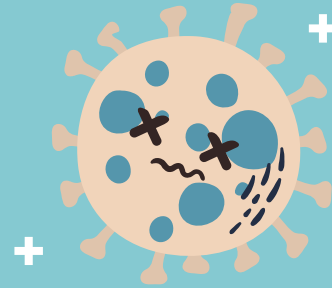
PROPORTIONAL/  
EQUAL DISTRIBUTION

# IMPLEMENTED APPROACHES



## PROPORTIONAL

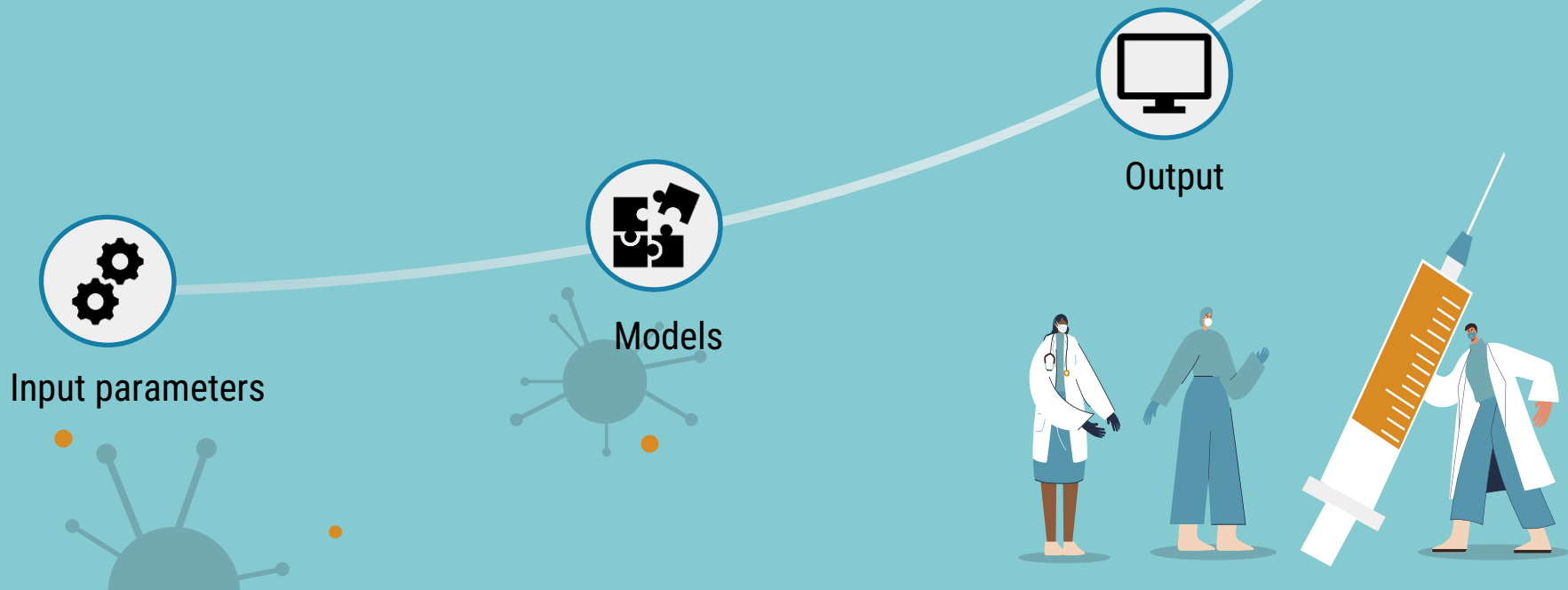
- ✓ Outbreak risk areas receive a higher number of vaccines



## EQUAL

- ✓ Smaller medical hubs will be finished earlier

# DATA-DRIVEN DIGITAL APPLICATION



# 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!**

Please check us out live at  
[www.lab-to-arm.com](http://www.lab-to-arm.com)

