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“Modelled versus experienced reality: a study on the risk of experiencing transport poverty for the city of Rotterdam”



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The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

Foreword

In front of you lies my thesis in conclusion to my bachelor Economie & Bedrijfseconomie at the Erasmus University Rotterdam. This thesis is the final product of an informative and valuable period in which I learned a lot about constructing, executing and analysing an academic research. In constructing the research question, I was looking for a subject that has a close relationship to real-life situations and problems. So, when I first heard about the subject of “transport poverty” in my major courses, I was immediately intrigued. Growing up in the rural area of Zeeland, I was confronted with transportation choices from a young age.

Relatively large distances to my daily activities in combination with a lack of suitable public transportation options meant that with every activity you planned, the question of “how to get there” became first priority. Since I was young and got used to the situation, the lack of transportation options and the impact this had on my daily activities never really occurred to me. This thesis helped me gain an understanding of the concepts of social exclusion and transport poverty, and the impact on the life (quality) of individuals that might experience it.

I would like to thank prof. Dr. Mingardo for the great guidance during this strange period. I never once felt like the COVID19-pandemic complicated or limited me in getting the guidance I needed. The smooth communication and useful critique allowed me to look at the subject from multiple points of view and choose the one most suitable for the research. Instead of limiting me in my thinking process, Dr. Mingardo pointed out the potential pitfalls and difficulties of the different research options that I myself did not foresee.

Rotterdam, July 2020

Niels Westdorp

Summary

This thesis studies the potential risk of experiencing transport poverty for inhabitants of each different neighbourhood in the city of Rotterdam. To do so, the thesis is split up into two parts. The first part aims to construct a risk-prediction model containing literature-based indicators of transport poverty. The second part will then analyse the experienced transport poverty for two case-neighbourhoods in real-life to see if the prediction model provides an useful indication.

To complete the first part, literature review about the topics of “transport poverty” and “social exclusion” will determine adequate indicators of transport poverty. For these indicators, neighbourhood-specific data from the Dutch Centraal Bureau voor de Statistiek (CBS) will be used. A risk-prediction model will then be constructed containing the following components; the data of the indicators will be grouped into four equal quantiles, each indicating a degree of risk on experiencing transport poverty. The average of all the risk-scores for the different indicators for each corresponding neighbourhood will then provide a final risk-score for each neighbourhood ranging from “Very low” to “Very high”. The results of the risk-prediction model will be visualized using QGIS.

For the second part a survey is conducted amongst inhabitants of two case-neighbourhoods. One of this neighbourhoods has a “Very low” risk-score, whilst the other one scores “Very high”. Unfortunately, due to the pending COVID19-pandemic, no personal in-depth interviews could be conducted. The level of experienced transport poverty will therefore be determined by the extent to which respondents agree with a number of statements concerning transport poverty. These answers will then be compared with the personal characteristics of the respondents to see if the indicators used in the risk-prediction model seem to be accurate.

In the end, comparison of the results indicate the validity of most indicators used in the risk-prediction model. Respondents with a low income, a non-Dutch immigration background or no access to a car or motorcycle are experiencing a higher level of transport poverty than their counterparts. Also, distance related variables seem to be a strong indicator for the risk of experiencing transport poverty as personal characteristics that indicate a higher risk of experiencing transport poverty seem to be less relevant when a neighbourhood is in close proximity to daily activities and facilities.

List of figures and tables

Figure 1. Research model depicting the order in which the different research processes lead to answering the main research question.....	10
Figure 2. Different definitions of social exclusion within transport studies (Rajé,2003).	12
Figure 3. All variables linked to their corresponding concept explaining transport poverty	16
Figure 4. QGIS visualization of all neighbourhoods in the city of Rotterdam	21
Figure 5. QGIS visualization of all neighbourhoods used in the dataset	21
Figure 6. Visualization of all neighbourhoods in the city of Rotterdam. The grey areas indicate residential areas, the orange areas are areas of industry.....	22
Figure 7. QGIS visualization of all neighbourhoods used in the dataset with their corresponding risk-score.	23
Figure 8. QGIS visualization of neighbourhoods with risk-score “very low”	23
Figure 9. QGIS visualization of neighbourhoods with risk-score “low”	24
Figure 10. QGIS visualization of neighbourhoods with risk-score “neutral”	24
Figure 11. QGIS visualization of neighbourhoods with risk-score “high”	25
Figure 12. QGIS visualization of neighbourhoods with risk-score “very-high”	25
Figure 13. Visualization of the location of Prins-Alexander district	28
Figure 14. Visualization of the location of neighborhood Nesselände	29
Figure 15. Visualization of the location of Rotterdam-Noord district.....	30
Figure 16. Visualization of the location of neighborhood Blijdorp.....	31
Figure 17. Frequency table “In which neighbourhood do you live?” for respondents from both neighbourhoods	33
Figure 18. Frequency table “What is your age?” for respondents from both neighbourhoods.....	33
Figure 19. Frequency table “What is your age?” for respondents from Nesselände	34
Figure 20. Frequency table “What is your personal background?” for respondents from Nesselände..	34
Figure 21. Frequency table “What is your income?” for respondents from Nesselände	35
Figure 22. Frequency table “Do you make use of financial arrangements?” for respondents from Nesselände.....	35
Figure 23. Letter that was distributed amongst inhabitants of neighbourhoods Nesselände and Blijdorp inviting them to participate in the survey	61
Figure 24. Message posted by “Nieuws Nesselände” Facebook page asking inhabitants of Nesselände to fill in the survey.....	62
Figure 25. Message posted by “Wijkraad Blijdorp en Blijdorpse Polder” Facebook page asking inhabitants of Blijdorp to fill in the survey	62
Figure 26. The result from the random comment picker used to determine the winner of the €25 MediaMarkt gift card (link to result: https://commentpicker.com/nl/online-naam-loten.php?id=rnp_5eec86dae3437735)	63
Figure 27. Delivery of the €25 MediaMarkt gift card to Lieve Vrijzen, inhabitant of Blijdorp	63
Table 1. Selection of Variables Used in Risk-prediction Model With Corresponding Description	15
Table 2. Group Classification for Variable “Percentage of inhabitants aged under 15 or over 65” Based on Four Quantiles	17
Table 3. The Group Classification for All Variables Used in the Risk-prediction Model.....	18
Table 4. Descriptive Statistics of All Variables Used in Risk-prediction Model	20
Table 5. The Averaged Risk Scores for Each Neighbourhood in the District Prins-Alexander.....	28
Table 6. The Averaged Risk Scores for Each Neighbourhood in the District Rotterdam-Noord.....	30
Table 7. Risk scores of Each Indicator for Each Corresponding Neighbourhood from the Risk-prediction Model	52

Table 8. Frequency Tables for All Answers to the Survey Questions; Both Neighbourhoods	54
Table 9. Frequency Tables for All Answers to the Survey Questions; Only Neighbourhood of Nesselande.....	56
Table 10. Frequency Tables for All Answers to the Survey Questions; Only Neighbourhood of Blijdorp.....	58

List of abbreviations

EU – European Union

Centraal Bureau voor de Statistiek - CBS

SEU – Social Exclusion Unit

Table of contents

Foreword	2
Summary	3
List of figures and tables	4
List of abbreviations	5
Chapter 1	7
1.1 Introduction	7
1.2 Aim and research questions	8
1.3 Research model	10
Chapter 2	11
2.1 Theoretical framework	11
2.1.1 Social exclusion	11
2.1.2 Transport poverty	12
2.1.3 Choice of indicators transport poverty	15
Chapter 3	16
3.1 Research methodology: Risk prediction model	16
3.1.1 Descriptive statistics indicators used in risk-prediction model	20
3.1.2 Population selection: Risk-prediction model	21
Chapter 4	22
4.1 Results: Risk-prediction model	22
Chapter 5	26
5.1 Research methodology: survey	26
5.1.1 Case selection	27
5.1.2 Population selection: Survey	31
5.1.3 Survey questions	32
Chapter 6	33
6.1 Results: Survey	33
6.1.1 Data collection process and general results	33
6.1.2 Results Nesselande	34
6.1.3 Results Blijdorp	38
Chapter 7	41
7.1 Conclusion	41
7.1.1 Sub-questions	41
7.1.2 Main research question	44
7.2 Discussion	45
7.3 Recommendations	47

7.4 Reflection	48
Chapter 8	49
8.1 Bibliography	49
8.2 Appendix	52

Chapter 1

1.1 Introduction

Equal rights and opportunities for all is a core value in many of modern-day societies. One hurdle to overcome when striving for equal opportunities is the existence of social exclusion. This exclusion involves a lack of or denial of resources, rights or goods resulting in an inability to participate in relationships and activities that the majority of the population does have access to (Levitas et al, 2007).

One problem contributing to social exclusion is transport poverty. Transportation, and the lack of it, plays a major role in everyday life. The accessibility of different transportation modes impacts the availability and accessibility of facilities that contribute to the quality of life for individuals. For example, the most popular transportation mode in the Netherlands is the car. There are an estimated 8.7 million cars in the country, and this number has been increasing for over two decades (CBS, 2020). Because of this popularity, many facilities are often located close to highways or sub-urban areas, which are in general harder to reach by public transport or bicycle. Non-car owners therefore must sacrifice more time, effort and costs to reach certain destinations as compared to car owners (Martens, 2011). So, a non-car owner might experience limited access to educational or employment facilities due to his or her lack of transportation mode choices. The disparity that arises because of car ownership was first recognized by Baetens et al in 1997, over two decades ago. Yet, infrastructure in countries and cities since then has mainly prioritized the car as main mode of transport.

It is important to note that the outcome of studies conducted in other countries on the topic of transport poverty might not be applicable to the fullest extent in the Netherlands. In the Netherlands cities are fairly compact, public transport is considered to be quite well organized and, perhaps most importantly, the bicycle plays a major role in the daily transportation of many people (Bastiaanssen, 2013). Unfortunately, the data surrounding bicycle use in the Netherlands and the city of Rotterdam is inadequate for this thesis. Contrary to the characteristics stated above that might have a negative impact on the chances of experiencing transport poverty in the Netherlands, growing urbanisation of employment opportunities and

rising cost of car ownership in the Netherlands might be factors contributing to transport poverty (Bastiaanssen, 2013). All considered, the risk of experiencing transport poverty in the Netherlands overall is seen as relatively low, but higher for low-income households in urban areas like the city of Rotterdam (Martens, 2011). This thesis will therefore try to construct a risk-prediction model for each neighbourhood in the city of Rotterdam and compare it to the actual level of transport poverty experienced by the inhabitants of these neighbourhoods. The model will hopefully allow us to make a relatively accurate prediction for the experienced transport poverty. The variables needed for this model will be derived from previous studies and research concerning transport poverty.

1.2 Aim and research questions

Municipalities across the Netherlands receive monetary aid from the national government to battle poverty. However, this monetary help for low-income households usually consist of direct financial aid. A few examples of this direct aid are welfare, lowering municipality taxes and lowering healthcare insurance bills. However, these measures see financial poverty as an all-encompassing term for all forms of poverty. This can cause municipalities to ignore the underlying foundations that cause poverty and just focus on assisting individuals financially. The most globally used definition of poverty: “Fundamentally, poverty is a denial of choices and opportunities, a violation of human dignity. It means a lack of basic capacity to participate effectively in society.” (United Nations, 1998), does not include transportation in its list of basic human necessities at all, meaning there is currently no global cooperation in battling transport poverty. So, in battling poverty the importance of studying transport poverty cannot be underestimated. Because transport is a derived demand, it is often required to gain access to services and opportunities (Mattioli et al, 2017). Therefore, a lack of transportation is shown to impact factors that are positively correlated with poverty (SEU, 2003). For example, a lack of transportation options increases the chances of unemployment (Smart & Klein, 2015) and can limit the possibility of attaining education (Kenyon, 2011). This thesis therefore finds its social relevance in the current lack of focus on transport poverty in battling poverty in the Netherlands.

The studying of transport poverty is relatively new in Western Societies and the Netherlands in particular. A few studies have been conducted to gain a better insight on the impact and indicators of transport poverty. Some of these studies have been quantitative, like the work of Smart and Klein (2015) others have focussed on the qualitative aspects of studying transport poverty, by for example conducting in-depth interviews (Bastiaanssen, 2013). However, no

research has yet investigated the differences between estimated and experienced risk of transport poverty.

Like mentioned in the introduction, low-income households in urban areas are at more risk of experiencing transport poverty. This group is very much present in Rotterdam. This thesis therefore aims to estimate a risk-prediction model for each neighbourhood in Rotterdam and compare it with the actual transport poverty experienced in these neighbourhoods. The analyses will be conducted to construct a coherent and decisive answer to the following main research question:

Can a risk-prediction model for transport poverty be constructed that reflects the experienced transport poverty for the city of Rotterdam?

To find an answer to the main research question stated above, a number of sub questions will be evaluated to construct a coherent and decisive answer. The sub questions that will be evaluated are:

1. What are the determinants of transport poverty?
2. Which neighbourhoods are estimated to have the lowest and highest risk of transport poverty?
3. Is the level of experienced transport poverty higher in a neighbourhood with a high risk-score?

1.3 Research model

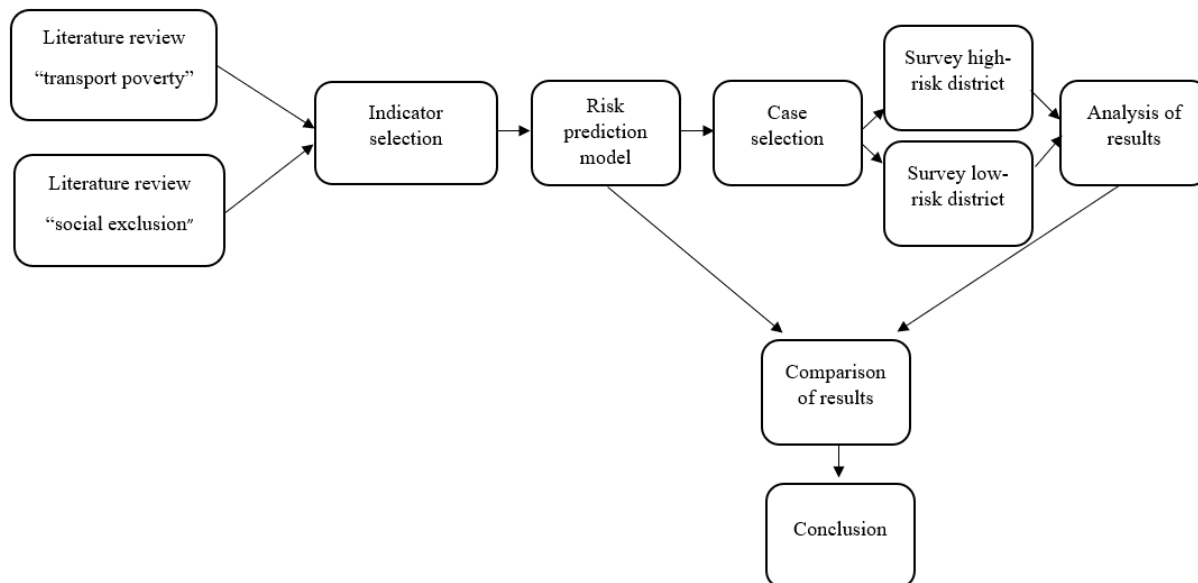


Figure 1. Research model depicting the order in which the different research processes lead to answering the main research question.

In the research model above, a rough outline of the research conducted in this thesis is depicted. First, literature of previous studies concerning social exclusion and transport poverty will be analysed to construct a clear understanding of the indicators contributing to the risk of experiencing transport poverty. After the indicators are selected, the risk-prediction model will be made. The results of this model will then be used to select two appropriate cases. After describing the current situation and demographic characteristics of both these neighbourhoods, one high-risk neighbourhood will be selected. The other one will be a low-risk neighbourhood. Once the cases are selected, a survey will be constructed and distributed amongst the inhabitants of both these neighbourhoods to evaluate the experienced transport poverty for inhabitants of both neighbourhoods. The results of this survey will then be compared to the results of the risk-prediction model to form an answer to the research questions.

Chapter 2

2.1 Theoretical framework

In the theoretical framework, the most important terms will be defined and explained in respect to the research questions. The two terms that form the foundation for this thesis are social exclusion and transport poverty. Literature and previous studies concerning these topics will therefore be reviewed to form the base for further research processes.

2.1.1 Social exclusion

The terms inclusion and exclusion have been around for a long time. To exclude means to shut out, bar, hinder, put out or eject (Gove, 1993). This meaning also holds when analysing exclusion as a social issue. The French government official Lenoir is seen as the founder of the term “social exclusion” when he described the different groups of society in France that were not able to fully participate in society (1974). The term social exclusion since then has been more and more used in relation to- and as indicator for- poverty. Some countries even established special government agencies to tackle the problem, an example of this is the Social Exclusion Unit (SEU) in Great Britain (Levitas, 2007). Although most academics agree that social exclusion and poverty are related, Miliband argues that both problems need to be battled separately (2006). He states that battling social exclusion through the war on poverty is ineffective. The problem of social exclusion is also tackled on a cooperative basis; at the Nice convention in 2001, the European Union (EU) specified that it would focus on social inclusion in its social policy. The EU also urged each member state to come up with its own programmes to battle social exclusion, like the SEU mentioned above. (Levitas, 2007).

As literature suggests, defining the term “social exclusion” correctly is important and can be different for different (academic) disciplines. Therefore, the concept of social exclusion has also been defined in multiple ways for studying the concept in transportation studies. Figure 2 shows an overview of these definitions (Rajé, 2003). The figure shows that there are many ways to interpret social exclusion, however, all of them seem to share the view that some kind of underlying indicators cause individuals or groups to not be able to fully participate in society.

Definitions and explanations of the term social exclusion

Definition/explanation	Key concepts of definition/explanation	Source
Social exclusion is a process, which causes individuals or groups, who are geographically resident in a society, not to participate in the normal activities of citizens in that society.	Process, individual/group, participation, normal activities	Hine and Mitchell (2001)
Social exclusion is a shorthand term for what can happen when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime, bad health and family breakdown.	Individual/group, social/family/ personal problems	Social Exclusion Unit (2001)
The condition of living in a society but not having the opportunity to participate in the normal activities of citizens in that society.	Condition, opportunity, participation, normal activities	Sinclair (2001)
Social exclusion is more influenced by accessibility of goods and services than by mobility per se.	Accessibility rather than mobility	Commission for Integrated Transport (2001)
Social exclusion is a process, which causes individuals or groups not to participate in the normal activities of the society where they are residents. The concept of social exclusion is understood as a multi-dimensional phenomenon, where exclusion is characterized conceptually as the process, which prevents people from a full participation in the society, i.e. from being socially integrated.	Process, individual/group, participation, normal activities Multi-dimensional, process	Preston et al. (2000) EUBusiness (2000)
Social exclusion and poverty are strongly linked. Generally there seems to be agreement that poverty can be seen as 'distributional', linked to resources, and social exclusion as 'relational' (Room, 1995; Spicker, 1997). Relational issues include 'inadequate social participation, lack of social integration and lack of power' (Room, 1995).	Relational, without power/ social interaction	TraC (2000)
Exclusion springs from the desire to belong while not being able to.	Belonging	McCluskey (1997)

Figure 2. Different definitions of social exclusion within transport studies (Rajé,2003).

The following definition from EUBusiness (2000) for social exclusion within transportation studies will be used throughout this thesis (figure 2):

“The concept of social exclusion is understood as a multi-dimensional phenomenon, where exclusion is characterized conceptually as the process, which prevents people from a full participation in the society, i.e. from being socially intergrated”

2.1.2 Transport poverty

The concept of transport poverty comes from the studying of social exclusion (CBS, 2018). A definition for transport poverty, as stated by Meert et al. (2003), describes what the potential impact of transport poverty on social exclusion can be. This definition will be used as guideline in this thesis for studying transport poverty:

“A lack of mobility that causes an individual to not be able to fully participate in society.”

Indicators for experiencing transport poverty can differ between rural and urban areas. In rural areas, car ownership is important because facilities and activities tend to move away from these scarcely inhabited areas and public transport networks are not as good as in urban areas. Contrary, inhabitants of cities experience more risk of transport poverty when compared to rural areas because of indicators like safety of the public transport network and the safety of bicycle usage in crowded cities (CBS, 2018). As this thesis focusses on the city of Rotterdam, it is important to keep this in mind when selecting the indicators. Furthermore, it is important

to notice that experiencing transport poverty is subjective. That's why this thesis in part focusses on the amount of transport poverty actually experienced. Some people are more sensitive than others. An example of this is the fact that certain people tend to get used to their situation and therefore do not experience transport poverty in the same way that other individuals might. (Martens et al., 2011).

The indicators that influence the risk of experiencing transport poverty can be categorized in one of four different concepts (Lucas, 2016):

1. Mobility poverty: a lack of adequate transportation modes
2. Accessibility poverty: facilities or activities that cannot be reached by individuals.
3. Affordability of transport: Individuals lack mobility options because of monetary reasons
4. Personal circumstances: Some individuals might have to deal with personal circumstances that hinder mobility (e.g. handicaps, health, etc.)

These concepts explain transport poverty for separate individuals, however the theory is also suitable to use in this thesis when analysing a collection of individuals, like neighbourhoods. The relation of each variable used to determine the risk of experiencing transport poverty to its corresponding concept will be formatted in part 2.1.3.

For the Rotterdam case in this thesis, the following groups of high-risk individuals are of interest; first, people living in poverty are shown to be less mobile and have a smaller social range (Meert et al., 2003; Lucas et al., 2016). People that live in poverty also tend to spend less of their income on transportation as compared to wealthier individuals, which limits their mobility possibilities (CBS, 2017). In this thesis, individuals who receive welfare are also seen as having a low-income.

Second, people that do not own a car or motorcycle are more in danger of experiencing transport poverty as mobility is more and more depending on the usage of these transportation modes. Almost half of all transportation in the Netherlands is by car, and this number has been rising for the last decades (CBS, 2018). As described in part 1.1, infrastructure and facility location choices in modern Western societies like the Netherlands are based on the fact that the car is the most popular mode of transportation. This leads to more facilities locating in areas that are difficult to reach by public transport or bicycle. This means that non-vehicle owners are restricted from certain activities simply because there is no other way than by car or motorcycle to reach these destinations (Jeekel, 2011).

Third, children and elderly are less mobile because of several factors. Elderly are often less capable of walking and cycling longer distances and therefore depend more on motorized transport. However, the percentage of elderly individuals that are in possession of a driver license is lower than that of adults. Therefore, the dependency on motorized transport is often restricted to public transport or help from family and relatives (Harms, 2008). Children are generally restricted to walking or cycling, which restricts the number of facilities and activities they can reach (CBS, 2018). If the children want to make use of motorized transport, they are often depended on their parents. Picking your children up or dropping them off often can also cause a greater risk of experiencing transport poverty for the parents (Bastiaanssen, 2012).

Fourth, literature suggest that an individual's background might be an indicator for experiencing transport poverty. People living in cities that have a non-western immigration background are less mobile and make less use of bicycles (Harms, 2006). Also, individuals with these backgrounds sometimes do not master the Dutch languages, which makes using and understanding the public transport system a lot harder (Huijnk & Andriessen, 2016).

Fifth, one of the main factors prohibiting people from reaching certain activities or destinations, next to car ownership, is the distance to these facilities. The facilities that are perceived as most vital can differ amongst individuals (CBS, 2019). This thesis will therefore analyse the average distance for all inhabitants to facilities that are vital to the wellbeing of almost every individual, like going to the supermarket and visiting your general practitioner. Almost a quarter of the total travel time for individuals is work related (CBS, 2019), unfortunately there is no adequate data available to take this into account for the risk-prediction model.

2.1.3 Choice of indicators transport poverty

From the literature review in part 2.1.2, a total number of 12 variables are selected from the data that help explain transport poverty in the risk-prediction model.

Table 1.

Selection of Variables Used in Risk Prediction Model With Corresponding Description

<i>Variable</i>	<i>Description</i>
Percentage younger than 15 and older than 65 years	The percentage of inhabitants of a neighbourhood that are either younger than 15 or older than 65 years.
Percentage non-western immigration background	The percentage of inhabitants that have a non-western immigration background.
Percentage low-income household in the neighbourhood	The percentage of household within the neighbourhood that are classified as low-income. A household is classified as low-income when the household income is part of the 40% lowest incomes in the Netherlands.
Percentage receiving welfare aid	The percentage of inhabitants in a neighbourhood that receive governmental welfare aid.
Vehicle-ownership rate	This rate is composed by adding the total number of cars and motorcycles in a neighbourhood and dividing this by the number of inhabitants
Distance to nearest school	The average distance for all inhabitants to the nearest elementary or high school
Distance to nearest supermarket	The average distance for all inhabitants to the nearest (large) supermarket
Distance to nearest general practitioner	The average distance for all inhabitants to the nearest general practitioner
Distance to nearest life supplies store	The average distance for all inhabitants to the nearest store that sells all other life supplies outside of food and drinks (e.g. cosmetics or hygiene products)
Distance to nearest train station	The average distance for all inhabitants to the nearest train station
Distance to nearest public transportation hub	The average distance for all inhabitants to the nearest public transportation hub. A public transportation hub is a place where travellers can switch between trains, busses, trams, etc.
Distance to nearest social gathering	The average distance for all inhabitants to the either the nearest museum, music venue or cinema.

Recognizing the four concepts that together form transport poverty as described in part 2.1.2 (Lucas, 2016), The following visualization indicates which variables correspond to which concept:

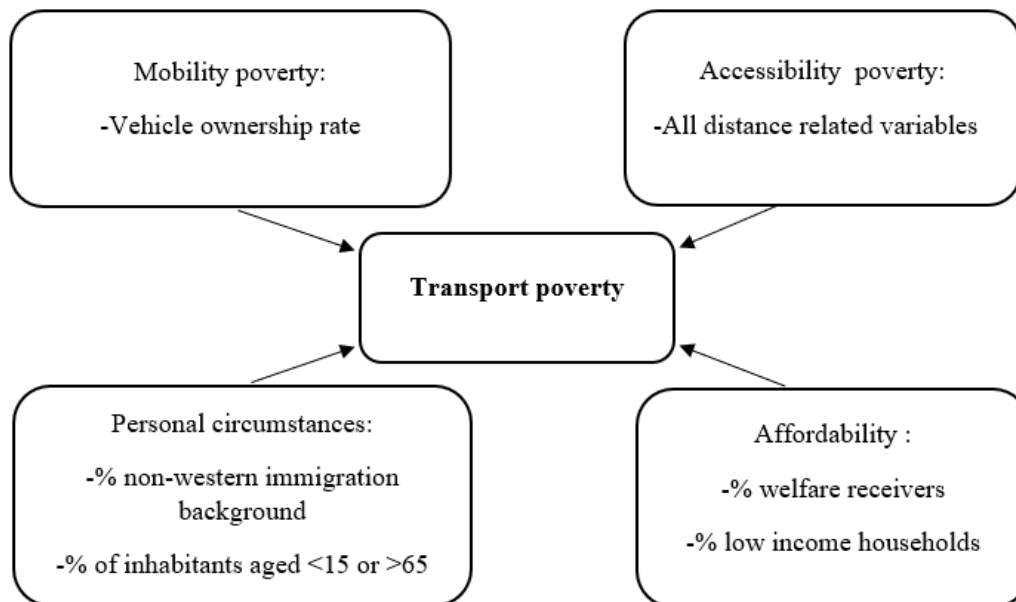


Figure 3. All variables linked to their corresponding concept explaining transport poverty

Chapter 3

3.1 Research methodology: Risk prediction model

Like mentioned previously, this thesis focusses on two processes of analysing transport poverty. The first part will revolve around constructing a risk-prediction model. This model will use the indicators stated in part 2.1.3 to calculate an average score for each neighbourhood. This more quantitative method allows us to make use of neighbourhood-specific data for all neighbourhoods in Rotterdam instead of directly making assumption about which cases-neighbourhoods should be analysed in the qualitative part of the thesis. The data used in the process of constructing the model comes from the Dutch “Centraal Bureau van Statistiek” (CBS). The CBS focusses on collecting and using data about the Netherlands, surrounding a wide variety of topics. The so-called CBS “StatLine” database contains all publicly available information and statistics. The CBS is seen as a trusted provider of data for conducting research.

The two datasets that are used from Statline are the “Wijk- en buurtstatistieken” and the “Nabijheid voorzieningen” datasets. Because not all data is available for each neighbourhood in the most recent “Wijk- en buurtstatistieken” dataset, the dataset from 2017 is used. This dataset contains information about all indicators relevant for the construction of the risk-

prediction model for all neighbourhoods. All distance indicators derived from the datasets are composed as follows: The average distance to X (school, supermarket, etc.) for all inhabitants of the neighbourhood. The indicators are only available for a neighbourhood if at least 90% of the inhabitant's locations are known, to make sure that the average distance is not calculated over, for example, just the inhabitants living on the borders of the neighbourhood.

For the data generation of some indicators, data transforming was required on the original dataset from CBS StatLine. The indicator of inhabitants below 15 or above 65 years old was created out of the percentages of, respectively, inhabitants younger than 15 years old and the percentage of inhabitants older than 65 living in the corresponding neighbourhood. The dataset also contained information about the average distance for a household in the neighbourhood to the nearest cinema, music venue and museum. The indicator "distance to nearest social gathering" is composed as the distance to the nearest place of social gathering out of these three venues (cinema, music venue or museum). The indicator "Vehicle ownership rate" is calculated by adding the total number of cars and motorcycles in a neighbourhood and dividing this by the number of inhabitants. The same applies for the variable "Percentage of inhabitants receiving welfare". For this variable, again, the total number of inhabitants receiving welfare in a neighbourhood is divided by the total number of inhabitants.

All data is transformed and ordered in Microsoft Excel. Hereafter, the dataset is loaded into Stata. Stata allows us to obtain all descriptive statistics, stated in table 4, on the indicators used and compose the group classifications for all variables. The group classifications were created by letting Stata divide the data into equal quantiles. These 4 quantiles split the underlying data into 4 equal groups and give us the lower and upper bound limits for all these groups. This makes sure that the group classifications are accurate and that all neighbourhoods can be classified correctly. An example of this grouping on the variable "Percentage of inhabitants aged under 15 or over 65" can be seen below.

Table 2

Group Classification for Variable "Percentage of inhabitants aged under 15 or over 65" Based on Four Quantiles

Summary statistics: "Percentage of inhabitants aged under 15 or over 65"					
Quantile	N	mean	min	max	sd
1	20	20.352	8.33	26.26	5.158
2	20	28.304	26.28	30.33	1.196
3	20	32.535	30.84	35.07	1.508
4	20	40.019	35.86	55.73	4.692

As can be derived from table 2, the percentage of inhabitants aged under 15 or over 65 for each neighbourhood is categorized into one of four groups. Since literature indicated that a higher percentage of children and elderly people in a neighbourhood increases the risk of experiencing transport poverty, a higher percentage gets a higher score. For example, if 32.14% of all inhabitants in a neighbourhood is aged under 15 or over 65, the corresponding score this neighbourhood will get for this variable is 3.

In the end, the average of the scores for all variables is taken to determine the final risk-score a neighbourhood has for experiencing transport poverty. Since there was no indication in the literature suggesting a difference in importance between variables, all variables will be weighted equally in the final average risk-score. See table 3 below for the grouping per variable and the labelling per risk group.

Table 3

The Group Classification for All Variables Used in the Risk Prediction Model

<i>% inhabitants aged <15 or >65</i>	<i>Score</i>
0 – 26.26	1
26.27 – 30.33	2
30.34 – 35.07	3
>35.07	4
<i>% non-western immigration background</i>	<i>Score</i>
0 – 16.03	1
16.04 – 34.74	2
34.75 – 45.27	3
>45.27	4
<i>% low-income households</i>	<i>Score</i>
0 – 43.60	1
43.61 – 55.74	2
55.75 – 62.40	3
>62.40	4
<i>% welfare receivers</i>	<i>Score</i>
0 – 1.812	1
1.813 – 5.854	2
5.855 – 8.460	3

>8.460	4
<i>% vehicle ownership rate</i>	<i>Score</i>
0 – 28.18	4
28.19 – 35.70	3
35.71 – 45.30	2
>45.30	1
<i>Distance to nearest school (in kilometres)</i>	<i>Score</i>
0 – 0.41	1
0.42 – 0.51	2
0.52 – 0.71	3
>0.71	4
<i>Distance to nearest supermarket (in kilometres)</i>	<i>Score</i>
0 – 0.31	1
0.32 – 0.51	2
0.52 – 0.71	3
>0.71	4
<i>Distance to nearest GP (in kilometres)</i>	<i>Score</i>
0 – 0.41	1
0.42 – 0.61	2
0.62 – 0.81	3
>0.81	4
<i>Distance to nearest life supplies store (in kilometres)</i>	<i>Score</i>
0 – 0.21	1
0.22 – 0.41	2
0.42 – 0.71	3
>0.71	4
<i>Distance to nearest train station (in kilometres)</i>	<i>Score</i>
0 – 1.71	1
1.72 – 2.51	2
2.52 – 3.41	3
>3.41	4
<i>Distance to nearest PT hub (in kilometres)</i>	<i>Score</i>
0 – 3.11	1

3.12 – 4.81	2
4.82 – 7.10	3
>7.10	4
<i>Distance to nearest social gathering</i>	<i>Score</i>
0 – 0.91	1
0.92 – 1.51	2
1.52 – 2.81	3
>2.81	4
<i>Average Score</i>	<i>Risk of experiencing transport poverty</i>
0 – 2.08	Very low
2.09 – 2.33	Low
2.34 – 2.50	Neutral
2.50 – 2.83	High
2.83 – 3.18	Very high

3.1.1 Descriptive statistics indicators used in risk-prediction model

Table 4

Descriptive Statistics of All Variables Used in Risk Prediction Model.

Descriptive Statistics					
Variable	Obs	Mean	Std Dev	Min	Max
Percentage aged under 15 or over 65	80	30.302	7.989	8.33	55.73
Percentage non-western immigration background	80	33.834	20.119	0	80.42
Percentage low-income households	80	48.621	18.927	0	74.7
Percentage welfare receivers	80	5.765	3.959	0	14.524
Vehicle-ownership rate	80	39.613	17.363	0	101
Distance to nearest supermarket	80	.706	.594	.2	3.2
Distance to nearest school	80	.603	.487	0	2.8
Distance to nearest general practitioner	80	.797	.717	.3	4.6
Distance to nearest life supplies store	80	.583	.599	.1	3.3
Distance to nearest train station	80	2.896	1.928	.5	10.5
Distance to nearest public transportation hub	80	5.83	4.375	.5	20
Distance to nearest place of social gathering	80	2.131	1.701	.2	8.5

3.1.2 Population selection: Risk-prediction model

The city of Rotterdam consists of 92 neighbourhoods spread out over a 324 km² area in the province of Zuid-Holland in the Netherlands (Figure 4).

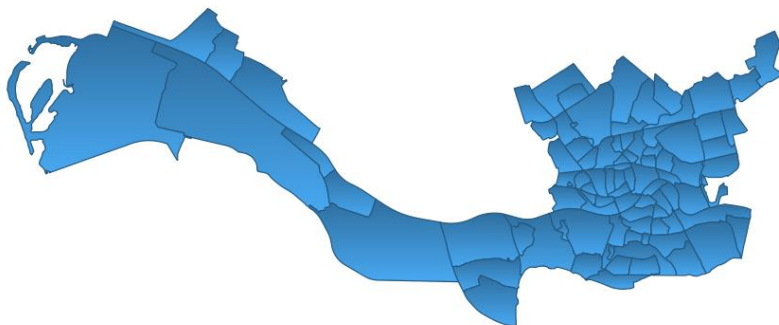


Figure 4. QGIS visualization of all neighbourhoods in the city of Rotterdam

To ensure a valid dataset, all neighbourhoods with 50 inhabitants or less are dropped from the sample. This has been done because these areas would give an inappropriate indication on the risk of experiencing transport poverty. As can be derived from figures 4, 5 and 6, the neighbourhoods that were dropped are seen as industrial (port) areas that are not labelled as residential areas. This limitation meant that 12 neighbourhoods were no longer accounted for in the sample, dropping the total population from 92 to 80 neighbourhoods. This threshold also ensured that data on all indicators needed for the model was available for every neighbourhood. All variables are only present in the dataset if they contain data from at least 90% of all inhabitants in a neighbourhood. This way the validity of the data is deemed sufficient.



Figure 5. QGIS visualization of all neighbourhoods used in the dataset



Figure 6. Visualization of all neighbourhoods in the city of Rotterdam. The grey areas indicate residential areas, the orange areas are areas of industry.

Chapter 4

4.1 Results: Risk-prediction model

After all data of the corresponding neighbourhoods was grouped based on the group classifications stated in part 3.1, the results were visualized in QGIS. The risk scores were divided into 5 equal quantiles and ranked from “very low” to “very high”. The scores for each variable in each corresponding neighbourhood can be found in table 1 in the appendix. The neighbourhood Rijnpoort scored the highest risk score (3.18). Rijnpoort scored a 4 for all distance related variables and for the percentage of young and elderly inhabitants. The second highest riskscore (3.17) is being shared by the neighbourhoods Landzicht and Nesselande. Landzicht gets its relatively high risk-score because of the distance to nearest facilities and the fact that a large proportion of the inhabitants is either part of a low-income household or receives welfare aid. The specific characteristics of Nesselande can be found in part 5.1.1.

On the low end, Blijdorp (1.42) Hillegersberg Zuid (1.50), Stadsdriehoek (1.58) and Liskwartier (1.58) scored the lowest risk-scores out of the dataset. Hillegersberg Zuid has a relatively rich population and has a wide variety of facilities nearby. Liskwartier borders the neighbourhood of Hillegersberg Zuid, which is reflected in the distance to nearest facilities for both neighbourhoods. The Stadsdriehoek is located in the city centre of Rotterdam. It comes as no surprise that the distance to facilities is low in this neighbourhood and the population is middle-aged and relatively wealthy. The specific characteristics of Blijdorp can be found in part 5.1.1.



Figure 7. QGIS visualization of all neighbourhoods used in the dataset with their corresponding risk-score.

Noticeable is the fact that most neighbourhoods that scored a risk score in the lowest quantile are almost all located close to the city centre of Rotterdam (see figure 8). The reason for this seems to be the wide availability of facilities in these areas. Almost all neighbourhoods located in and around the city centre have a score of 1 or 2 for most distance related variables. This availability of facilities might also be explanatory for the relatively low vehicle-ownership rates in these areas, as these facilities can be easily reached by car or bicycle. As the risk-score level rises, the disparity across the city of Rotterdam becomes larger. The higher the risk-score, the further away from the city centre seems to be the biggest take-away.

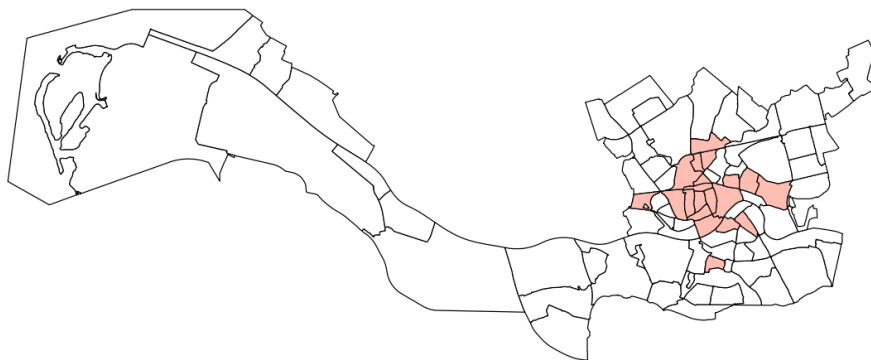


Figure 8. QGIS visualization of neighbourhoods with risk-score “very low”

Looking at the neighbourhoods with a “low” risk-score, a clustering just around the city centre can be observed (figure 9). Noticeable is the fact that a lot of neighbourhoods that are in this quantile are located in either the south side of Rotterdam, which is relatively poor, or the “poorer” areas in the north. No neighbourhood in this quantile gets a score of 1 for the percentage of low-income households and most of them score high on the percentage of welfare receivers. However, the close proximity to most daily activities counters out the negative impact of the relatively low wealth in these areas.

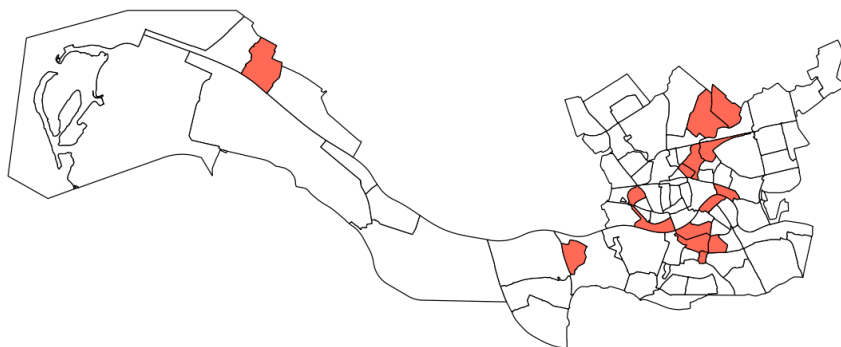


Figure 9. QGIS visualization of neighbourhoods with risk-score “low”

For the neighbourhoods with a “neutral” or “high” risk-score, different variables seem to have an impact (figure 10 and 11). Some neighbourhoods are relatively wealthy but the proximity to facilities combined with the absence of vehicle ownership negatively impact the risk-score, like Hillegersberg Noord. Remember that Hillegersberg Zuid, which is located next to Noord, had one of the lowest risk-scores. As the southern part is located closer to the city, it has less young or elderly inhabitants and is closer to daily activities. These differences make up for the gap between the risk-scores. Other neighbourhoods in the “neutral” or “high” quantiles deal with a high percentage of low-income inhabitants and high percentage of welfare receivers. This combined with a large proportion of the inhabitants being young or elderly leads to a higher risk-score, even if the distances to nearest facilities is very low for all distance related variables. An example of this is the neighbourhood Oud Crooswijk. The remaining part of the neighbourhoods in these quantiles are, as can be derived from figure 10 and 11, relatively far from the city centre. As we have observed before, this leads to high risk-scores for most distance related variables.

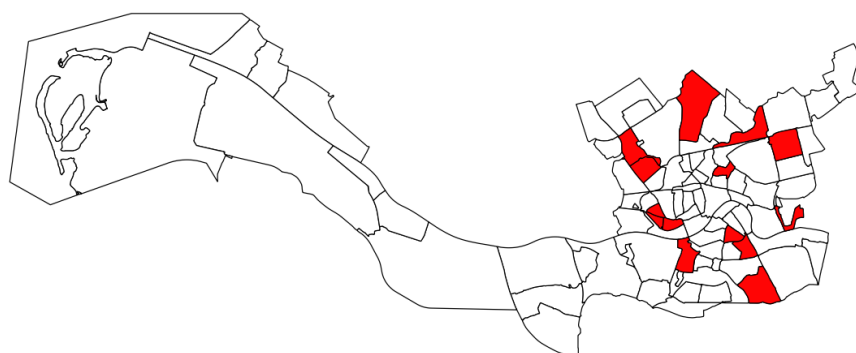


Figure 10. QGIS visualization of neighbourhoods with risk-score “neutral”



Figure 11. QGIS visualization of neighbourhoods with risk-score “high”

The neighbourhoods in the highest quantile of risk-scores can differ quite a lot in demographic characteristics of its inhabitants, however, they all seem to share some impacting factors as well. First, almost all neighbourhoods have a lot of young and elderly inhabitants. In some neighbourhoods, like Zuiderpark, this large proportion of these car-dependent inhabitants (as stated in part 2.1.2) is combined with a very low percentage of vehicle-ownership. Secondly there are the neighbourhoods that house a lot of low-income households, welfare receivers, inhabitants with a Non-western immigration background and low vehicle-ownership rates like Zuidwijk en Pendrecht. These two neighbourhoods are located next to each other and despite the close proximity of facilities, the demographic characteristics cause a very high risk-score.

Overall, the most important reason for the highest risk-scores seems to be the location of the neighbourhoods. As can be derived from figure 12, all areas with the highest risk-scores are located far from the city centre of Rotterdam. As mentioned before, there seems to be a relation between the distance from the city centre and the distance to the nearest facilities. This means that the vast majority of neighbourhoods in this quantile score a 3 or 4 for almost all distance related variables.

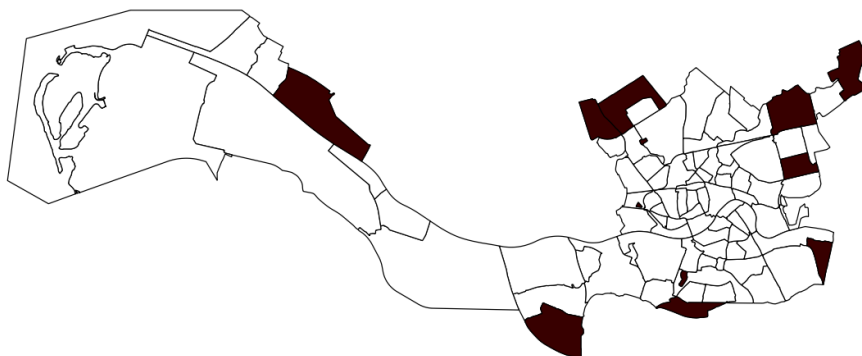


Figure 12. QGIS visualization of neighbourhoods with risk-score “very-high”

Chapter 5

5.1 Research methodology: survey

From the results of the risk-prediction model, two neighbourhoods with a low and a high average risk score are selected to be further analysed in case studies. In these neighbourhoods, a survey will be held amongst the inhabitants to see if the predicted risk of transport poverty matches the experienced risk of transport poverty. All residents of the two case neighbourhoods are potential respondents. This large potential populations does limit the depth of the survey questions that are possible, but a relatively large number of randomized respondents is deemed more important in answering the research question. The choice for inquiring a large number of subjects as opposed to a select number of subjects is also due to the current COVID-19 crisis, which limits the possibilities of in-depth interviews. The subjects will fill in the survey while remaining anonymous. Also, in hope to boost the number of respondents, a €25 MediaMarkt gift card will be raffled amongst the respondents. To enter the raffle of the gift card, the respondents that want to participate have to leave their e mail address in the last question of the survey.

A qualitative survey can be seen as one of the oldest and most basic forms of data gathering. This, however, does not mean that it is incapable of being a very useful tool in research (Jansen, 2016). Surveys can be used in many forms and take on different shapes. An example of this is the difference between intensive research on a small number of subjects versus an extensive research on a large number of subjects (Moser, 1958). Because of the wide variety of different kind of survey studies, there is no consensus about how to check the quality of surveys (Leung, 2015). However, the general concepts that determine the quality of a quantitative research are the same for qualitative research; validity, reliability and generalizability (Leung, 2015, Yin, 2009).

The validity can be split up into internal and external validity. To ensure internal validity the survey needs to be able to draw a link between the answers and the variable of interest. Therefore, the questions and statements in the survey are aimed to gain an understanding of the experienced transport poverty. No causal link is expected to be derived from the survey, but hopefully the answers are able to provide a clearer understanding of the inhabitant's personal experiences. The external validity defines the domain of which the study's findings can be generalized (Yin, 2009). Since this survey is focussed on two particular neighbourhoods, and the experienced transport poverty is estimated to be different in all neighbourhoods from the risk-prediction model, the external validity of the survey is

relatively weak. The external validity however is not the main focus point in the survey, as we only want to draw conclusions about the two case neighbourhoods and the relationship between the risk-prediction model and the survey outcomes. The reliability of the survey handles the extent to which the operations of the survey, such as the data collection process, can be repeated with the same results. As all the inhabitants of the two case neighbourhoods are potential respondents, it seems fair to expect similar answers from a survey in future research in the same neighbourhoods and with the same aim.

Since we are interested in analysing the experienced transport poverty, it is of importance to state how we interpret the results in order to come to a conclusion. So how can the survey explain the experienced transport poverty? The first part of the survey asks for demographic characteristics of the inhabitants like age, income, access to a vehicle and personal background that are in line with the indicators selected for the risk-prediction model. The second part consists of statements that are relevant for estimating the experienced transport poverty. The answers of the statements in the second part are based on a five-point Likert scale, ranging from “Strongly disagree” to “Strongly agree”. The statements in the second part are almost all formulated from the stance point that “the more a respondents agrees with a statement, the more the experience transport poverty”. So, for example, if someone strongly agrees with most statements in the second half of the survey, this respondent is deemed to experience transport poverty. Then, in the conclusion part, we will look into the demographic characteristics of the respondents that do or do not experience transport poverty to see if the indicators used in the risk-prediction model (part 2.1.2) can be validated. This will eventually provide us with an answer to the main research question.

5.1.1 Case selection

From the risk-prediction model, two neighbourhoods are selected to form the population for the qualitative part of the thesis. The neighbourhood of Nesselande scored the second highest in the prediction model with a score of 3.17. Only the neighbourhood of Rijnpoort scored higher (3.18), but since the number of inhabitants in Rijnpoort is relatively low, Nesselande is selected in the hope to get a sufficient number of respondents for the survey. Blijdorp had the lowest predicted risk of experiencing transport poverty with a score of 1.42. A closer look will help form a more definitive picture about these neighbourhoods.

Nesselande, together with six other neighbourhoods, forms the district of Prins-Alexander (figure 13). It should be noted that all of the seven neighbourhoods in the district have a risk score that is amongst the highest 2 quantiles of the data (table 5).

Table 5

The Averaged Risk Scores for Each Neighborhood in the District Prins-Alexander

<i>Neighbourhood</i>	<i>Risk score</i>
Nesselande	3.17
Ommoord	2.92
Prinsenland	2.92
Zevenkamp	2.67
Oosterflank	2.58
Kralingse veer	2.50
Het lage land	2.42

The fact that all neighbourhoods in the district have a “High” or “Very high” risk of experiencing transport poverty, is mainly due to the relatively high percentage of children and elderly and the nearest distance to everyday-life facilities. For example, all neighbourhoods in Prins-Alexander have a risk-score of 4 in respect to the nearest public transportation hub and social gathering.

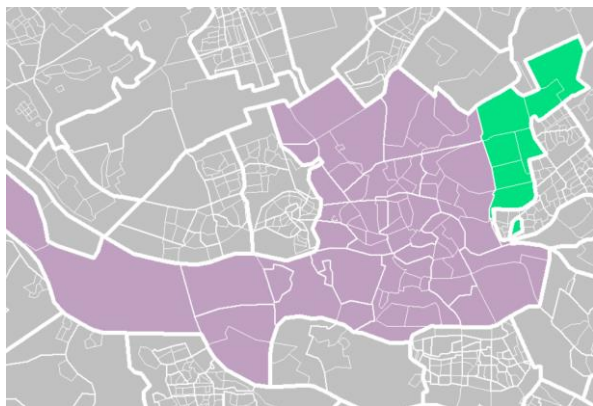


Figure 13. Visualization of the location of Prins-Alexander district

Nesselande is relatively new neighbourhood. Due to the growing population in Rotterdam, the decision was made to build the new neighbourhood of Nesselande in 2000. The newness of Nesselande caused hesitation amongst entrepreneurs to open facilities in the area, especially since the area is considered to be far away from downtown Rotterdam (figure 14). Nesselande is one of the biggest neighbourhoods in Rotterdam based on the number of inhabitants. The

fact that a lot of the inhabitants are either elderly or young families with children, increases the risk-score of experiencing transport poverty.

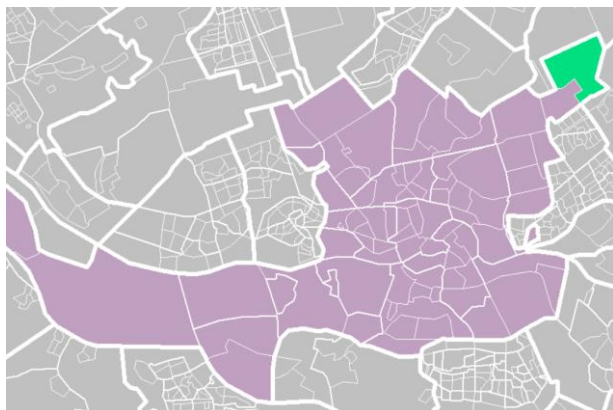


Figure 14. Visualization of the location of neighborhood Nesselande

Nesselande gets a score of 4 for the following variables in the risk-prediction model: percentage of population aged younger than 15 or older than 65 and all distance related variables. The population is relatively wealthy and the vehicle-ownership rate is quite high, as Nesselande scores a 1 for both income-related variables and a 2 for vehicle-ownership rate. Although a lot of neighbourhoods get a score of 4 for at least one variable, Nesselande seems to top the list because of its location and lack of facilities. The lack of facilities nearby could mean that inhabitants have to travel longer distances to fulfil their everyday needs. This is also reflected when analysing the number of business locations divided by the total surface of the neighbourhood. Nesselande has approximately 2.81 business locations per hectare. The average for all neighbourhoods in Rotterdam is 5.67 business locations per hectare (CBS, 2017). Although the number of businesses per hectare does not necessarily reflect the number of vital facilities in the area, it can provide an indication.

Since the construction of Nesselande in 2000, efforts have been made to establish a better connection with the other parts of Rotterdam. In 2005 the metro lines A and B were extended and new metro stations were opened in the neighbourhood. Unfortunately, the data does not contain information about distance to metro stations. Furthermore, the train station of Rotterdam Alexander is located in the district of Prins-Alexander, but this station is still relatively far away (approx. 5 kilometres) from Nesselande, which makes it hard to reach by foot or bicycle. It is also worth noticing that Nesselande does have some special facilities compared to other neighbourhoods in Rotterdam. It houses a beach, shopping centre and a boulevard. However, since these facilities are not seen as vital, their presence does not decrease the risk-score for Nesselande.

On the other side of the risk-score spectrum, we find Blijdorp. Blijdorp is situated in the district of Rotterdam-Noord (figure 15). Rotterdam-Noord is one of the older districts in the city of Rotterdam and houses inhabitants from all walks of life. The district is popular with low-income and Non-Dutch immigrants, but also with young, wealthy families and students.

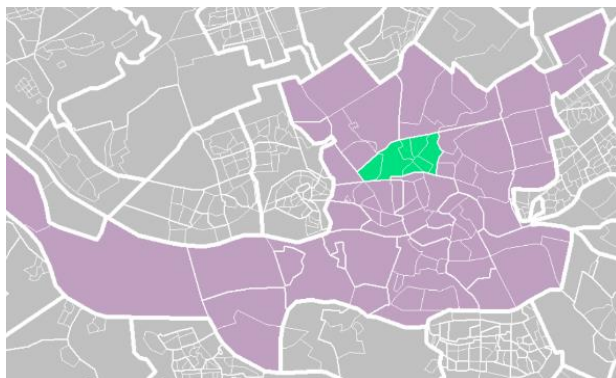


Figure 15. Visualization of the location of Rotterdam-Noord district

The neighbourhoods in this district almost all score lower than those in the district of Prins-Alexander. Only the neighbourhood Blijdorpse Polder scores relatively high, which could again be correlated to the distance to the city centre. Blijdorpse Polder is the furthest away from the city centre in the district of Rotterdam-Noord, and is the only neighbourhood in the area that scores a 4 for multiple distance related variables. The rest of the neighbourhoods all scored a score in the lowest 2 quantiles of the risk scores (see table 6).

Table 6

The Averaged Risk Scores for Each Neighborhood in the district Rotterdam-Noord

<i>Neighbourhood</i>	<i>Risk score</i>
Blijdorp	1.42
Liskwartier	1.58
Bergpolder	1.67
Provenierswijk	2.00
Agniesebuurt	2.17
Oude Noorden	2.25
Blijdorpse polder	2.55

The biggest difference between the neighbourhoods located in Prins-Alexander versus those located in Rotterdam-Noord is the average distance to facilities. Although the neighbourhoods in Rotterdam-Noord contain more individuals with a Non-western background, more low-income households and less vehicles, the score is still relatively low because of how nearby

all facilities are. This difference in distance to facilities will probably be mainly due to the location of the district. Rotterdam-Noord is located next to the city centre of Rotterdam, whereas Prins-Alexander is located quite far away from all downtown facilities. Again, if we look at the number of business locations per hectare for Blijdorp, it has approximately 6.66 businesses per hectare which is higher than the city-wide average and more than doubled that of Nesseland. This number hints that there are more facilities located in Blijdorp that are therefore easier to reach. Furthermore, the district of Rotterdam-Noord has an elaborate public transport network. There is a metro station in Blijdorp, a train station and multiple tram lines. The zoo that is located next to the neighbourhood of Blijdorp might be a reason for the relatively large number of public transportation options and from this neighbourhood.

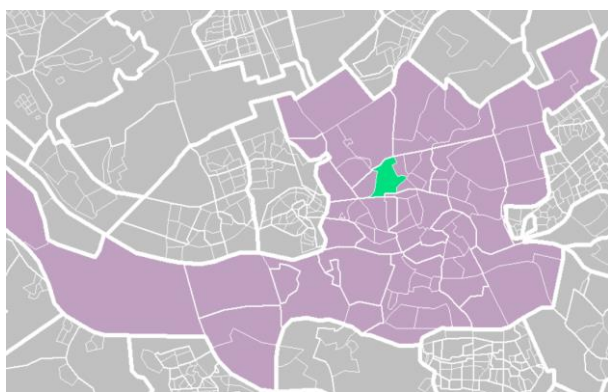


Figure 16. Visualization of the location of neighborhood Blijdorp

5.1.2 Population selection: Survey

To ensure randomized respondents whose answers can be generalized for the entire neighbourhood, 200 households scattered across different streets in all areas of the neighbourhood will receive a letter in the mail containing a QR-code and a link that will lead them to the survey. Subjects are entirely free to participate and will stay anonymous. Only if the respondent wants to enter the gift card raffle, they are required to leave their e-mail address. Also, a number of different local Facebook communities in the neighbourhoods are contacted. Some of the pages responded and agreed to post a message asking their followers to fill in the survey (see figure 24 & 25, appendix). Assuming that all followers of the local Facebook communities pages are from the respective neighbourhood, and the fact that the messages clearly stated that the survey was interested in respondents from either Nesseland or Blijdorp, we can assume that the respondents from these Facebook messages are indeed living in the corresponding area.

5.1.3 Survey questions

Introduction:

“Voor een onderzoek naar vervoersarmoede zijn we op zoek naar de ervaringen van bewoners in uw buurt omtrent dit onderwerp. In deze enquête wordt u gevraagd naar enkele persoonlijke kenmerken en meningen omtrent een aantal statements. Op basis van de door u verstrekte antwoorden wordt de mate waarin u te maken heeft met vervoersarmoede in uw dagelijkse leven ingeschat.”

Questions:

1. In welke wijk woont u?
2. Wat is uw leeftijd?
3. Wat is uw persoonlijke achtergrond?
4. Wat is de hoogte van uw inkomen?
5. Maakt u gebruik van financiële regelingen?
6. Heeft u beschikking over een auto/ motorfiets?
7. In het algemeen, beschikt u over voldoende financiële middelen om te kunnen reizen hoe u wilt reizen?

Statements:

In hoeverre bent u het eens met de volgende stellingen?

8. “Doordat ik geen toegang heb tot een auto of motorfiets voel ik mij verhindert in mijn dagelijkse activiteiten.”
9. “Ik zou gemakkelijker mijn dagelijkse activiteiten kunnen uitvoeren als mijn vervoersmiddel goedkoper zou zijn.”
10. “Ik zou gemakkelijker mijn dagelijkse activiteiten kunnen uitvoeren als mijn vervoersmiddel betrouwbaarder zou zijn.”
11. “Ik zou gemakkelijker mijn dagelijkse activiteiten kunnen uitvoeren als mijn vervoersmiddel sneller zou zijn.”
12. “Ik zou gemakkelijker mijn dagelijkse activiteiten kunnen uitvoeren als mijn vervoersmiddel veiliger zou zijn.”

Other questions:

13. Heeft u nog op- of aanmerkingen?
14. Wilt u mee loten voor de tegoedbon? Vul dan hier uw e-mailadres in.

Chapter 6

6.1 Results: Survey

6.1.1 Data collection process and general results

On June 10th and 11th the 200 letters were distributed in, respectively, Blijdorp and Nesselande. The original response level of the inhabitants of Blijdorp was good. Within a day of the delivery, over 20 respondents from Blijdorp had filled in the survey. Unfortunately, this was not the case for Nesselande. Only a few inhabitants reacted to the received letters in the first day. Therefore, local Facebook pages were contacted to see if they were willing to post a message including the link to the survey to help boost the number of respondents. This turned out to be very effective. Especially the message posted by the “Nieuws Nesselande” Facebook page boosted the number of respondents significantly.

In total, 207 responses were collected. However, 64 responses were not completed. These incomplete responses are dropped from the data. This leaves us with a total of 143 valid responses were collected, split up in 102 respondents from Nesselande and 41 from Blijdorp.

In which neighborhood do you live? (Q1)

Neighborhood	Frequency	Percentage	Cumulative percentage
Nesselande	102	71.33	71.33
Blijdorp	41	28.67	100.00

Figure 17. Frequency table “In which neighbourhood do you live?” for respondents from both neighbourhoods

The vast majority of the overall respondents was middle-aged. There were no responses collected from anyone aged under 15 years. However, 12.50% of respondents is aged 65 years or older, meaning the survey can be used to analyse the supposed increase risk on transport poverty that these inhabitants could experience as stated in part 2.1.2.

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	26	18.06	18.06
31-50	80	55.56	73.61
51-65	20	13.89	87.50
65+	18	12.50	100.00

Figure 18. Frequency table “What is your age?” for respondents from both neighbourhoods

81 people wanted to participate in the raffle for the gift card. All e-mail addresses were entered in the random name picker <https://commentpicker.com/nl/>. This website chooses one random entry from the list. The winner, Lieve Vrijzen, was contacted by mail. The gift card

was personally handed over (see figure 26 & 27, appendix).

Unfortunately, because the survey was also distributed on different Facebook pages, the response rate is unknown. However, 28 respondents filled in the survey by scanning the QR-code. This QR-code was only available on the letters that were distributed in both neighbourhoods.

6.1.2 Results Nesselande

Most of the respondents from Nesselande are aged 31-50. There were no respondents aged 0-15. 16.67% of respondents from Nesselande are aged 65 years or older. This percentage is significantly higher than the number of respondents from the same age group in Blijdorp (2.44%). However, these percentages can be put into perspective by the CBS data, which states that the percentage of young and elderly inhabitants in Nesselande is almost double that of Blijdorp's.

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	8	7.84	7.84
31-50	63	61.76	69.61
51-65	14	13.73	83.33
65+	17	16.67	100.00

Figure 19. Frequency table "What is your age?" for respondents from Nesselande

The percentage of respondents with a non-Dutch background is a lot lower than the data from CBS suggests. Around 21% of inhabitants in Nesselande has a non-Western immigration background, but only 5.88% of respondents in the neighbourhood have a non-Dutch background.

What is your personal background? (Q3)

Background	Frequency	Percentage	Cumulative percentage
Dutch	95	93.14	93.14
Non-Dutch	6	5.88	99.02
I'd rather not say	1	0.98	100.00

Figure 20. Frequency table "What is your personal background?" for respondents from Nesselande

The average income of the respondents is higher than the national average income. 70.29% of respondents states that they earn either equal to- or above the national average. Also, only 3.92% of respondents makes use of financial arrangements. Both these observations could in part explain why the majority of respondents (57.84%) does not ever experience limited

choice of transportation mode because of financial reasons.

What is your income? (Q4)

Income	Frequency	Percentage	Cumulative percentage
< Average income	17	16.83	16.83
Average income	21	20.79	37.62
> Average income	50	49.50	87.13
I'd rather not say	13	12.87	100.00

Figure 21. Frequency table "What is your income?" for respondents from Nesselande

Do you make use of financial arrangements? (Q5)

Financial arrangements	Frequency	Percentage	Cumulative percentage
Yes	4	3.92	3.92
No	95	93.14	97.06
I'd rather not say	3	2.94	100.00

Figure 22. Frequency table "Do you make use of financial arrangements?" for respondents from Nesselande

Most respondents from Nesselande has access to a car or motorcycle. 88.24% of the respondents does have access to a car or motorcycle. This could in part be due to the relatively large distances to facilities in the neighbourhood. However, the data cannot tell us whether there are a lot of cars because of the long distances to facilities or the other way around. Noticeable is the fact that within the group of respondents that do not have access to a car or motorcycle, the majority disagrees that the lack of access to a car or motorcycle limits them in their daily activities.

Do you have access to a car or motorcycle? (Q6)

Vehicle	Frequency	Percentage	Cumulative percentage
Yes	90	88.24	88.24
No	12	11.76	100.00

Surprisingly, most respondents state that their daily activities and facilities are easily reachable from their neighbourhood in Q9.1. This contradicts the fact that most facilities, on average, are relatively far away from Nesselande. These long distances may be countered out by the high vehicle-ownership rate amongst the respondents, or by the fact that experiencing transport poverty is subjective. This means inhabitants might get used to their situation and the location of their daily activities, as explained in part 2.1.2 (Martens et al., 2011).

To which extent do you agree with the following statement: (Q9.1)**“I can easily access my daily activities from the neighborhood I live in.”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	2	1.98	1.98
Disagree	7	6.93	8.91
Neutral	11	10.89	19.80
Agree	39	38.61	58.42
Strongly agree	42	41.58	100.00

Furthermore, respondents were asked what change in their favoured transportation mode would make reaching their daily activities easier (cheaper, more reliable, faster and safer). The cost of the respondent's favourite transportation mode brings out mixed feelings. 44.00% of the respondents disagrees (strongly) with the statement that cheaper transportation would make their daily activities easier to reach. Contrary, 37.00% of respondents agrees (strongly) with the statement. The reliability of the transportation modes, whether this be cars or public transport, does not seem to be a relevant issue for the inhabitants of Nesselande. 77.23% does not agree that an improvement in the reliability of their transportation mode would result in a better accessibility of daily activities. The same seems to be the case for the speed and safety of the transportation modes used in Nesselande. The majority disagrees with the statements that an improvement in speed or safety would make their daily activities more accessible. So, overall the respondents from Nesselande predominantly disagree with the statements. This result stands in contrast to the risk-prediction model, that estimated a high risk of experiencing transport poverty in this neighbourhood.

To which extent do you agree with the following statement: (Q9.2)**“Fulfilling my daily activities would be easier if my mode of transportation was cheaper”**

Opinion	Frequency	Percentage	Cum.
Strongly disagree	20	20.00	20.00
Disagree	22	22.00	42.00
Neutral	21	21.00	63.00
Agree	30	30.00	93.00
Strongly agree	7	7.00	100.00

To which extent do you agree with the following statement: (Q9.3)**“Fulfilling my daily activities would be easier if my mode of transportation was more reliable”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	26	25.74	25.74
Disagree	24	23.76	49.50
Neutral	28	27.72	77.23
Agree	16	15.84	93.07
Strongly agree	7	6.93	100.00

To which extent do you agree with the following statement: (Q9.4)**“Fulfilling my daily activities would be easier if my mode of transportation was faster”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	20	20.00	20.00
Disagree	30	30.00	50.00
Neutral	23	23.00	73.00
Agree	21	21.00	94.00
Strongly agree	6	6.00	100.00

To which extent do you agree with the following statement: (Q9.5)**“Fulfilling my daily activities would be easier if my mode of transportation was safer”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	24	24.24	24.24
Disagree	23	23.23	47.47
Neutral	34	34.34	81.82
Agree	15	15.15	96.97
Strongly agree	3	3.03	100.00

It can however be important to analyse the comment section and some individual cases that fit the personal characteristics that could lead to a higher risk of experiencing transport poverty. In the comments section, multiple respondents stated that the public transport network is too expensive in general, and not easily accessible in Nesseland. Furthermore, respondents state that during the summertime, the public transport network is too crowded because of people visiting the beach in Nesseland. Also, some comments from elderly individuals point out that they no longer take care of their daily activities themselves. And if they do so, the public transport is free to use for them. Especially the free public transport could reduce the potential risk of experiencing transport poverty for elderly inhabitants.

When looking into the groups of inhabitants that literature suggest have a higher risk of experiencing transport poverty, we can see that the elderly predominantly (strongly) disagree with the statements. This indicates that the elderly inhabitants of Nesseland are not experiencing transport poverty stronger than middle-aged inhabitants. This changes however when we look into the respondents with a Non-Dutch immigration background. The majority of respondents predominantly (strongly) agree with the statements, contrary to respondents with a Dutch background. This indicates that this group does experience more transport poverty than Dutch inhabitants, which is in line with the literature review in part 2.1.2. A similar conclusion can be drawn for inhabitants with a low-income and non-vehicle owners. Both these groups of individuals predominantly (strongly) agree with the statements, contrary to respondents that have a higher-income or do own a vehicle. So again, literature might be accurate when depicting income and vehicle ownership as indicators for transport poverty.

6.1.3 Results Blijdorp

Compared to the respondents from Nesselande, the inhabitants that took part in the survey from Blijdorp are younger of age. There are significantly more respondents aged 16-30, and only 1 respondents that classifies as an elderly person. Again, no respondents younger than 15 participated in the survey. Also, the same difference between the percentage of inhabitants with a Non-Dutch immigration background can be observed. Data suggest 13.99% of inhabitants has a Non-Dutch immigration background, but only 4.88% of respondents do. The average income of the respondents from Blijdorp is lower than that of the respondents from Nesselande, although the percentage of respondents making use of financial arrangements is the same. Despite the income being lower for respondents from Blijdorp, there are no respondents stating that ever feel like a lack of financial resources limits them in fulfilling their daily activities.

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	17	41.46	41.46
31-50	17	41.46	82.93
51-65	6	14.63	97.56
65+	1	2.44	100.00

What is your personal background? (Q3)

Background	Frequency	Percentage	Cumulative percentage
Dutch	37	90.24	90.24
Non-Dutch	2	4.88	95.12
I'd rather not say	2	4.88	100.00

What is your income? (Q4)

Income	Frequency	Percentage	Cumulative percentage
< Average income	11	26.83	26.83
Average income	9	21.95	48.78
> Average income	17	41.46	90.24
I'd rather not say	4	9.76	100.00

Noticeable is the fact that the percentage of respondents that has access to a car or motorcycle is significantly lower than in Nesselande. This support the suggestion that the distance inhabitants have to travel to fulfill their daily activities stands in positive relation with car ownership. Again, the majority of respondents that does not have access to a car or motorcycle states this lack of vehicle ownership does not limit them in their daily activities. This further insinuates that close proximity to facilities can limit the experienced level of transport poverty.

Do you have access to a car or motorcycle? (Q6)

Vehicle	Frequency	Percentage	Cumulative percentage
Yes	25	60.98	60.98
No	16	39.02	100.00

Again, respondents were asked to state their opinions on a number of statements concerning potential improvement to their favored mode of transportation. The vast majority of respondents (strongly) agrees that facilities are easily reachable from their neighbourhood. This result is in line with the results from previous questions that stated that no respondent ever feels like they are limited in their daily activities because of a lack of vehicle-ownership or financial resources. When asked about the possibility of improving the mobility potential of inhabitants by making their transportation mode cheaper, the opinions were split. A small majority of 45.00% (strongly) disagrees with the statement, compared to 30.00% of respondents (strongly) agreeing. The split opinion about the price of transport is almost identical to the opinions of the respondents from Nesselande. The respondents are a lot more consentient about the impact of an improvement in speed. Predominantly, the respondents state that an improvement in travel time would not necessarily make fulfilling their daily activities easier. Furthermore, 60.00% of respondents (strongly) disagrees that improved reliability could be an improvement in reaching their daily activities. Lastly, only 7.69% of respondents feels like the safety of their transportation mode could be improved in order to make fulfilling their daily needs easier. There is no one that strongly agrees with the statement. So, all considered, we again see that predominantly the respondents from Blijdorp seem to disagree with the statements. This suggest that the respondents do not experience (high levels) of transport poverty.

To which extend do you agree with the following statement: (Q9.2)**“Fulfilling my daily activities would be easier if my mode of transportation was cheaper”**

Opinion	Frequency	Percentage	Cum.
Strongly disagree	8	20.00	20.00
Disagree	10	25.00	45.00
Neutral	10	25.00	70.00
Agree	10	25.00	95.00
Strongly agree	2	5.00	100.00

To which extend do you agree with the following statement: (Q9.3)**“Fulfilling my daily activities would be easier if my mode of transportation was more reliable”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	9	22.50	22.50
Disagree	15	37.50	60.00
Neutral	7	17.50	77.50
Agree	6	15.00	92.50
Strongly agree	3	7.50	100.00

To which extent do you agree with the following statement: (Q9.4)**“Fulfilling my daily activities would be easier if my mode of transportation was faster”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	7	17.50	17.50
Disagree	14	35.00	52.50
Neutral	12	30.00	82.50
Agree	6	15.00	97.50
Strongly agree	1	2.50	100.00

To which extent do you agree with the following statement: (Q9.5)**“Fulfilling my daily activities would be easier if my mode of transportation was safer”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	11	28.21	28.21
Disagree	16	41.03	69.23
Neutral	9	23.08	92.31
Agree	3	7.69	100.00
Strongly agree	0	0.00	100.00

However, let us again analyse the comments and individuals that literature suggests are at higher risk. Some comments state that the availability of a strong public transport network in the neighbourhood eliminates the need of car or motorcycle use. However, another comments states that his or her main mode of transportation is the bicycle because of the cost of public transportation are too high. Another comments states that car-ownership should be discouraged in Blijdorp. This could be in line with the relatively short distances to facilities for inhabitants in Blijdorp. Also, two comments state that their transportation options are expanded by the close proximity of Rotterdam Central Station. This is contrary to the respondents from Nesselande, where no one mentioned the use of the train as transportation mode.

Unfortunately, there was only 1 respondent aged 65 or older so interpreting the results for elderly in Blijdorp is only possible to a very limited extent. This respondent does not agree with any of the statements, so this suggest that this individual does not experience a higher level of transport poverty compared to younger respondents. The respondents that have a Non-Dutch immigration background also predominantly disagree with the statements. This is contrary to the results found in Nesselande, where people with an immigration background seemed to experience a higher level of transport poverty. The same is applicable for respondents that have an income below the national average. Again, the statements do not share the opinions of these respondents, suggesting no evidence for a higher risk of experiencing transport poverty. Lastly, the opinions of non-vehicle owners also differ from the respondents from Nesselande. The non-vehicle owners in Blijdorp predominantly agree to

almost the same extent with the statements as respondents that do have access to a car or motorcycle. So, all considered, the results on the statements generally speaking are quite similar between respondents from Nesselande and Blijdorp. However, when analysing the different population groups that literature suggest are at higher risk, we find differences. The “higher-risk” respondents from Nesselande seem to indeed experience higher levels of transport poverty compared to their counterparts. In Blijdorp however, the results are the other way around. The respondents that are expected to be at more risk of experiencing transport poverty actually predominantly (strongly) disagree with the statements that would suggest so.

Chapter 7

7.1 Conclusion

Now that the results from both the qualitative and quantitative part are collected, the answers to the sub-questions and main research question can be formulated. Together, these answers make up the conclusion to the research.

7.1.1 Sub-questions

After the most important concepts within this thesis were recognized, literature review was conducted. From this literature, the definition of “social exclusion” in respect to transport studies was derived. The definition explains how social exclusion is a multi-dimensional phenomenon and is characterized conceptually as the process which prevents individuals from a full participation in society. One of the concept contributing to the existence of social exclusion is transport poverty. Transport poverty has the same potential effect on individuals as social exclusion; both limit the possibilities for an individual to fully participate in society. However, in transport poverty this is caused by a lack of mobility. This lack of mobility stems from four different issues; mobility poverty, accessibility poverty, affordability of transport and personal circumstances. Within these four concepts, different indicators were derived from literature that allowed us to answer the first sub-question:

1. What are the determinants of transport poverty?

First, mobility poverty is caused by an inadequate access to transportation modes. An example of this is the increases cost, effort and time that individuals have to endure to reach certain destinations if they do not have access to a car. To incorporate this issue into the risk-prediction model, the variable vehicle-ownership rate was constructed from neighbourhood-specific data. Second, accessibility poverty stems from the fact that certain locations or facilities cannot be reached by individuals. This was translated into the risk-prediction model

by constructing a distance-related variables to daily activities that are deemed essential for every individual. Third, affordability of transport explains how individuals might experience a lack of mobility because of the cost of transportation. Literature states that individuals with a low income are less mobile and have a smaller social range. To take this into account, data concerning the percentage of low-income households and welfare receivers was used in the risk-prediction model. Lastly, personal circumstances explain how an individual might have personal circumstances that can hinder mobility, like handicaps or health. This was acknowledged by different papers that explained how ethnicity and age can have an impact on the risk of experiencing transport poverty.

Unfortunately, there were relevant indicators that could not be incorporated in the model because of a lack of data. Indicators like the availability of public transport in a neighbourhood, health statistics and distance to relatives and friends are also linked in various academic papers with the concept of transport poverty, but no sufficient data concerning these indicators was available.

After the relevant and available indicators were selected based on sub-question 1, the risk-prediction model was constructed to answer the next sub-question:

2. Which neighbourhoods are estimated to have the lowest / highest risk of transport poverty?

The risk-prediction model states that the neighbourhood with the highest risk-score from the dataset is the neighbourhood of Rijnpoort with a score of 3.18. Rijnpoort is located far west of the city of Rotterdam, which is reflected by the average distances to nearest facilities. Rijnpoort gets a risk-score of 4 for all distance related variables. The distance to facilities like public transportation hubs or social gatherings are some of the highest in the entire dataset. This relatively remote location, combined with a high percentage of young and elderly inhabitants earns Rijnpoort the highest risk-score. However, like mentioned in part 5.1.1, the neighbourhood of Nesselande was used in the survey because of the relatively small number of inhabitants in Rijnpoort and the need for a sufficient amount of respondents. Nesselande gets a score of 3.17. Although Nesselande has a relatively high-income population, with a low relatively low percentage of people with a Non-Dutch immigration background and a high percentage of vehicle-ownership, its relatively old population and the long distances to nearest facilities make up for a high-risk score.

The lowest risk of experiencing transport poverty is estimated to be for inhabitants living in the neighbourhood of Blijdorp. This low risk-score is mainly due to the relatively middle-aged and wealthy population and the close proximity to all facilities. Blijdorp only gets a score of 3 for the vehicle-ownership rate. This relatively low percentage of vehicle-owners could be explained by short distances that the inhabitants have to travel to fulfil their daily activities.

To measure the experienced transport poverty, two neighbourhoods with a high and low risk-score were selected as population for a survey to answer the third sub-question:

3. Is the level of experienced transport poverty higher in a neighbourhood with a high risk-score?

The experienced level of transport poverty is estimated by analysing the opinions of the respondents on a number of statements. The more the respondents agree with the statements, the higher the perceived level of transport poverty is. A higher percentage of respondents from the high-risk neighbourhood (Nesselände) agreed with the relevant statements. The respondents from Nesselände agreed to a bigger extent that lower cost, higher reliability, reduced travel time and improved safety of their favoured mode of transportation would lead to a feeling of easier fulfilling their daily needs than the respondents from Blijdorp. It should be noticed that the differences from the results overall were relatively small. However, when comparing individual respondents that are deemed to be at higher risk of experiencing transport poverty, the differences are bigger. The results show a higher level of experiencing transport poverty for high-risk individuals living in Nesselände.

7.1.2 Main research question

To measure the effectiveness of the risk-prediction model, the results need to be compared to those of the survey. In order to do so, the personal characteristics of the respondents in the survey in combination with their experienced level of transport poverty are analysed to see the correctness of the indicators used for the risk-prediction model and answer the following main research question:

Can a risk-prediction model for transport poverty be constructed that reflects the experienced transport poverty for the city of Rotterdam?

From the results of the risk-prediction model, it is expected that the level of experienced transport poverty is higher for Nesselande than Blijdorp. The responses from the survey seem to somewhat signal the same result. The respondents from Nesselande do in fact agree to a larger extent with the statements from the survey. This means that the respondents feel like they are limited to some extent in fulfilling their daily activities because of imperfections in their favoured mode of transportation. It seems reasonable to assume that the inaccessibility to some modes of transportation has more effect on the inhabitants of Nesselande than Blijdorp because of the relatively long distances that need to be travelled for the inhabitants in Nesselande.

However, to measure the effectiveness of the risk-prediction model, the most important aspect is the accuracy and validity of the indicators used in the model. Young and elderly people, individuals with a low-income, non-vehicle owners and individuals with a Non-Dutch immigration background were all indicated by literature to be at higher risk of experiencing transport poverty. When analysing the results from these groups of respondents, the results show the effectiveness of most (personal characteristics) indicators. First, when analysing the opinions of high-risk individuals from the total number of respondents, we find that respondents who state they have an above-average income disagree with the statements far more than individuals with a low-income. Noticeable is however that individuals that have a below-average income but are also benefitting from financial arrangements are less agreeable to the statements than below-average income respondents without arrangements. Overall, results from the survey show that respondents with a lower income are experiencing more transport poverty. Second, the differences in experienced transport poverty are even bigger between respondents with a Dutch versus a non-Dutch immigration background. Respondents with a non-Dutch immigration background (strongly) agree twice as much with the statements as their counterparts. So, this indicates the validity of using the personal background indicator

in the risk-prediction model. A similar conclusion can be drawn when analysing respondents that do not have access to a car or motorcycle. These respondents are more agreeing with every statement compared to respondents that do have access to a car or motorcycle, again indicating that using this indicator in the risk-prediction model seems validated. However, the fourth personal characteristics indicator that was used in the risk-prediction model seems incorrect. Respondents aged 65 years or older agree far less to the statements than the younger respondents. None of the elderly respondents agrees with the statements that improvement in travel time or safety of their favoured mode of transportation would make it easier to fulfil their daily needs. This result indicates that using age as an indicator for the risk of experiencing transport poverty seems wrong.

So, in conclusion, this thesis finds a possibility of constructing a risk-prediction model in order to estimate the experienced levels of transport poverty for different neighbourhoods. Even though no strong evidence of the relationship between the experienced level of transport poverty and the risk-prediction model constructed in this thesis can be presented, the responses collected from the survey indicate the validity of most indicators used in the risk-prediction model.

7.2 Discussion

In every research, there is room for improvement, and this thesis forms no exception to that. Although the research methods and datasets used in this thesis were constructed by keeping as much potential pitfalls in mind, they are not extensive enough to describe everyday real-life situations. Data and variable related potential pitfalls are mostly relevant for the risk-prediction model, while aspects like validity and representativeness can limit the effectiveness of the survey in answering the research question.

One potential pitfall is the fact that some important data that could potential help a lot in explaining the risk of experiencing transport poverty was unfortunately not available. For example, a lot of Dutch people use and depend on their bicycle as favored mode of transportation. Especially in settings like the city of Rotterdam, car use is being discouraged because of traffic jams and inaccessibility. Furthermore, bicycles are used a lot in fulfilling the daily needs of people because of the wide availability of facilities within bike-range. So, it can be expected that the risk of experiencing transport poverty would be lower when taking into account bicycle use. Also, there was no suitable data surrounding the number of public transport stops in a certain neighborhood. Therefore, the dataset used in this thesis only includes the average distance to public transportation lay-over hubs and train stations. This

gives us a limited view of the true potential reach of the public transportation network in a neighbourhood. For example, a lot of neighbourhoods do not have a train station or public transport lay-over hub, but do have an extensive bus and/or tram network. Furthermore, data concerning the health and handicap status of inhabitants would have been a good addition to the risk-prediction model. In a lot of the literature, the health situation of individuals is indicated to have a positive impact on the risk of experiencing transport poverty. Unfortunately, there was no applicable data found for the selected population. Lastly, data surrounding the distance to family and/or friends for individuals could have been helpful. Literature suggests that, in part, individuals can depend on family and/or friends in their transportation needs. For example, think of elderly people might get their groceries delivered to their door by a relative or people that borrow a car from a friend for a day. If a part of an individual's transportation needs is in fact depended on family and/or friends, data concerning the distance to their family and friends might indicate an increase or decrease in the risk of experiencing transport poverty.

Next to the fact that potentially important data was not included, another limitation of the risk-prediction model is the fact that all variables were given the same weight in determining the risk-score. Because half of all variables are distance related, the proximity of facilities might impact the risk-score too strong. The decision to give the same weight to all variables was made because no literature was found that suggested otherwise. So, although this has been assumed throughout the thesis, it seems reasonable to assume that not all variables should have been weighted equally.

Furthermore, the risk-score for each variable is based on the division of the data for only neighbourhoods in Rotterdam into four equal quantiles. This means, that a neighbourhood has a higher or lower risk of experiencing transport poverty relative to other neighbourhoods in Rotterdam. An example of a problem that might arise because of this limitation; maybe all neighbourhoods in Rotterdam have a high risk on experiencing transport poverty compared to other areas of the Netherlands, but since we only compare neighbourhoods in Rotterdam these (on a national level) high-risk neighbourhoods might show up as low-risk in Rotterdam.

Concerning the qualitative part of the thesis, the survey that was used has some flaws as well. First, the aim was to use in-depth interviews to gain a clear understanding of the experienced transport poverty. Unfortunately, due to current COVID19-pandemic, in-depth face-to-face interviews were not an option. Therefore, a larger population was selected to ensure enough randomized respondents from both neighbourhoods. This did however mean that the potential

depth of questioning was limited, and therefore the potential to analyze the experienced transport poverty to. The amount of statements in the second part of the survey that were analyzed to conclude the extent in which transport poverty was experienced was limited. It seems however fair to assume that this limited amount of statements does not represent all feelings or experiences concerning transport poverty that an individual can have. Also, because Facebook messages were used, there was no full control over the population selection process. As the messages were posted on local pages, it is assumed that the respondents really do live in the corresponding neighbourhood. However, there is no way of checking this. Getting respondents from the Facebook messages also means there was no check possible on the response rate.

7.3 Recommendations

In future research, a more extensive risk-prediction model could be made. As new indicators of transport poverty arise and data concerning those indicators becomes available, a more accurate model could be formulated. The indicators used in this thesis are limited and therefore more suitable variables could improve the effectiveness of the model substantially.

Concerning the weight of all variables that are taken being used in the risk-prediction model; I would recommend future research to somehow establish the importance, and therefore relevant weight-factor, for each variable. Also, some interaction effects might be explanatory in determining the weights of each variable. For example; if the individual of interest has access to a car or motorcycle, should the distance to facilities matter as much as in a situation where an individual does not have access to a car or motorcycle? Interaction effects seem especially important because of the conclusion that personal characteristics seem to be less relevant when a neighbourhood is in close proximity to most daily activities and facilities.

In today's time, the studying of transport poverty is still very much conceptual. Once a method is designed to actually measure transport poverty, data concerning the level of transport poverty should be compared to the outcomes of a (more extensive) risk-prediction model using statistical methods. If there seems to be a way to make a robust and decisive risk-prediction model, this model would be able to give policy makers a projection of neighbourhoods or areas that are in high risk of being exposed to this form of social exclusion.

7.4 Reflection

Looking back at the entire process, this thesis research has taught me a lot. Although I started on time and already had a rough outline of the concepts I wanted to study, I was surprised by the number of sidetracks and potential pitfalls that come to mind at each step of the process. Whether it was the importance of correctly formulating the main research question and fitting sub-questions or the multiple stance points of interpreting the survey results, each (sub)chapter made me realize that for every decision you make has a huge impact on the validity and representativeness of your conclusion.

I also learned that a well-constructed research is hard to build from the ground up on your own. You need different stance points and opinions about your research questions and methodology. Without these it is easy to focus on just your own thoughts on the topic and thereby miss a lot of potential sidetrack and pitfalls. Every comment I got was useful, mostly because it made me realize that there is a big gap between what you want to do and what you are actually able to do.

I wish I had found more relevant data to incorporate in the risk-prediction model to make it more decisive. The difficulty of gathering relevant and trustworthy data was a process I underestimated. However, after reading the literature I soon found out that there were a lot of potential indicators I could not include because of a lack of data.

Overall, I did really enjoy writing the thesis. Because you come up with the idea, the process and the methods yourself, I felt responsible for the quality of the entire research process. I also feel like I learned a lot about academic writing, research skills and data gathering, which are all relevant and useful skills to apply in the remainder of my academic education.

Chapter 8

8.1 Bibliography

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8.2 Appendix

Table 7. Risk-scores of Each Indicator for Each Corresponding Neighbourhood from the Risk-prediction Model

Neighbourhood	<15 / >65	% Non-dutch	% low-income	% welfare	Vehicle ownership	School	supermarket	GP	Lifesupplies	Station	PThub	Soc.gathering	Risk-score
<i>Blijdorp</i>	1	1	1	1	3	1	1	1	2	2	1	2	1,416667
<i>Hillegersberg Zuid</i>	2	1	1	1	2	1	3	1	2	1	2	1	1,5
<i>Stadsdriehoek</i>	1	2	2	2	2	3	1	2	1	1	1	1	1,583333
<i>Liskwartier</i>	2	2	2	2	3	1	1	1	1	1	1	2	1,583333
<i>Nieuwe Werk</i>	1	1	2	1	1	4	2	2	1	3	1	1	1,666667
<i>Bergpolder</i>	1	2	3	2	3	1	2	2	1	1	1	1	1,666667
<i>Cool</i>	1	3	2	2	3	2	1	3	1	1	1	1	1,75
<i>Cs Kwartier</i>	1	3	1	1	1	3	3	3	2	1	1	1	1,75
<i>Middelland</i>	1	3	3	3	4	1	1	1	1	1	1	2	1,833333
<i>Rubroek</i>	2	3	3	3	4	1	1	1	1	1	1	2	1,916667
<i>Provenierswijk</i>	1	3	3	3	4	1	3	2	1	1	1	1	2
<i>Kralingen West</i>	2	3	3	3	3	2	1	2	1	1	1	2	2
<i>Kralingen Oost</i>	3	1	2	1	2	2	2	2	3	2	2	2	2
<i>Carnisse</i>	1	3	3	2	3	1	1	1	1	4	3	1	2
<i>Oude Westen</i>	2	4	4	4	4	1	1	1	1	1	1	1	2,083333
<i>Dijkzigt</i>	1	3	4	1	1	3	3	2	3	2	1	1	2,083333
<i>Nieuwe Westen</i>	1	4	3	4	4	1	1	1	1	2	1	2	2,083333
<i>Oud Mathenesse</i>	2	3	4	3	3	1	1	1	2	1	2	2	2,083333
<i>Kop van Zuid</i>	1	3	2	1	1	3	4	4	2	2	1	1	2,083333
<i>Kop van Zuid - Entrepot</i>	3	4	2	3	3	1	1	1	2	1	2	2	2,083333
<i>Agniesebuurt</i>	1	4	4	4	4	2	2	1	1	1	1	1	2,166667
<i>Katendrecht</i>	3	4	2	3	3	1	2	1	2	2	2	1	2,166667
<i>Zuidplein</i>	3	3	2	2	3	3	1	1	1	3	3	1	2,166667
<i>Dorp</i>	4	1	2	2	1	2	2	2	3	1	4	2	2,166667
<i>Oude Noorden</i>	2	4	4	4	4	1	1	2	1	1	1	2	2,25
<i>Nieuw Crooswijk</i>	2	3	3	4	3	1	2	1	2	2	1	3	2,25
<i>Struisenburg</i>	1	2	3	2	3	4	3	4	2	1	1	1	2,25
<i>Noordereiland</i>	2	2	2	3	2	4	1	3	2	2	2	2	2,25
<i>Spangen</i>	2	4	3	4	4	1	2	1	1	2	1	3	2,333333
<i>Schiemond</i>	3	4	2	3	3	2	1	1	3	3	2	1	2,333333
<i>Hillegersberg Noord</i>	4	1	1	2	1	3	3	2	3	2	3	3	2,333333
<i>Molenlaankwartier</i>	4	1	1	1	1	1	3	3	3	3	3	4	2,333333
<i>Bloemhof</i>	2	4	4	4	4	1	1	1	1	2	2	2	2,333333
<i>Pernis</i>	3	1	1	2	1	2	2	2	2	4	4	4	2,333333
<i>Tarwewijk</i>	1	4	4	3	4	1	1	3	1	3	2	1	2,333333
<i>Delfshaven</i>	1	4	4	4	4	1	2	2	2	3	1	1	2,416667
<i>Bospolder</i>	2	4	4	4	4	1	1	1	1	3	2	2	2,416667
<i>Tussendijken</i>	2	4	4	4	4	1	2	1	1	3	1	2	2,416667
<i>Schiebroek</i>	4	2	2	3	3	1	2	2	2	2	3	3	2,416667

<i>Terbregge</i>	3	1	1	1	1	1	4	3	4	3	3	4	2,416667
<i>Oud Crooswijk</i>	3	4	4	4	4	1	2	1	1	2	1	2	2,416667
<i>Het Lage Land</i>	4	2	2	2	2	3	2	2	2	1	3	4	2,416667
<i>Oud Charlois</i>	2	3	3	3	3	1	2	1	1	4	3	3	2,416667
<i>Kleinpolder</i>	4	3	3	3	2	1	2	3	2	3	2	2	2,5
<i>Overschie</i>	3	2	1	2	1	3	4	3	2	4	2	3	2,5
<i>Hillesluis</i>	2	4	4	4	4	1	1	1	1	2	3	3	2,5
<i>Afrikaanderwijk</i>	3	4	4	4	4	1	2	1	1	2	2	2	2,5
<i>Lombardijen</i>	4	3	3	3	3	2	3	1	2	1	4	1	2,5
<i>Kralingseveer</i>	2	1	1	1	2	4	4	2	2	4	3	4	2,5
<i>Blijdorpsepolder</i>	1	4	1	1	1	4	4	4	4	3	1	1	2,545455
<i>Zestienhoven</i>	4	2	1	1	2	1	4	4	4	3	2	3	2,583333
<i>Oosterflank</i>	3	3	2	3	2	2	2	2	3	1	4	4	2,583333
<i>Strand en Duin</i>	4	1	1	1	1	4	4	4	4	1	4	2	2,583333
<i>De Esch</i>	2	3	3	3	2	3	3	3	3	3	2	2	2,666667
<i>Vreewijk</i>	4	2	4	4	3	1	3	2	2	2	3	2	2,666667
<i>Feijenoord</i>	3	4	4	4	4	1	2	3	1	1	2	3	2,666667
<i>Groot IJsselmonde</i>	4	3	2	3	2	2	3	2	3	2	4	2	2,666667
<i>Zevenkamp</i>	3	2	2	2	2	2	3	3	3	2	4	4	2,666667
<i>'s Gravenland</i>	2	2	1	1	1	4	3	4	4	4	3	4	2,75
<i>Heijplaat</i>	3	2	2	3	2	1	2	4	2	4	4	4	2,75
<i>Rozenburg</i>	4	1	1	2	1	3	2	4	3	4	4	4	2,75
<i>Kralingse Bos</i>	2	1	1	4	1	1	4	4	4	3	3	4	2,818182
<i>Spaanse Polder</i>	1	1	3	1	4	4	4	4	4	2	3	3	2,818182
<i>Oud IJsselmonde</i>	2	2	1	2	1	4	4	4	4	3	4	3	2,833333
<i>Zuidwijk</i>	4	3	4	4	3	1	2	1	2	3	4	3	2,833333
<i>Pendrecht</i>	3	4	3	4	3	1	2	2	2	4	3	3	2,833333
<i>Zuiderpark</i>	4	2	1	2	4	3	3	3	3	4	3	3	2,833333
<i>Hoogvliet Noord</i>	3	3	1	2	2	1	4	3	3	4	4	4	2,833333
<i>Noord Kethel</i>	1	1	1	1	1	4	4	4	4	4	4	4	2,909091
<i>Witte Dorp</i>	3	4	3	4	4	2	3	4	2	1	2	3	2,916667
<i>Prinsenland</i>	4	2	2	2	2	1	4	4	4	3	3	4	2,916667
<i>Ommoord</i>	4	2	2	2	2	2	3	4	3	3	4	4	2,916667
<i>Schieveen</i>	4	1	1	1	1	4	4	4	4	4	4	4	3
<i>Beverwaard</i>	3	4	2	3	3	2	3	2	3	4	4	3	3
<i>Charlois Zuidrand</i>	4	1	1	1	1	4	4	4	4	4	4	4	3
<i>Hoogvliet Zuid</i>	4	2	2	2	2	3	3	2	4	4	4	4	3
<i>Wielewaal</i>	3	2	4	4	2	3	2	3	4	4	3	3	3,083333
<i>Landzicht</i>	3	1	4	3	2	4	4	4	3	4	3	3	3,166667
<i>Nesselande</i>	4	2	1	1	2	4	4	4	4	4	4	4	3,166667
<i>Rijnpoort</i>	4	1	3	1	1	4	4	4	4	4	4	4	3,181818

Table 8. *Frequency Tables for All Answers to the Survey Questions; Both Neighbourhoods***In which neighbourhood do you live? (Q1)**

Neighborhood	Frequency	Percentage	Cumulative percentage
Nesselande	102	71.33	71.33
Blijdorp	41	28.67	100.00

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	26	18.06	18.06
31-50	80	55.56	73.61
51-65	20	13.89	87.50
65+	18	12.50	100.00

What is your personal background? (Q3)

Background	Frequency	Percentage	Cumulative percentage
Dutch	133	92.36	92.36
Non-Dutch	8	5.56	97.92
I'd rather not say	3	2.08	100.00

What is your income? (Q4)

Income	Frequency	Percentage	Cumulative percentage
< Average income	29	20.28	20.28
Average income	30	20.98	41.26
> Average income	67	46.85	88.11
I'd rather not say	17	11.89	100.00

Do you make use of financial arrangements? (Q5)

Financial arrangements	Frequency	Percentage	Cumulative percentage
Yes	7	4.86	4.86
No	134	93.06	97.92
I'd rather not say	3	2.08	100.00

Do you have access to a car or motorcycle? (Q6)

Vehicle	Frequency	Percentage	Cumulative percentage
Yes	116	80.56	80.56
No	28	19.44	100.00

To which extent do you agree with the following statement: (Q7)**“Because I do not have access to a car or motorcycle I feel limited in my daily activities”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	4	14.29	14.29
Disagree	16	57.14	71.43
Neutral	3	10.71	82.14
Agree	4	14.29	96.43
Strongly agree	1	3.57	100.00

In general, do you possess enough financial resources to use the mode of transportation you desire? (Q8)

Opinion	Frequency	Percentage	Cumulative percentage
Never	1	0.69	0.69
Mostly not	3	2.08	2.78
Sometimes not, sometimes yes	12	8.33	11.11
Mostly yes	48	33.33	44.44
Always	80	55.56	100.00

To which extent do you agree with the following statement: (Q9.1)**“I can easily access my daily activities from the neighborhood I live in.”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	2	1.40	1.40
Disagree	8	5.59	6.99
Neutral	13	9.09	16.08
Agree	53	37.06	53.15
Strongly agree	67	46.85	100.00

To which extent do you agree with the following statement: (Q9.2)**“Fulfilling my daily activities would be easier if my mode of transportation was cheaper”**

Opinion	Frequency	Percentage	Cum.
Strongly disagree	28	19.86	19.86
Disagree	33	23.40	43.26
Neutral	31	21.99	65.25
Agree	40	28.37	93.62
Strongly agree	9	6.38	100.00

To which extent do you agree with the following statement: (Q9.3)**“Fulfilling my daily activities would be easier if my mode of transportation was more reliable”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	35	24.65	24.65
Disagree	40	28.17	52.82
Neutral	35	24.65	77.46
Agree	22	15.49	92.96
Strongly agree	10	7.04	100.00

To which extent do you agree with the following statement: (Q9.4)**“Fulfilling my daily activities would be easier if my mode of transportation was faster”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	27	19.15	19.15
Disagree	44	31.21	50.35
Neutral	36	25.53	75.89
Agree	27	19.15	95.04
Strongly agree	7	4.96	100.00

To which extent do you agree with the following statement: (Q9.5)**“Fulfilling my daily activities would be easier if my mode of transportation was safer”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	35	25.18	25.18
Disagree	39	28.06	53.24
Neutral	43	30.94	84.17
Agree	19	13.67	97.84
Strongly agree	3	2.16	100.00

Table 9. Frequency Tables for All Answers to the Survey Questions; Only Neighbourhood of Nesselande

In which neighbourhood do you live? (Q1)

Neighborhood	Frequency	Percentage	Cumulative percentage
Nesselande	102	100.00	100.00

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	8	7.84	7.84
31-50	63	61.76	69.61
51-65	14	13.73	83.33
65+	17	16.67	100.00

What is your personal background? (Q3)

Background	Frequency	Percentage	Cumulative percentage
Dutch	95	93.14	93.14
Non-Dutch	6	5.88	99.02
I'd rather not say	1	0.98	100.00

What is your income? (Q4)

Income	Frequency	Percentage	Cumulative percentage
< Average income	17	16.83	16.83
Average income	21	20.79	37.62
> Average income	50	49.50	87.13
I'd rather not say	13	12.87	100.00

Do you make use of financial arrangements? (Q5)

Financial arrangements	Frequency	Percentage	Cumulative percentage
Yes	4	3.92	3.92
No	95	93.14	97.06
I'd rather not say	3	2.94	100.00

Do you have access to a car or motorcycle? (Q6)

Vehicle	Frequency	Percentage	Cumulative percentage
Yes	90	88.24	88.24
No	12	11.76	100.00

To which extend do you agree with the following statement: (Q7)**“Because I do not have access to a car or motorcycle I feel limited in my daily activities”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	1	8.33	8.33
Disagree	6	50.00	58.33
Neutral	2	16.67	75.00
Agree	2	16.67	91.67
Strongly agree	1	8.33	100.00

In general, do you possess enough financial resources to use the mode of transportation you desire? (Q8)

Opinion	Frequency	Percentage	Cumulative percentage
Never	1	0.98	0.98
Mostly not	3	2.94	3.92
Sometimes not, sometimes yes	9	8.82	12.75
Mostly yes	30	29.41	42.16
Always	59	57.84	100.00

To which extend do you agree with the following statement: (Q9.1)**“I can easily access my daily activities from the neighborhood I live in.”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	2	1.98	1.98
Disagree	7	6.93	8.91
Neutral	11	10.89	19.80
Agree	39	38.61	58.42
Strongly agree	42	41.58	100.00

To which extend do you agree with the following statement: (Q9.2)**“Fulfilling my daily activities would be easier if my mode of transportation was cheaper”**

Opinion	Frequency	Percentage	Cum.
Strongly disagree	20	20.00	20.00
Disagree	22	22.00	42.00
Neutral	21	21.00	63.00
Agree	30	30.00	93.00
Strongly agree	7	7.00	100.00

To which extent do you agree with the following statement: (Q9.3)**“Fulfilling my daily activities would be easier if my mode of transportation was more reliable”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	26	25.74	25.74
Disagree	24	23.76	49.50
Neutral	28	27.72	77.23
Agree	16	15.84	93.07
Strongly agree	7	6.93	100.00

To which extent do you agree with the following statement: (Q9.4)**“Fulfilling my daily activities would be easier if my mode of transportation was faster”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	20	20.00	20.00
Disagree	30	30.00	50.00
Neutral	23	23.00	73.00
Agree	21	21.00	94.00
Strongly agree	6	6.00	100.00

To which extent do you agree with the following statement: (Q9.5)**“Fulfilling my daily activities would be easier if my mode of transportation was safer”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	24	24.24	24.24
Disagree	23	23.23	47.47
Neutral	34	34.34	81.82
Agree	15	15.15	96.97
Strongly agree	3	3.03	100.00

Table 10. *Frequency Tables for All Answers to the Survey Questions; Only Neighbourhood of Blijdorp***In which neighbourhood do you live? (Q1)**

Neighborhood	Frequency	Percentage	Cumulative percentage
Blijdorp	41	100.00	100.00

What is your age? (Q2)

Age	Frequency	Percentage	Cumulative percentage
0-15	0	0.00	0.00
16-30	17	41.46	41.46
31-50	17	41.46	82.93
51-65	6	14.63	97.56
65+	1	2.44	100.00

What is your personal background? (Q3)

Background	Frequency	Percentage	Cumulative percentage
Dutch	37	90.24	90.24
Non-Dutch	2	4.88	95.12
I'd rather not say	2	4.88	100.00

What is your income? (Q4)

Income	Frequency	Percentage	Cumulative percentage
< Average income	11	26.83	26.83
Average income	9	21.95	48.78
> Average income	17	41.46	90.24
I'd rather not say	4	9.76	100.00

Do you make use of financial arrangements? (Q5)

Financial arrangements	Frequency	Percentage	Cumulative percentage
Yes	2	4.88	4.88
No	39	95.12	100.00
I'd rather not say	0	0.00	100.00

Do you have access to a car or motorcycle? (Q6)

Vehicle	Frequency	Percentage	Cumulative percentage
Yes	25	60.98	60.98
No	16	39.02	100.00

To which extend do you agree with the following statement: (Q7)**“Because I do not have access to a car or motorcycle I feel limited in my daily activities”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	3	18.75	18.75
Disagree	10	62.50	81.25
Neutral	1	6.25	87.50
Agree	2	12.50	100.00
Strongly agree	0	0.00	100.00

In general, do you possess enough financial resources to use the mode of transportation you desire? (Q8)

Opinion	Frequency	Percentage	Cumulative percentage
Never	0	0.00	0.00
Mostly not	0	0.00	0.00
Sometimes not, sometimes yes	3	7.32	7.32
Mostly yes	18	43.90	51.22
Always	20	48.78	100.00

To which extend do you agree with the following statement: (Q9.1)**“I can easily access my daily activities from the neighborhood I live in.”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	0	0.00	0.00
Disagree	1	2.44	2.44
Neutral	2	4.88	7.32
Agree	14	34.15	41.46
Strongly agree	24	58.54	100.00

To which extent do you agree with the following statement: (Q9.2)**“Fulfilling my daily activities would be easier if my mode of transportation was cheaper”**

Opinion	Frequency	Percentage	Cum.
Strongly disagree	8	20.00	20.00
Disagree	10	25.00	45.00
Neutral	10	25.00	70.00
Agree	10	25.00	95.00
Strongly agree	2	5.00	100.00

To which extent do you agree with the following statement: (Q9.3)**“Fulfilling my daily activities would be easier if my mode of transportation was more reliable”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	9	22.50	22.50
Disagree	15	37.50	60.00
Neutral	7	17.50	77.50
Agree	6	15.00	92.50
Strongly agree	3	7.50	100.00

To which extent do you agree with the following statement: (Q9.4)**“Fulfilling my daily activities would be easier if my mode of transportation was faster”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	7	17.50	17.50
Disagree	14	35.00	52.50
Neutral	12	30.00	82.50
Agree	6	15.00	97.50
Strongly agree	1	2.50	100.00

To which extent do you agree with the following statement: (Q9.5)**“Fulfilling my daily activities would be easier if my mode of transportation was safer”**

Opinion	Frequency	Percentage	Cumulative percentage
Strongly disagree	11	28.21	28.21
Disagree	16	41.03	69.23
Neutral	9	23.08	92.31
Agree	3	7.69	100.00
Strongly agree	0	0.00	100.00

Beste Mevrouw / Meneer,

Allereerst hoop ik dat u in goede gezondheid verkeert in deze bijzondere tijden. In het kader van mijn afstuderen aan de Erasmus Universiteit Rotterdam, doe ik onderzoek naar het risico op vervoersarmoede in uw buurt. Helaas is het voor mij niet mogelijk om in deze periode persoonlijk enquêtes af te nemen, daarom ontvangt u deze brief.

Voor het onderzoek is het van groot belang dat ik enkele vragen kan afnemen bij inwoners van uw buurt om een goed beeld te hebben van de situatie in uw omgeving. Het gaat om 7 meerkeuze vragen en 6 stellingen. Het beantwoorden hiervan kost minder dan 5 minuten en onder de deelnemers wordt een Mediamarkt tegoedbon t.w.v. €25 verloot.

U kunt de enquête openen door naar de volgende link te gaan OF door de QR-code te scannen met de camera van uw telefoon:

https://erasmusuniversity.eu.qualtrics.com/jfe/form/SV_b2yOFOZ8bcW0Eux



Deelname is uiteraard volledig anoniem, enkel als u kans wilt maken op de tegoedbon dient u bij de laatste vraag uw e-mailadres achter te laten.

Ik hoop van harte dat u mij kunt en wilt helpen in deze lastige tijd.

Alvast vriendelijk bedankt!

Niels Westdorp, student Economie en Bedrijfseconomie aan de Erasmus Universiteit Rotterdam

Juni 2020

Figure 23. Letter that was distributed amongst inhabitants of neighbourhoods Nesselande and Blijdorp inviting them to participate in the survey

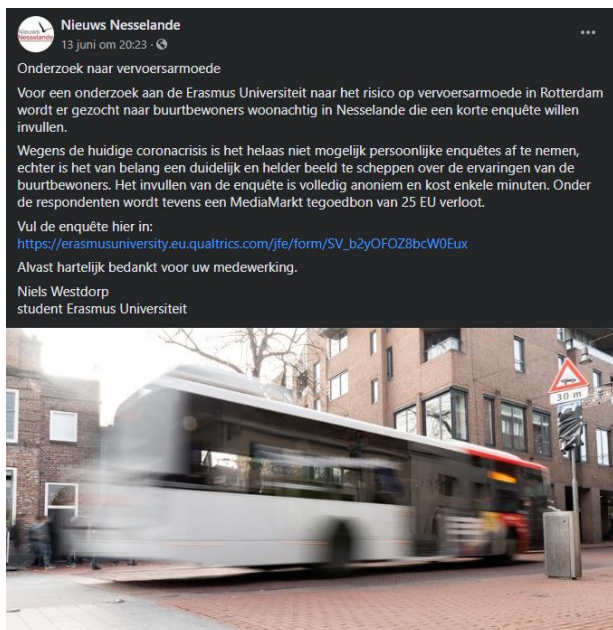


Figure 24. Message posted by “Nieuws Nesselande” Facebook page asking inhabitants of Nesselande to fill in the survey

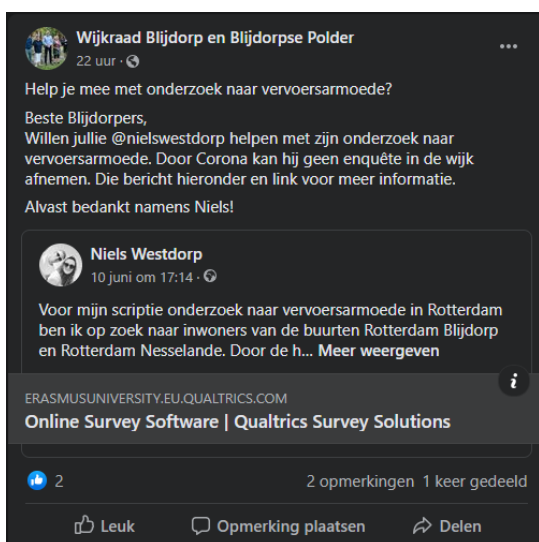


Figure 25. Message posted by “Wijkraad Blijdorp en Blijdorpse Polder” Facebook page asking inhabitants of Blijdorp to fill in the survey

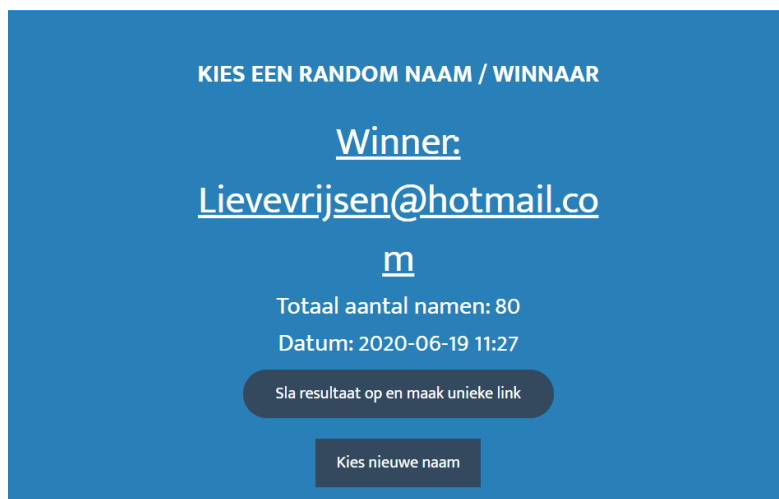


Figure 26. The result from the random comment picker used to determine the winner of the €25 MediaMarkt gift card (link to result: https://commentpicker.com/nl/online-naam-loten.php?id=rnp_5eec86dae3437735)



Figure 27. Delivery of the €25 MediaMarkt gift card to Lieve Vrijsen, inhabitant of Blijdorp