TECHNISCHE HOCHSCHULE DEGGENDORF

IMPACT OF COVID-19 ON MOBILITY IN THE NETHERLANDS

as submitted by
Shraddha Ranganathan,
matriculation number 00817274,
email: shraddha.ranganathan@stud.th-deg.de

in partial fulfilment of the course LSI-11 Data Visualization
for the study course M.Sc Life Science Informatics

Date of submission: 07/07/2021

Examiner: Prof. Dr. Javier Valdes

Overview

This analysis uses Apple's COVID-19 mobility data to analyze the impact of a global pandemic on mobility, using the Netherlands as a case study. It leverages statistical methods to gain insights on regions with interesting mobility levels, and speculates on the implications of this for a company wishing to introduce new products or adapt existing ones, for the sports market in the Netherlands. This report shows that the variance in the regions within the Netherlands may be used to customize the products and services by province to optimize results.

Keywords: walking, driving, Netherlands, COVID-19

Contents

Table of Figures

1. Introduction

The Sars-CoV pandemic of 2019 was a key factor in changing many facets of daily life. In many parts of the world, lockdowns were introduced, which meant that people worked from home for several months. This restriction of mobility also reflected in the way people spent their time and money - as consumers were forced to spend more time indoors, more in-person activities transitioned into online ones.

Under the highly visible impact of a global health crisis, it is also understandable that health concerns rose steeply. A Google Trends search of the keyword ‘home workout’ shows a sharp rise in the global interest in exercising when gyms were no longer open (March 2020). Interestingly, interest in the keyword ‘Fitbit’ dropped sharply at the same time. April of 2020 also saw an increased interest in healthy eating, with keywords such as ‘healthy recipes’, ‘keto’, and ‘calorie’ showing an increase on Google Trends (Appendix 1). These observations lead to the conclusion that global interest in general health and wellbeing has risen in the time of the COVID-19 pandemic. These data may be of interest to businesses that are centered on health, fitness, sports, and well-being.

2. Problem Definition

The global interest in health, particularly through exercise, has been rising steadily since 2004, often seeing spikes when new research becomes integrated into popular culture. The trend of interest over one year’s time is similar every year, but the total interest rises incrementally (Appendix 1b). Under standard circumstances, these trends may be seen as constant, and integrated statically into product development, sales, and marketing plans. However, in the face of an extended period of changed behavior, these factors must be seen as dynamic. The sudden and swift changes in consumer behavior and interests must be considered for businesses attempting to optimize their projections.

It may also be taken as fact that to best optimize these projections, the data used must also be highly relevant to the outcome (sales, revenue, interest in product, etc.) The problem to be targeted is filtering out the unnecessary data and focusing on the data that may have an impact on consumer behavior in the sports market.

3. Objectives

Objectives of this analysis are as follows:

1. Examining one subset of global mobility data as a case study of the relevance of the data.
2. Examining total mobility in the subset, as well as the regions contained within that subset.
3. Comparing regional data and deriving insights relevant to the client's requirements.

4. Methods

This analysis uses data from the Apple Mobility Trends Report[1]. This dataset consists of mobility (in the form of walking, use of public transit and driving) from 63 countries and 295 major cities globally. This data is leveraged using the following methods:

1. The chosen subset (the Netherlands) is separated into total data and regional data.
2. The data is described using descriptive statistics.
3. Total mobility in the Netherlands is examined - insights gained from this examination are further analyzed in following sections.
4. Regional data is examined, and insights gained are compared for various regions.

Methods 3 and 4 are performed using base R and ggplot2.

5. Results

This section applies the methods described above, to the data sets for total mobility in the Netherlands, and data about regional mobility in the Netherlands. The plots are briefly interpreted and explained here, and more details and insights are offered in section 6.

5.1 Basic data analysis

5.1.1 Descriptive statistics

As a first check, we begin by examining the distribution of the data. Ideally, it will be normally distributed.

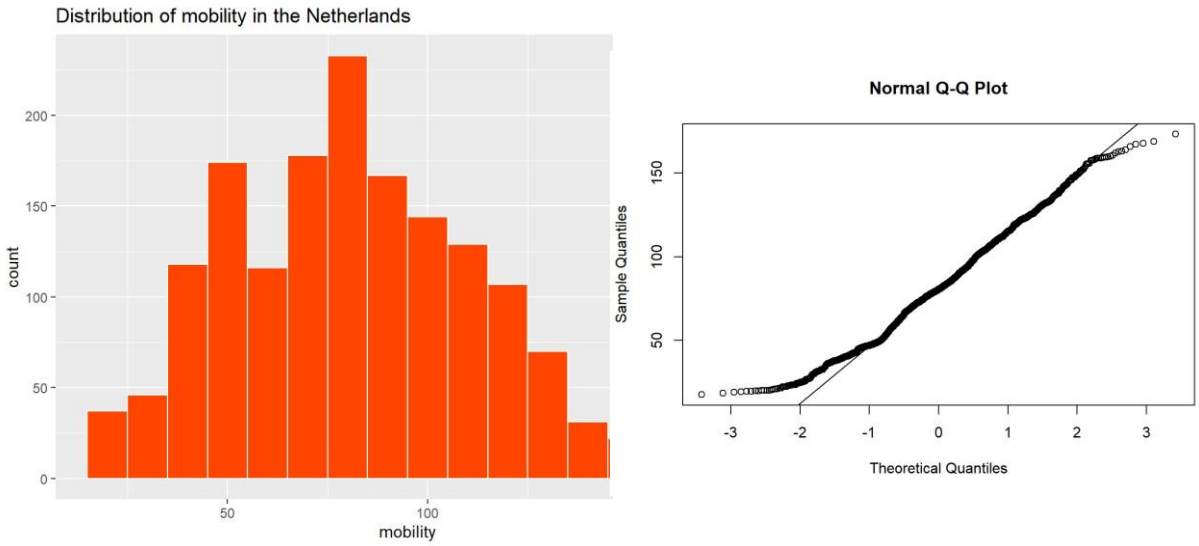


Figure 1: Distribution of mobility in the Netherlands

Figure 1 shows that the data is distributed normally. We can proceed with the analysis using normal distributions as our baseline. The slight spike at 50% mobility may be attributed to the unusual circumstances surrounding COVID-19 related lockdowns.

5.2.2 Overview of the total data

The change in behavior over time can be viewed at a high level using a series of box plots. In particular, the median values will be useful to see the trends over the pandemic, particularly highlighting outliers.

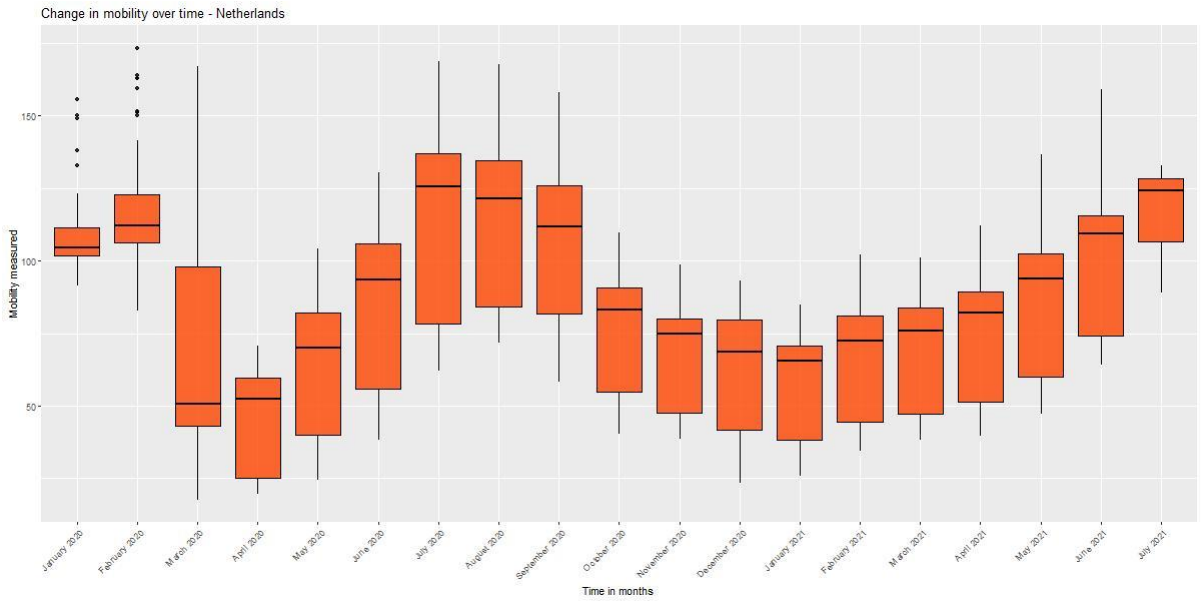


Figure 2: Change in total mobility from January 2020 to June 2021 in the Netherlands

As seen in figure 2, the median value of mobility dropped sharply in March 2020 and rose back to pre-pandemic levels by July 2020. Another drop was seen in October 2020.

The data set includes groupings of values by type of transportation. The use of the various transportation methods can be summarized using a stacked bar plot.

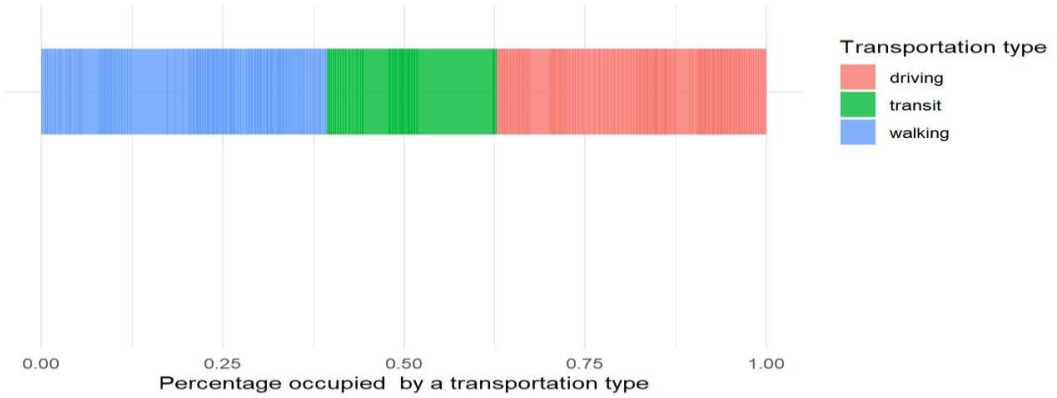


Figure 3: Proportion of mobility in the Netherlands split up by transportation types: driving, (public) transit, walking

This data may now be combined to view the changes in mobility over time, as described by the various transportation methods.

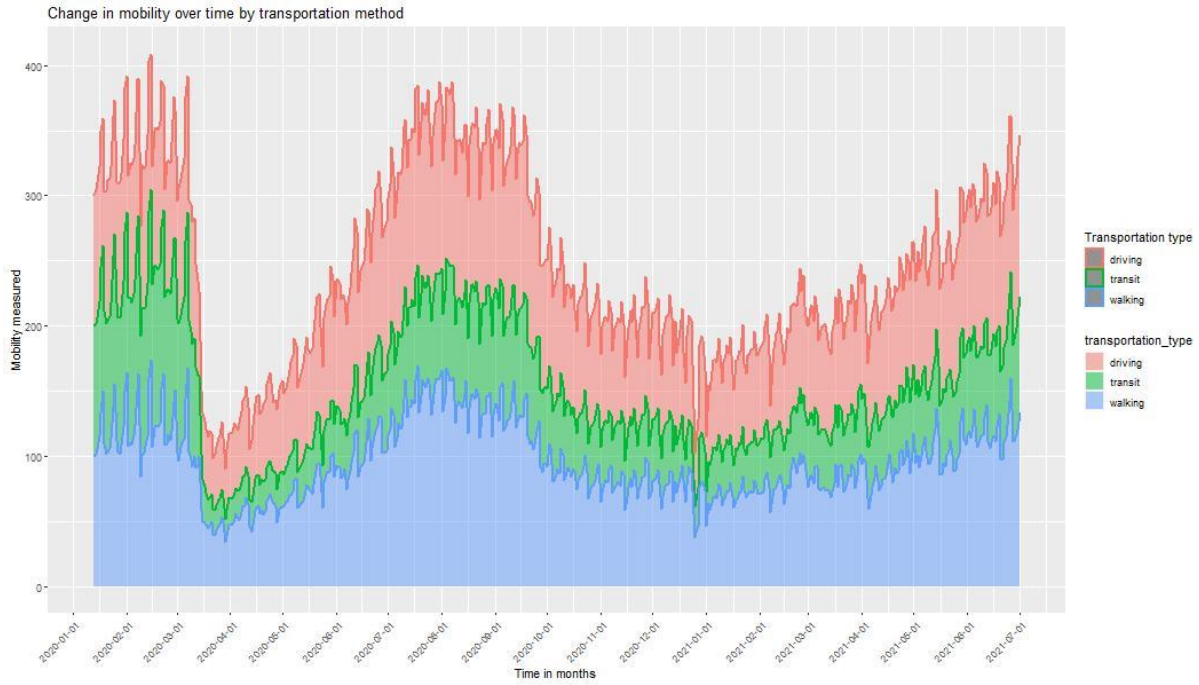


Figure 4: Area plot describing the change in mobility over time by transportation type.

We observe a sharp drop in all modes of transportation in mid-March, 2020, and a lesser one in early/mid-October 2020. Public transport ('transit') takes the greatest hit, and does not recover to its original values. On the other hand, walking and driving both increased at approximately the same rate. The total amount of walking and driving increased back to 'pre-pandemic' levels in July 2020, and drop again in October 2020. By June of 2021, both have reached approximately the same levels as pre-pandemic figures. Transit has not yet achieved this.

5.1.3. Overview of regional data

It is also interesting to compare all the regions within the Netherlands to see how they differed in their reaction to the lockdowns in terms of mobility.

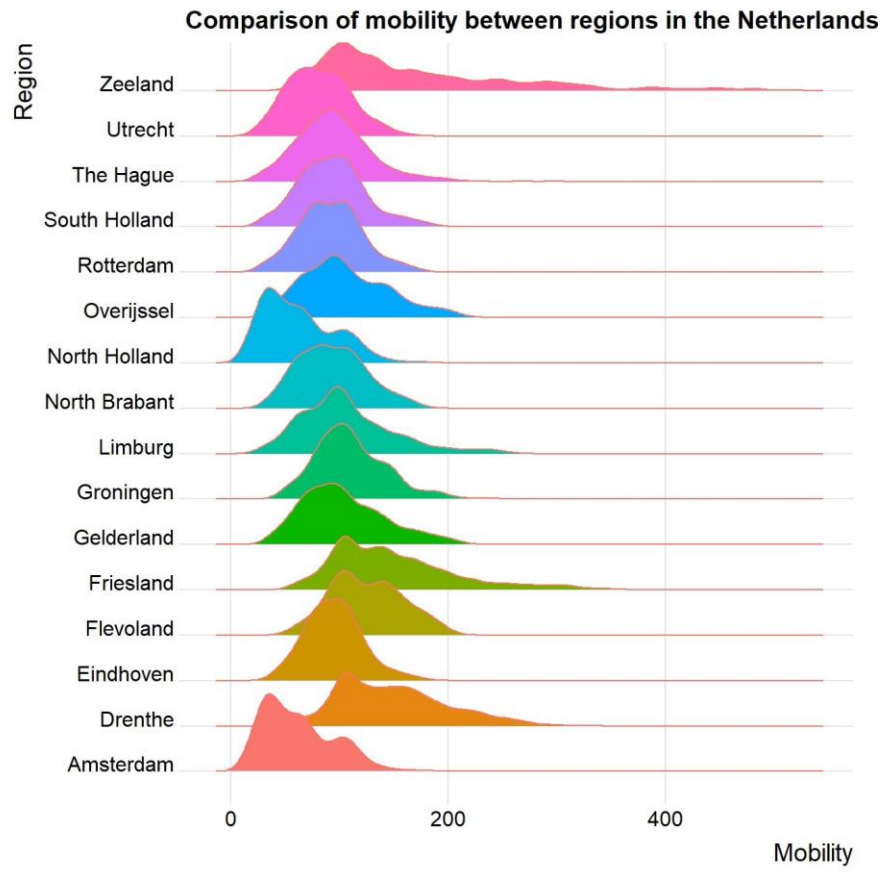


Figure 5: Ridge plot describing the distribution of mobility in the different provinces of the Netherlands.

Several discrepancies between mobility behaviors may immediately be noted; for example, Zeeland shows a much flatter distribution as compared to North Holland, for example. Regions with flatter distributions are likely to be higher mobility regions.

To further evaluate this, we can now compare the mobility trends in the different regions over time. Considering the number of variables to be examined here, a heat map is called for compressed visualization.

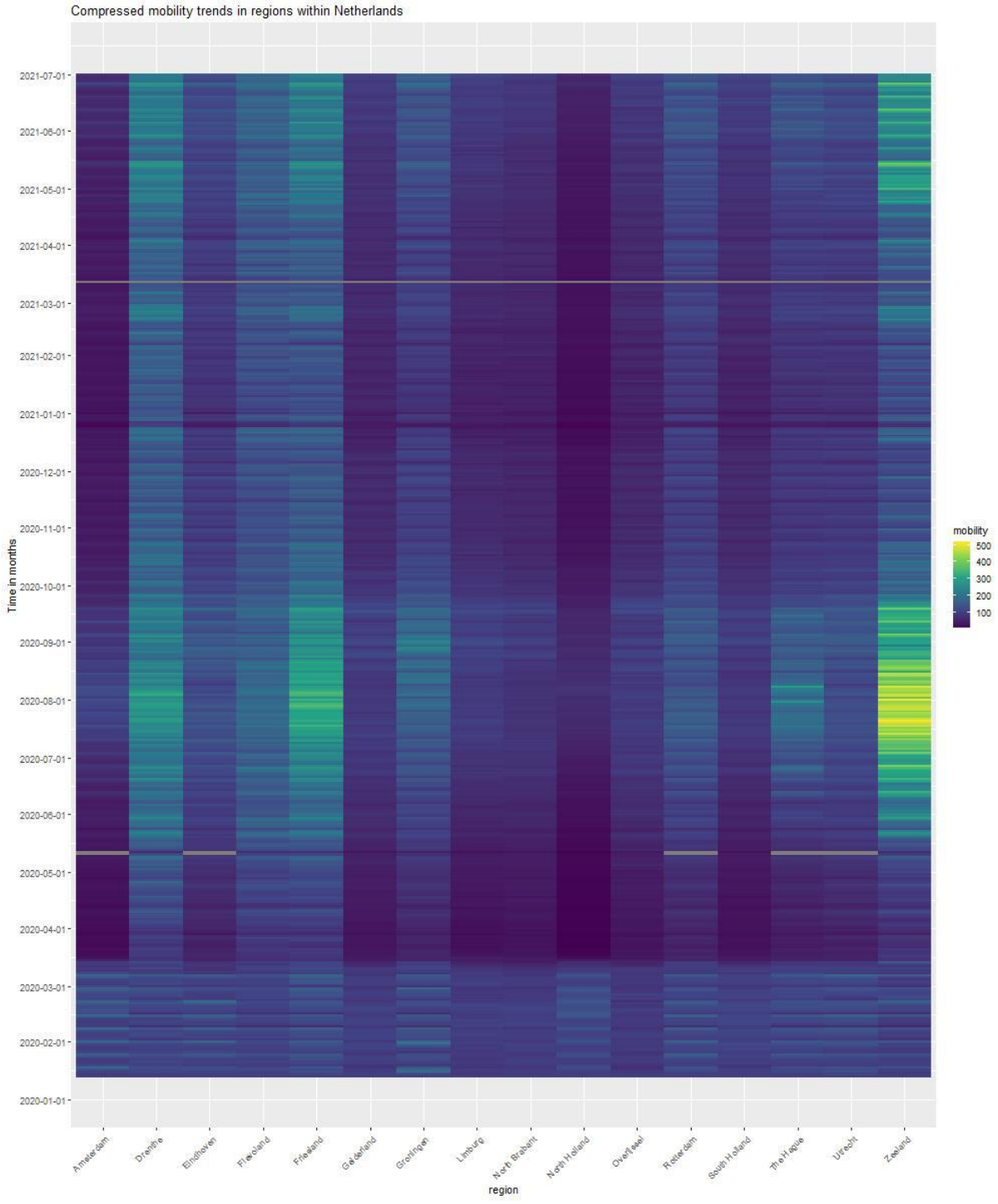


Figure 6: Heat map comparing the mobility in each province from January 2020 to June 2021

Observations:

It is seen that until the point of interest in March 2020, all the regions had similar trends. All regions recovered mobility around July, except for North Holland and Amsterdam, which remained low. Another reduction is seen around October 2020, except in Drenthe, Friesland, and Zeeland. (Note: Amsterdam lies within the province of North Holland, therefore trends seen are very similar.)

The Amsterdam region remains consistently low until the end of the available data, reverting to pre-pandemic figures in May 2021. The Zeeland, Drenthe and Friesland regions increased its mobility even more than before drop in March 2020. Minimal fluctuations were seen in the Overijssel region.

From these plots, we can identify that:

1. An interesting event occurred around 15th March 2020 and 15th October 2020. This can be crosschecked against the news from those days.
2. The Amsterdam region is of interest for reduced mobility.
3. The Overijssel region remained mostly stable, despite the changes in laws and restrictions.
4. The Zeeland, Friesland and Drenthe regions are of interest for increased mobility.

5.2 Further exploration

5.2.1. Event of interest

By crosschecking on the government website, it was seen that 15th March 2020 was the day that the first set of lockdowns were introduced in the Netherlands[2]. Schools, universities, sports clubs, gyms, saunas and coffee shops were also to be closed from this date onwards. It is highly likely that this was a major reason for the sharp decline in mobility. A second, partial lockdown was announced on 13th October, 2020[3].

5.2.2. Region of most reduced mobility

Visualizing the trends in Amsterdam may provide important insights about reduced mobility areas; we begin with a high-level overview.

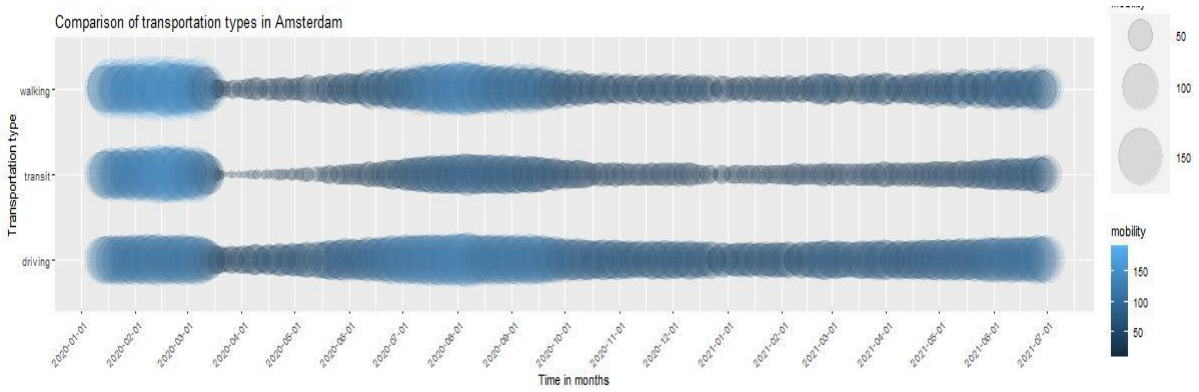


Figure 7: Comparison of mobility trends shape in Amsterdam.

We note that transit was affected strongly, and walking moderately, during both lockdowns. It is interesting to examine the trends of driving in the Amsterdam region.

Figure 8:Comparing change of driving trends in Amsterdam with walking/transit trends.

We note from this plot that the trend of driving recovered quickly after the first lockdown and remained high in Amsterdam. It is seen to be preferred over both walking and transit. It is useful to check these distributions to spot any discrepancies.

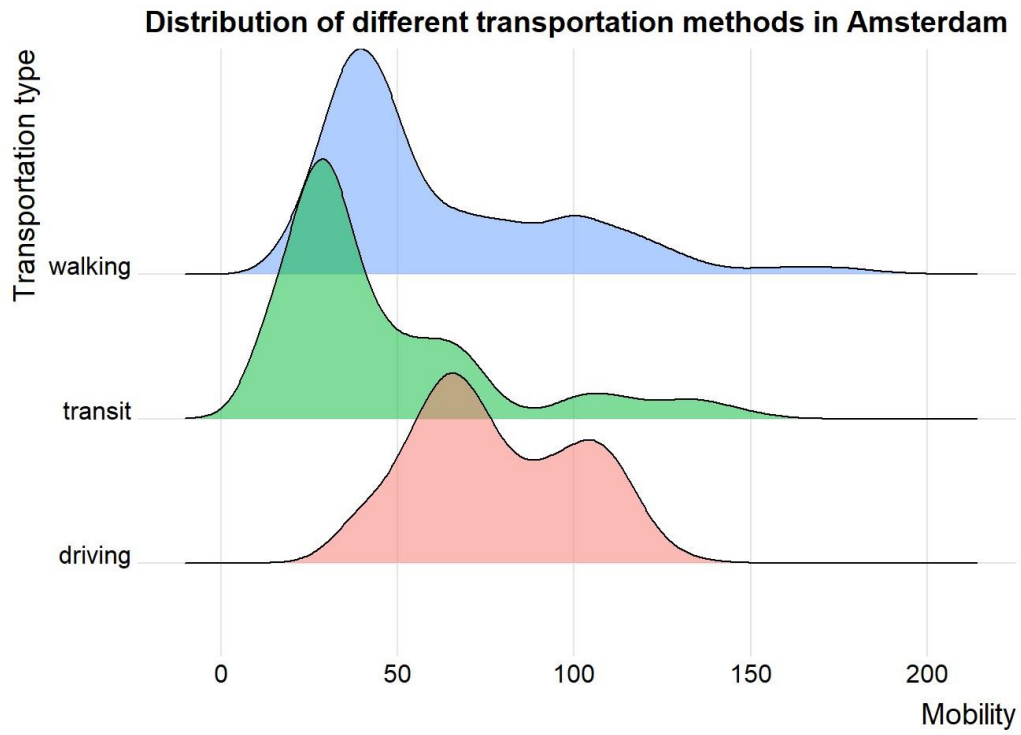


Figure 9: Distribution of different methods of transport in Amsterdam

The ridge plot confirms that driving is maintained as a stable form of transport in Amsterdam.

5.2.3 Regions showing relative stability

The Overijssel region did not appear to show much fluctuation in mobility. This may be examined by viewing the shape of mobility over time in this province.

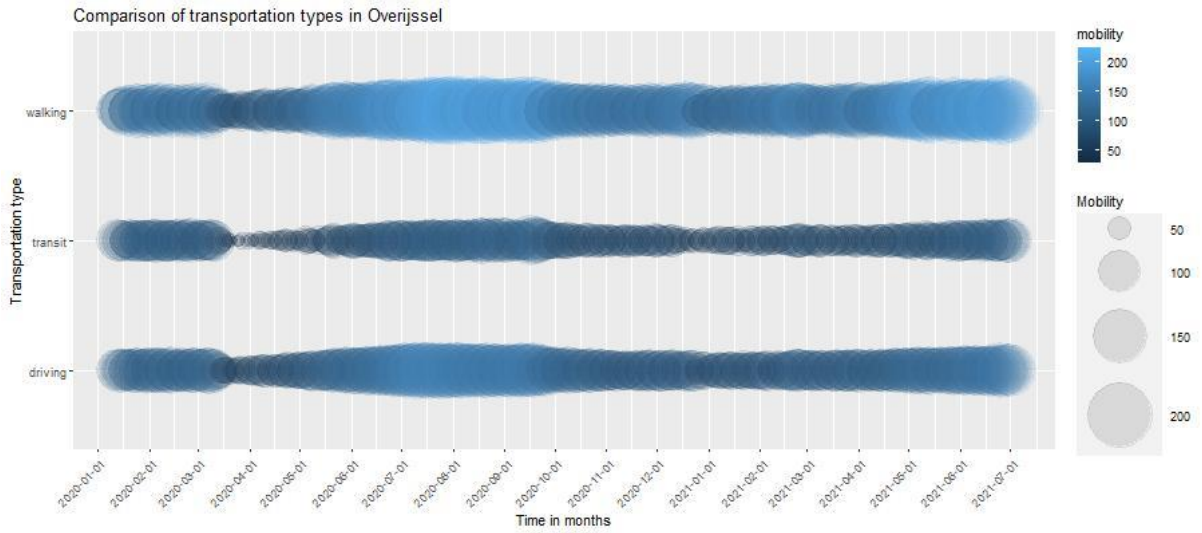


Figure 10: Comparison of mobility trend shape in the Overijssel province.

Like national trends, Overijssel also saw the greatest reduction in the use of public transport around March 2020, as seen in figure 10. Driving and walking also reduced to some extent but recovered more quickly than transit did. We can further visualize the trends in walking (compared to other methods), which appears to be the least affected group.

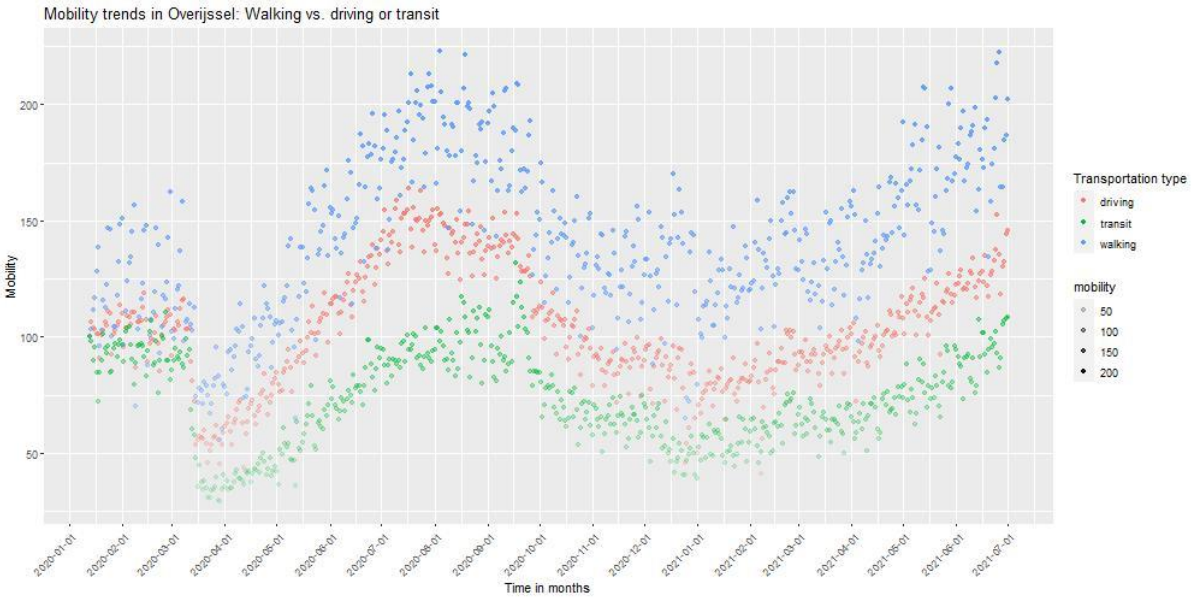


Figure 11: Comparison of walking data with transit/driving in Overijssel

Not only did walking quickly regain its high numbers in Overijssel, but it also exceeded them by June 2020. Walking also remains high until the end of the given time-period, as per figure 11. In comparison, driving exceeds pre-pandemic figures in around August, which drops off around October 2020, and then flattens out. Transit does not recover to pre-pandemic levels until the end of the given data.

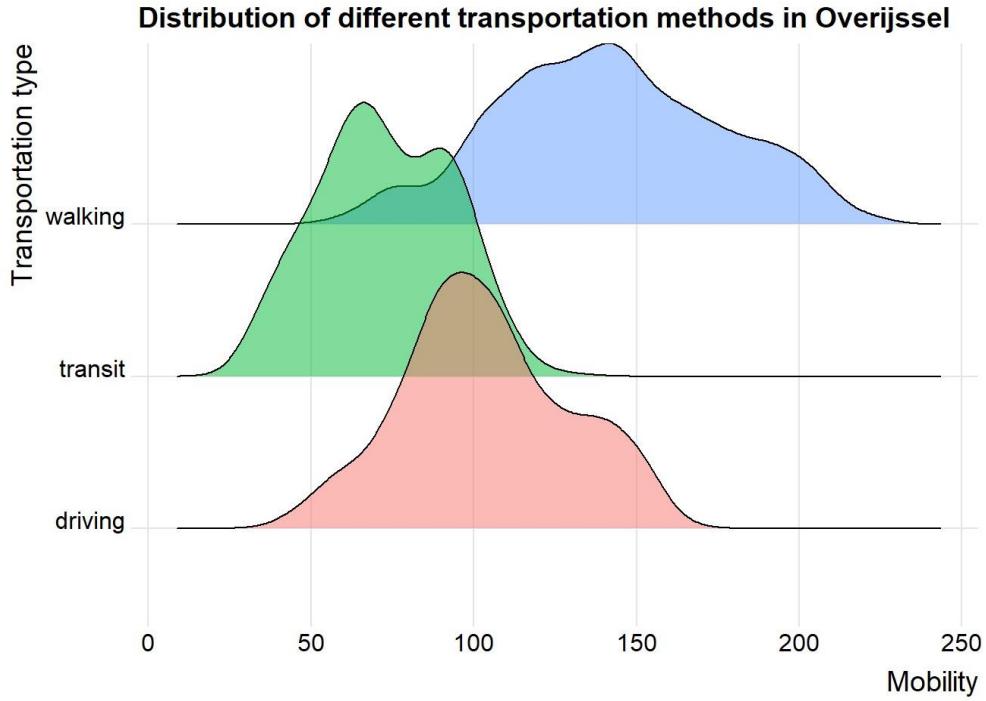


Figure 12: Comparison of distribution of transportation types in Overijssel

The distribution in Overijssel shows that walking is strongly favored. Compiling this insight with those from the previous plots, we can infer that consumers who favor walking should be the target group in this area.

5.2.4 Regions of highest mobility

Three regions were seen to maintain high mobility after the lockdowns were announced. Comparing these may provide interesting insights. Note: the dataset contained no information on public transit for these regions.

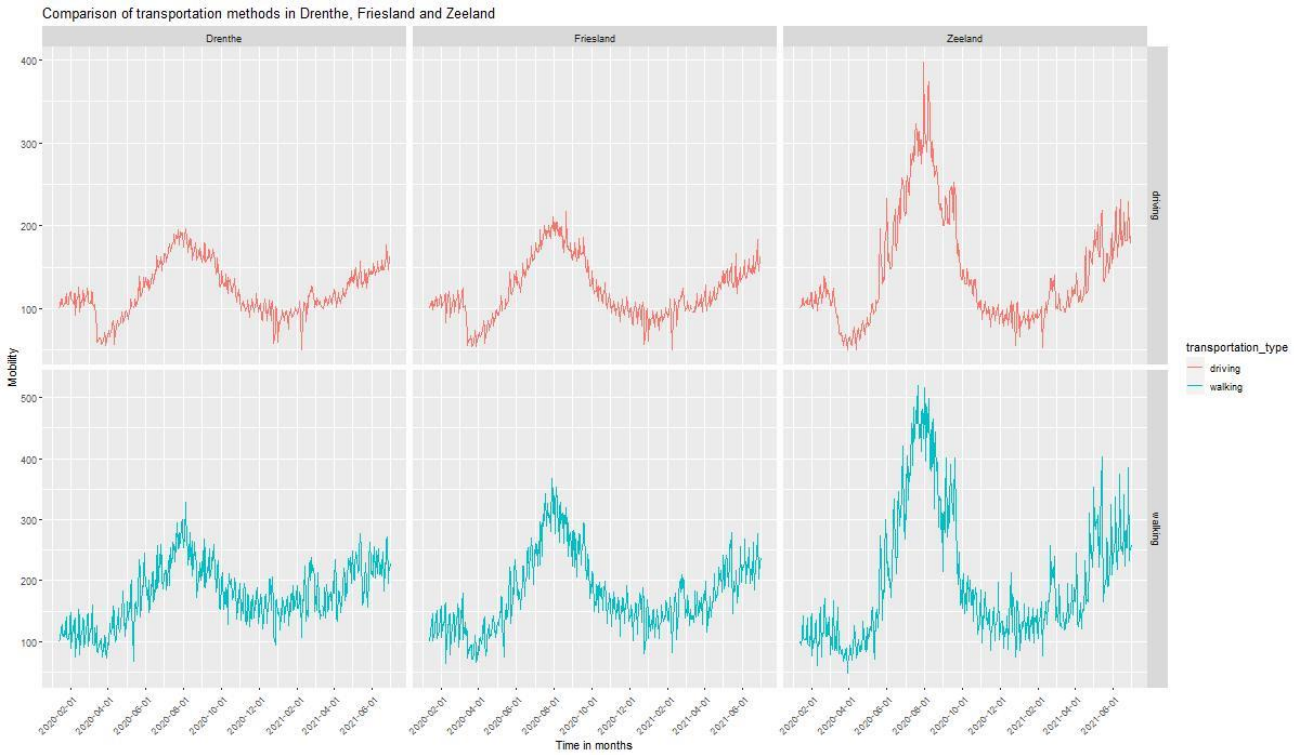


Figure 13: Comparison of driving and walking trends between Drenthe, Friesland and Zeeland provinces

Figure 13 shows that mobility fell to lower amounts in Zeeland (<50), but overall, it shows greater mobility than both Drenthe and Friesland. This is true for both walking and driving. All three regions have greater mobility through walking than driving.

5.2.5. Comparison of highly varied regions

As a check, we may compare the differences in walking data between Amsterdam, the high mobility regions (Drenthe, Friesland & Zeeland), and Overijssel. This visualization can help to elucidate whether the variance is sufficiently big to base decisions upon.

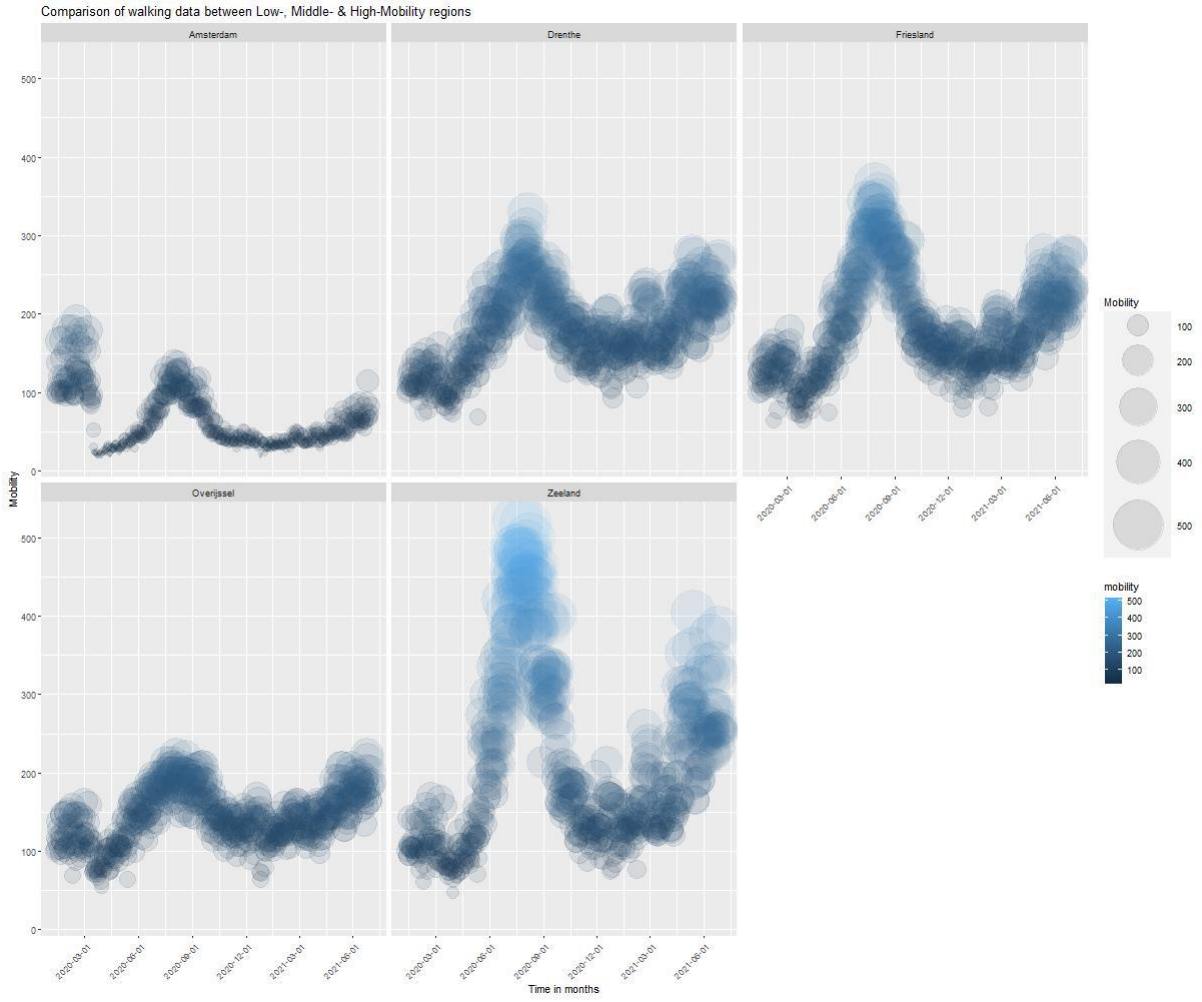


Figure 14: Comparison of low-, middle- and high-mobility provinces

The comparative plot highlights important differences between the regions of interest. Based on figure 14, we may establish that the difference between the high-, mid- and low-mobility regions is big enough that the client may consider taking different actions in the different regions.

6. Discussion

In section 5, total mobility was examined in the Netherlands and its constituent regions. Several key insights were derived from this:

i. Large cities suffered heavy losses in the use of public transport. This is therefore an unreliable area for the client to focus on. It is advisable to focus on consumers who drive, as this statistic remained stable despite the two lockdowns.

ii. Provinces which do not have large cities did not have public transit data. This indicates that consumers preferring walking in that region may be reached most easily.
iii. Regions that show stability despite the two lockdowns may be more receptive to varied products and advertisements. It may also be of interest to focus on walking preferring consumers in the Overijssel region, as walking appears to be strongly favored there.

Market segmentation by region is likely to aid in the optimization of product release; the client does not need to waste resources on targeting less receptive consumers.

It is also essential to note some important cons of this analysis:

- The dataset had no information on bicycling. Cycling is an important commuting method in the Netherlands. In 2016, 27% of all mobility was attributed to bicycling. Analysis including this data may look different than this report[4].
- This analysis also did not consider the effect of the weather on mobility. Due to a lack of pre-pandemic data, it was not clear how divergent the trends were from normal.

7. Conclusions

This analysis may be combined with regional knowledge to optimize the introduction of products in the Netherlands. For example, for the client wishing to introduce new products in the sports market, the stability of the driving trend in Amsterdam may be of interest. Consumers who have invested in a car are less likely to also buy a skateboard or similar exercise-related transport method. Therefore, it may be ideal to focus on at-home workout equipment in this region. On the other hand, the Overijssel region, which strongly favors walking, may be a ripe market for fitness trackers, walking shoes or athleisure clothing lines.

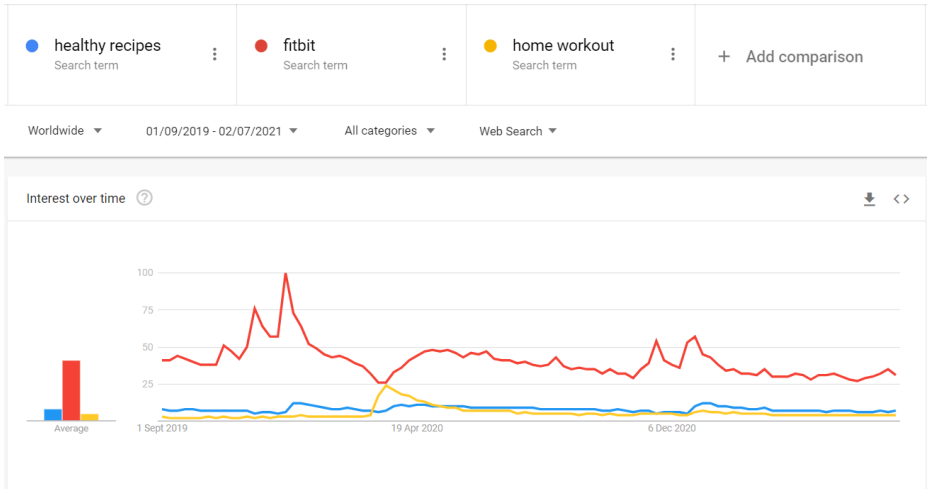
The COVID-19 pandemic has shown that flexible businesses are more likely to succeed. Leveraging available data to this end, then, is a wise decision for a company wishing to optimize business in a specific region.

Literature

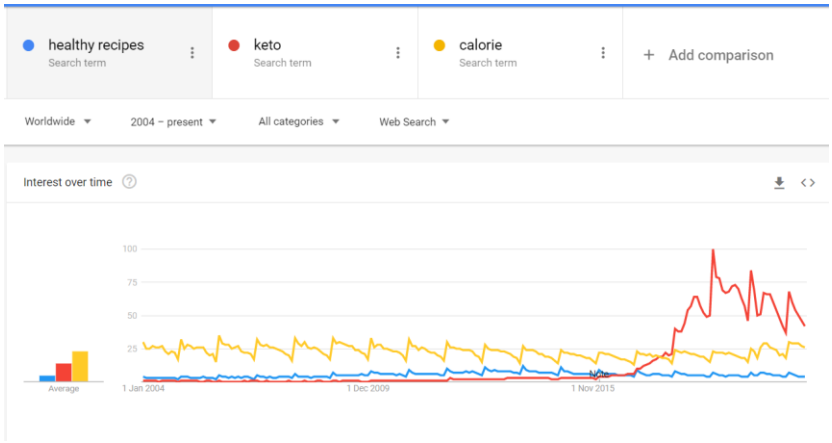
1. COVID-19 Mobility Trends Report. https://COVID19.apple.com/mobility. Accessed 25 June, 2021.
2. COVID-19: Additional measures in schools, the hospitality sector and sport. https://www.government.nl/latest/news/2020/03/15/additionalmeasures-in-schools-the-hospitality-sector-and-sport. Accessed 28 June, 2021.
3. Partial lockdown needed to bring down infections. https://www.government.nl/latest/news/2020/10/13/partial-lockdown-needed-to-bring-down-infections. Accessed 28 June, 2021.
4. Cycling Facts 2018. https://www.government.nl/documents/reports/2018/04/01/cycling-facts-2018. Accessed 05 July, 2021.

Appendix

1. Google Trends images
    a. Comparison of terms ‘healthy recipes’, ‘fitbit’, and ‘home workout’. Data source: Google Trends (https://www.google.com/trends)



    b. Comparison of terms ‘healthy recipes’, ‘keto’, and ‘calorie’. Data source: Google Trends (https://www.google.com/trends)


healthy recipes
Search term
keto
Search term
calorie
Search term
Add comparison
Worldwide
2004 – present
All categories
Web Search
Interest over time
100
75
50
25
Average
1 Jan 2004
1 Dec 2009
1 Nov 2015