# Rehabilitation Clinics
in North-Western Germany

A Data Science Project

## by Brita von Bartenwerffer

Introduction

- There are over 1,200 health-cure facilities in Germany, almost 200 of them in the North-West

- Almost 2 million people have been at one as an in-patient in 2018

- Period of stay is generally 3 weeks, which can be extended to up to 6 weeks

- Treatments are primarily for orthopaedic and cardio-vascular health complaints
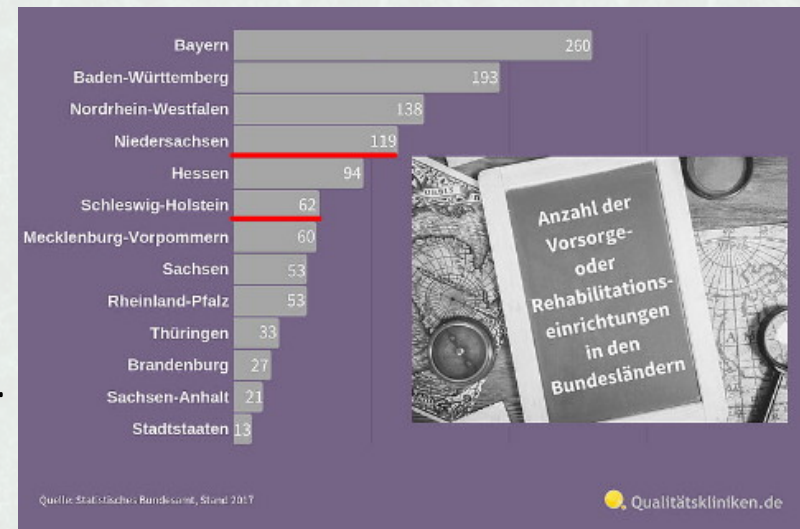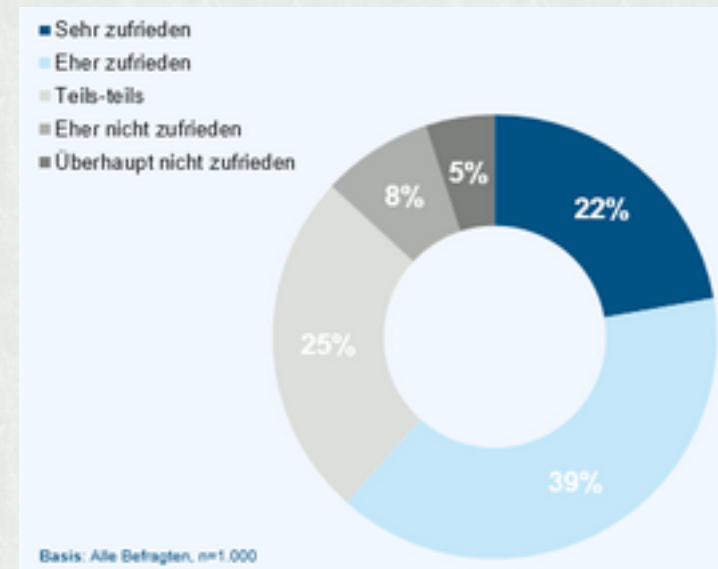
Introduction

- Surveys are conducted after patients' stay at a clinic, independent of length of their stay
- Percentage of patients unhappy with their stay have been showing to grow over the past decade in 2018
- Number of complaints are going up
- Health insurers are becoming worried about the downward trend but don't know how much of this is due to subjective dissatisfaction with live and personal health concerns

Map of Locations of Rehab Clinics
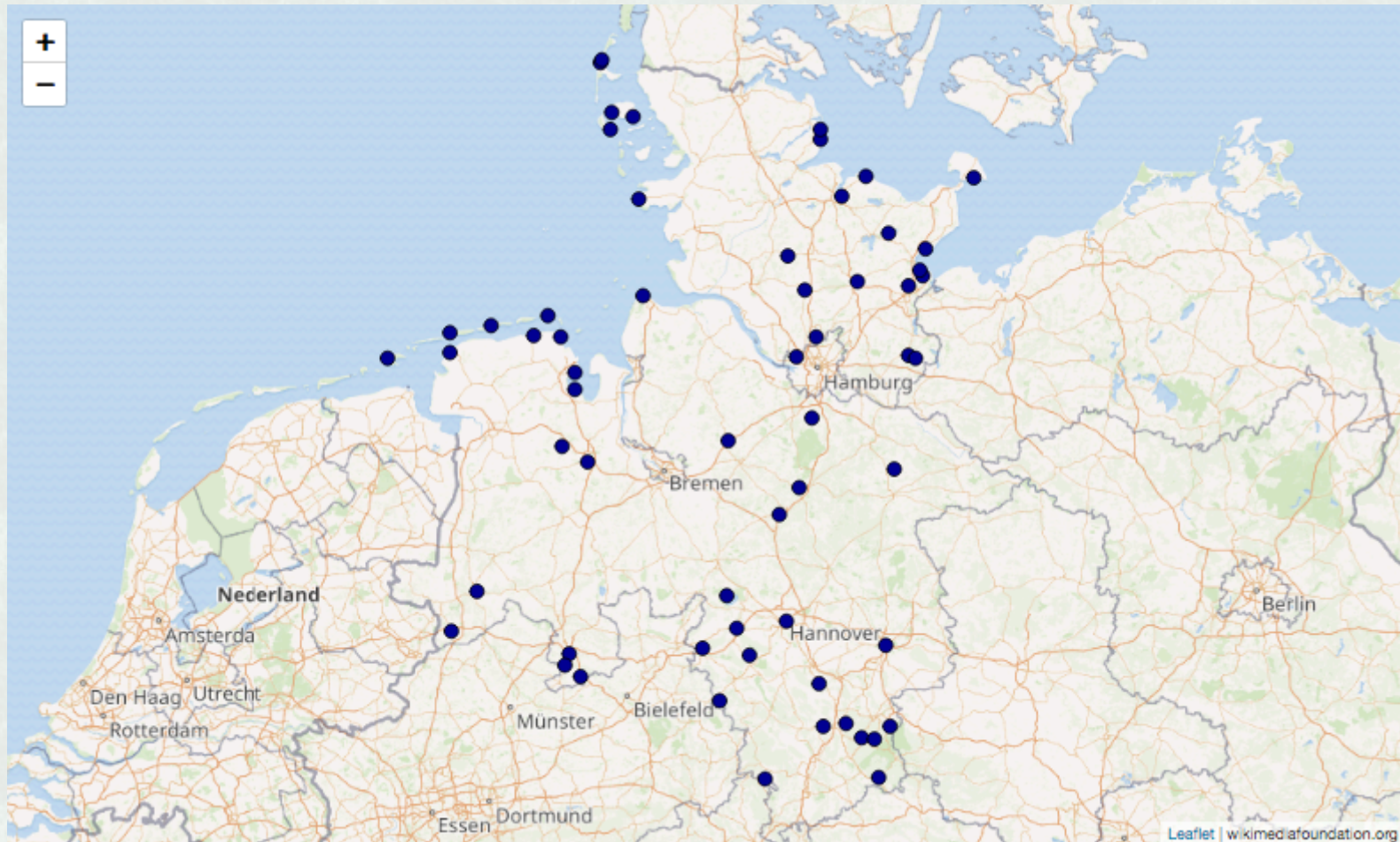
The Problem

- Falling trend of overall satisfaction over the past decade.

- 61% are still mostly or completely satisfied

- **but** 13% are mostly or completely dissatisfied

- many patients are fairly happy with the clinic but unhappy with the location

■ Sehr zufrieden
■ Eher zufrieden
■ Teils-teils
■ Eher nicht zufrieden
■ Überhaupt nicht zufrieden

5%
8%
22%
25%
39%

Basis: Alle Befragten, n=1.000

The Problem

- Health insurers know about the complaints
  - "Most boring place I have ever been to"
  - "Nowhere to have loved ones stay over the weekend"
  - "Choice of restaurants is dismal and limited"
- but have no data
  - to verify them in an objective way
  - give patients an easy way to choose a cluster of locations suited to their wishes

Where We Come In

- Data Science can leverage location data to provide objective information about venues in the vicinity of clinics
  - enable quick checks for health insurer whether complaints are justified
- Location data can be used to cluster clinics
  - thus helping health insurers to meet patients' wishes when allocating a specific clinic
- Clusters can be visualized on maps
  - making it easy for patients to choose the one according to their needs and wishes

Foursquare Location Service

- global service
  - health insurers can easily port the new application to other regions and even countries

- extensive database of venues
  - especially places to stay and places to eat

- used by other global companies like Apple and Amazon
 - high recognition value
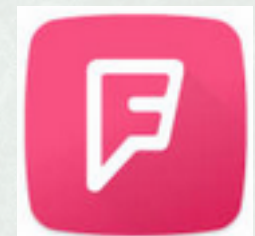
Complaint 1: Weekend Visitors

"There was nowhere to stay for my relations or friends over the weekend"

- Patients don't have treatments on weekends and are not expected to stay on clinic grounds

- Keeping contact by telephone and snail mail is no longer enough

- Positive social contacts add to patients' satisfaction and success of treatments

Complaint 1: Weekend Visitors
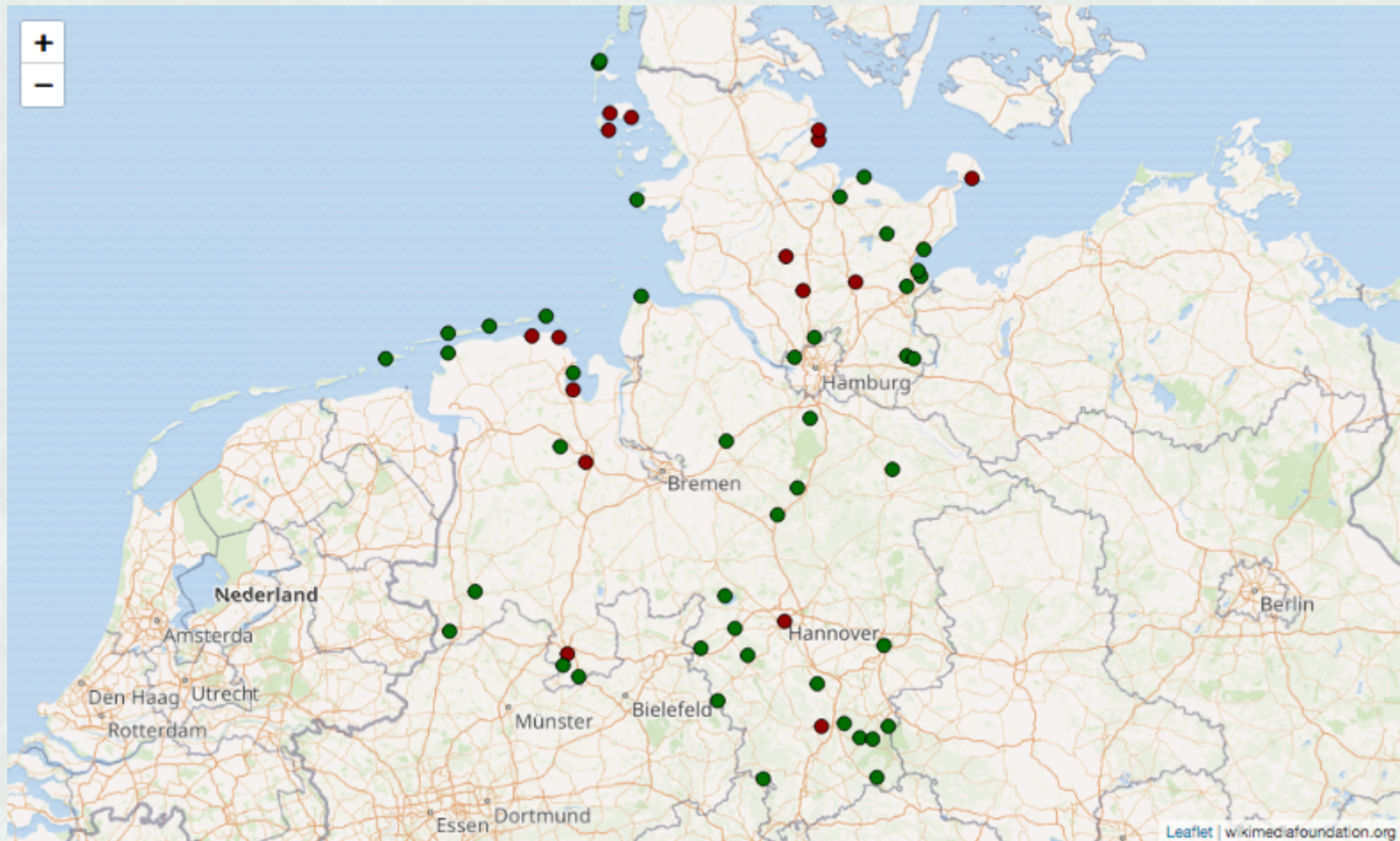
Complaint 1: Weekend Visitors

- approx. a third of all clinics does not have a place to stay for loved ones nearby, i.e. within a radius of 5 km

- places to stay are
  - hotels and hostels
  - bed & breakfast places
 - vacation/holiday rentals

=> Patients' application form should include the question whether they might have visitors staying over the weekend
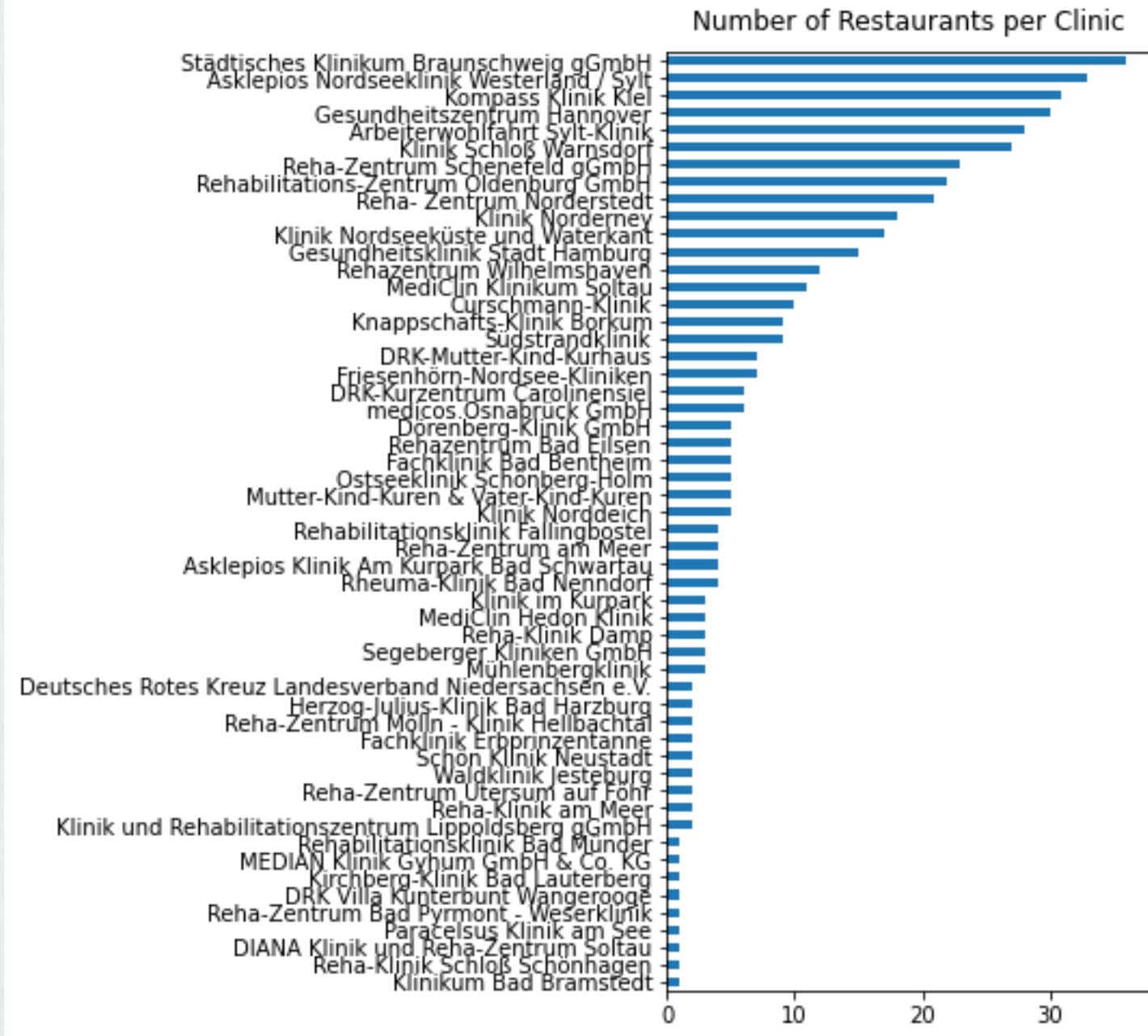
Complaint 2: Places to Eat At

"I had visitors or went out with a group of other patients and there weren't any restaurants"

- Patients are not expected to stay on clinic grounds provided they don't miss any treatments.

- Clinics do not cater to visitors except for coffee & cake in the afternoons

- Patients prefer a meal out on the weekends, especially when having visitors
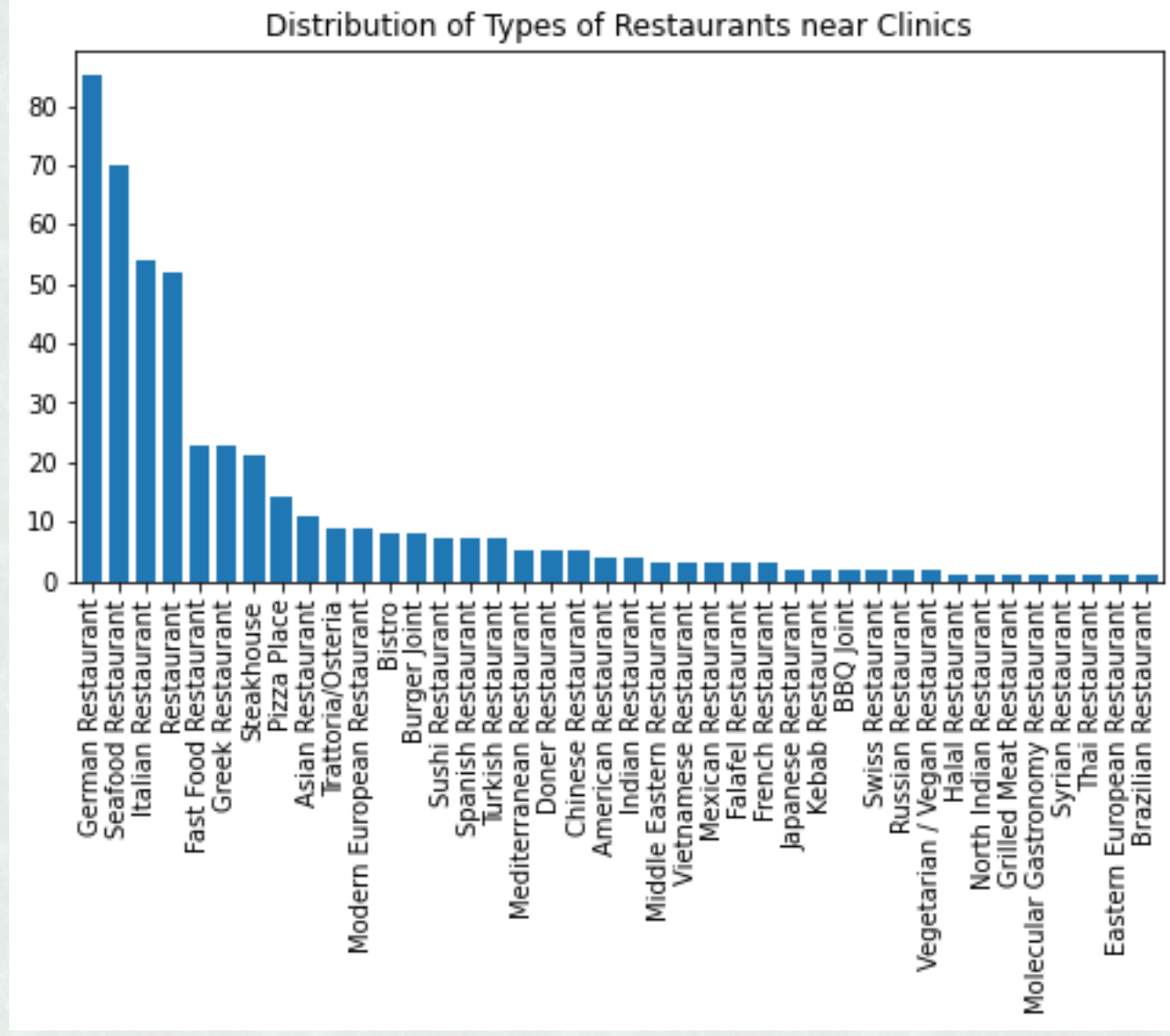
Complaint 2: Places to Eat At

Number of Restaurants per Clinic

Complaint 2: Places to Eat At

Distribution of Types of Restaurants near Clinics
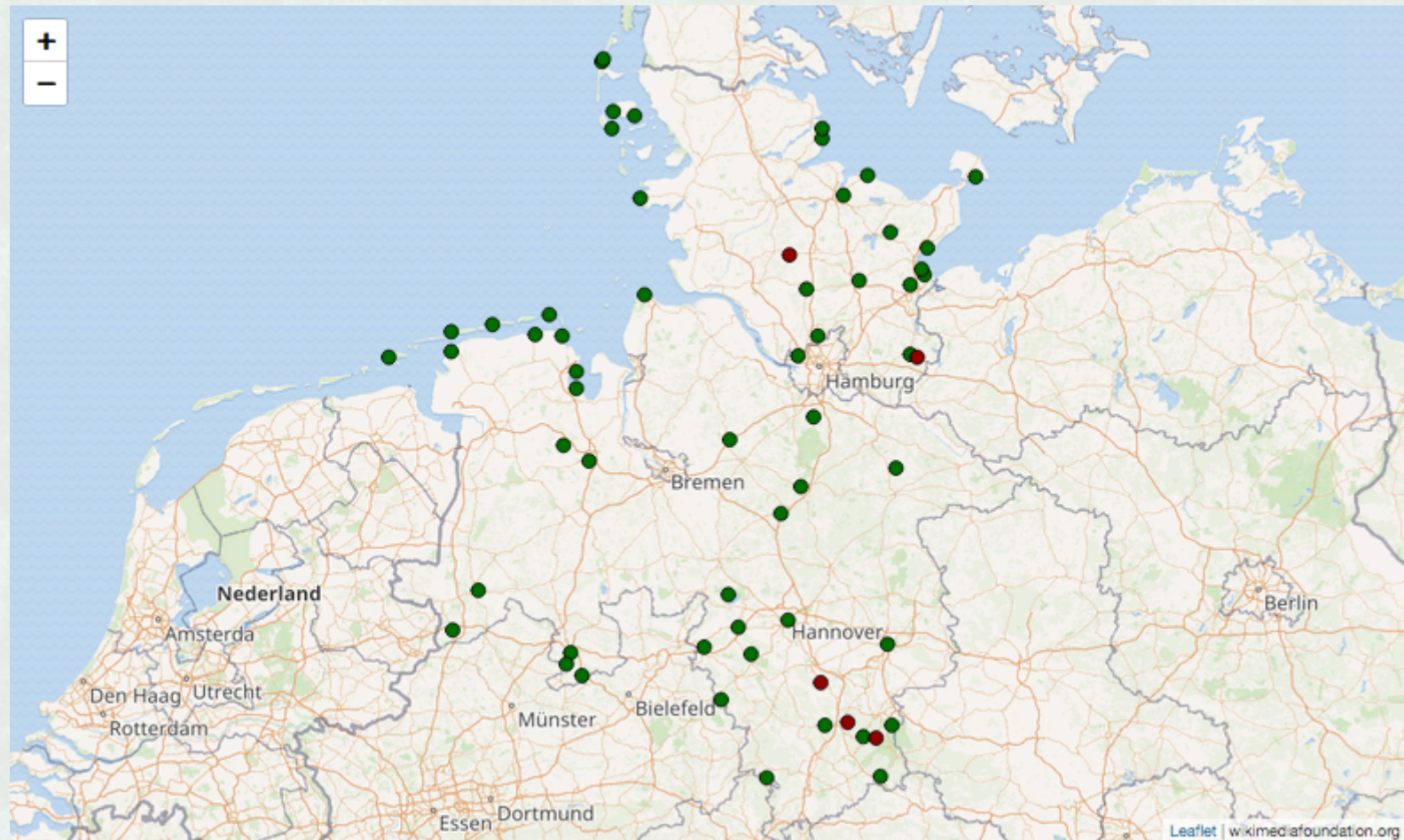
Complaint 2: Places to Eat At

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- Around 10% of clinics don't have any restaurants within a radius of 5 km
- Choice of restaurants per clinic varies wildly from just one to over thirty
- While there is a wide variety of types of restaurants, the distribution is of the different types also varies wildly

=> Patients' application form should include the question whether they would like to eat out once in a while
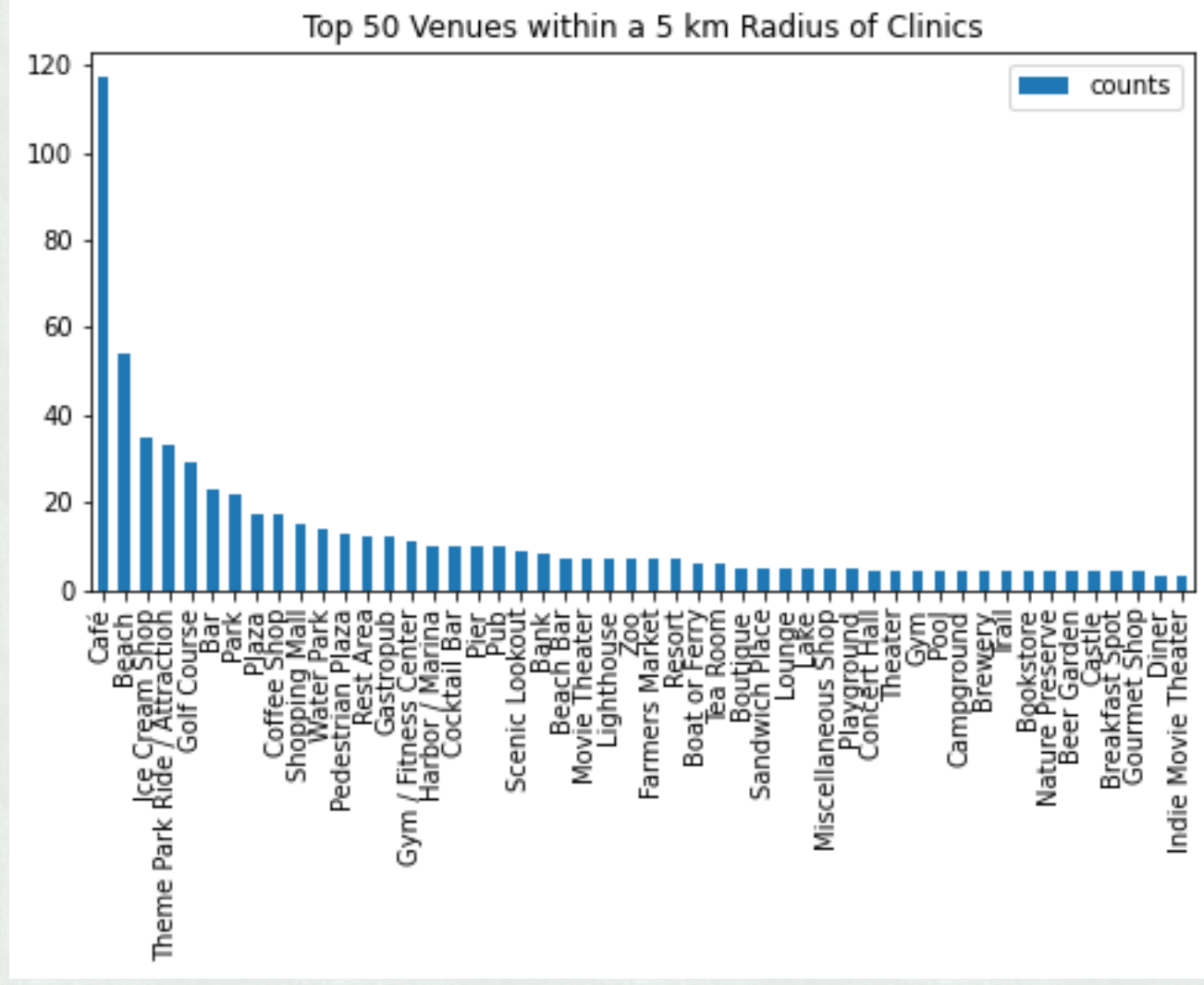
Complaint 3: No Interesting Venues

"It was the most boring place I ever had the misfortune to visit!"

- Patients like to have places to visit when taking a walk or spending time away from the clinic

- Interests vary wildly so it makes little sense to provide data for each and every single interest

- However, venues can be clustered using machine learning techniques
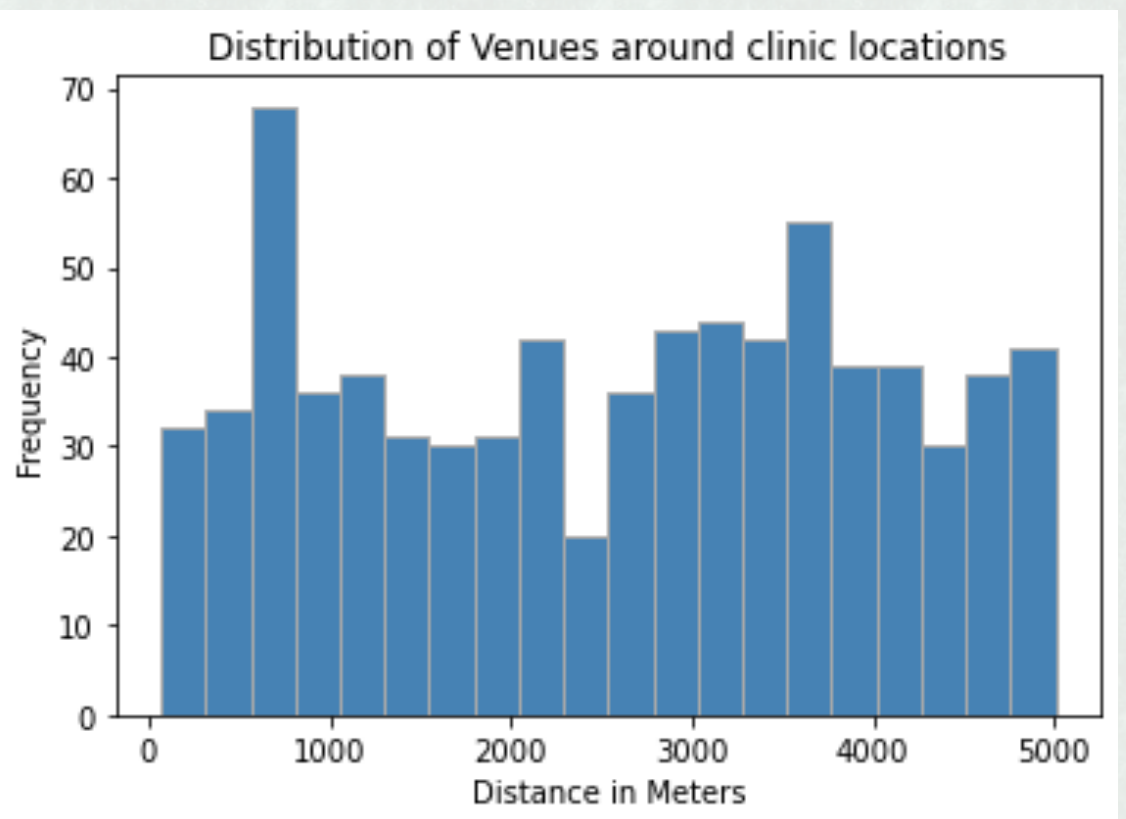
Complaint 3: No Interesting Venues

- Venue data was cleaned and for this analysis did not include
  - places to stay
  - places to have a meal at (places for having a snack and drinks or coffee and cake were included though)
  - supermarkets and other places to shop for food
- In total 140 different categories were used for clustering

Top 50 Venues within a 5 km Radius of Clinics

Complaint 3: No Interesting Venues

Distribution of Venues around clinic locations
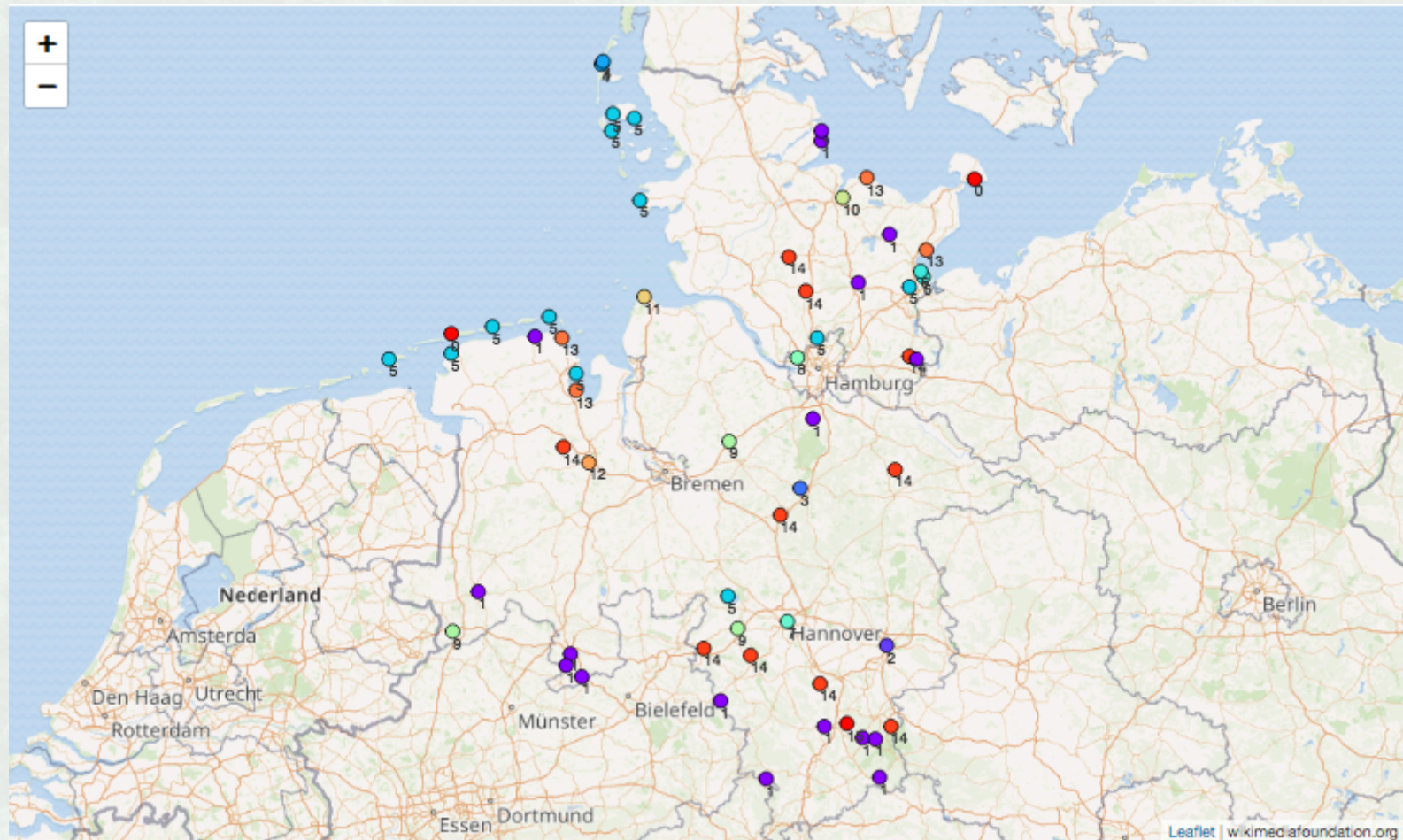
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- As we have already seen with restaurants there is a huge variety of venues but only a few have a high distribution:
  - cafés
  - beaches
  - ice cream shops
- Spatial distribution is much more balanced. Overall there are many venues within walking distance as well as within distances easily reached by bike or car.

Complaint 3: No Interesting Venues

- Clustering by Machine Learning
- algorithm k-means was chosen
  - unsupervised learning because there were no labels provided
  - gives insight into data humans might easily miss given the wide variety of venues
- Although fewer clusters are usual we defined 15 to ensure variety and choice for patients

Complaint 3: No Interesting Venues

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Counts of Clinics per Cluster

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
counts	2	17	1	1	2	12	2	1	1	3	1	1	1	4	10	1

- There was one clinic that had no venues at all and was assigned cluster 15 by hand afterwards

- Even with choosing a number of 15 clusters most clinics are still distributed between just three different clusters

Complaint 3: No Interesting Venues

- as with places to stay and restaurants the number and/or types of interesting venues nearby vary wildly.

- for tighter clusters venue categories could be cleaned and consolidated using broader categories, e.g.
    - use "cinema" for cinemas, movie theatres
    - cluster all shops and stores into one category
    - only use less ubiquitous venues, i.e. leave cafés, ice cream shops etc. out

Complaint 3: No Interesting Venues

Top 3 Clusters

- Cluster 1 contains most of the clinics that have only a few venues nearby and weren't clustered into any other cluster

- The venue with the highest count in Cluster 5 is a café and most also have an Ice Cream Shop

- Cluster 14 id for the sports-minded person: The top 1 venue is a golf course.

Observations

There's a high likelyhood that patients' complaints re places to stay, eat or visit are less subjective than might be thought

- 30% of clinics have no places for visitors to stay at nearby

- 10% of clinics do not have any restaurants within easy reach

- There isn't much choice as far as interesting places nearby go and it remains doubtful whether cafés and ice cream shops are high on a patient's list (while it might be high on a holiday maker's list)

Recommendations

- Implement a web application that gives patients an easy way to choose a cluster of clinics from which the specific clinic can then be allocated by the health insurer

- Implement a few basic yes/no-questions about patients' wishes concerning the location

- When planning to build new clinics consider sites with a greater diversity of venues