Assessment of Transport-Related Social Exclusion Among the Dutch Elderly: A Comparative Mixed Method Approach

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August, 2022

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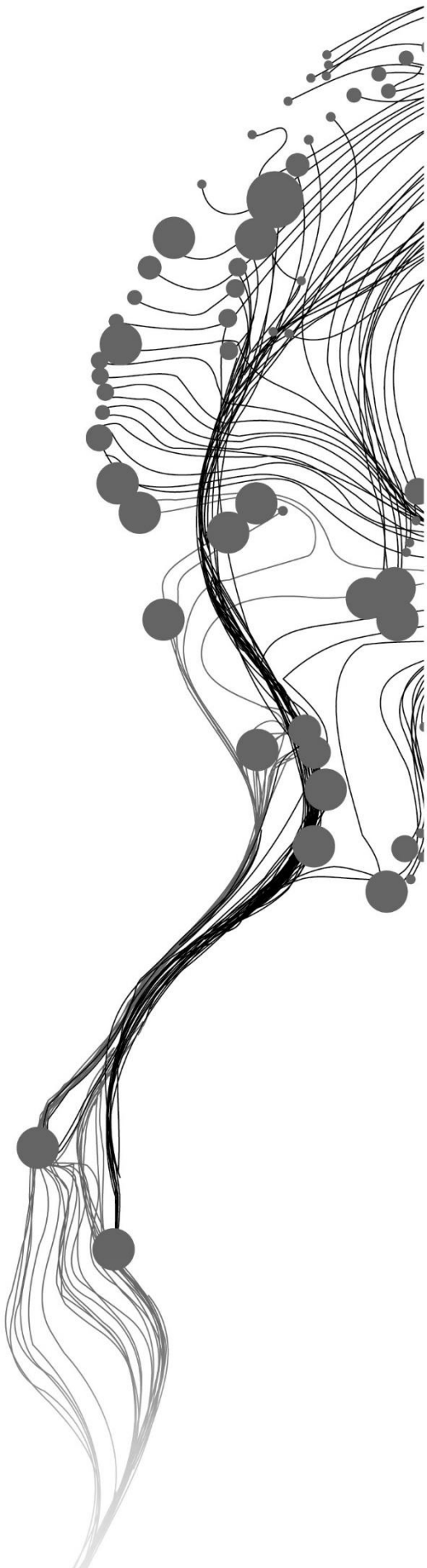

Assessment of Transport-Related Social Exclusion Among Dutch Elderly

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ABSTRACT

Around the world, social exclusion is considered an important problem that has been further exacerbated by the effects of the recent COVID-19 Pandemic. Because the core value of social exclusion is "the inability to fully participate in social life", accessibility, thus, transportation is a significant determinant of social exclusion. There is a growing literature that investigates transport-related social exclusion (TRSE) in various country contexts aimed at different disadvantageous target groups. Yet, only a few of the studies focus on the elderly despite their decreasing capabilities and increasing dependency on others making this group vulnerable to TRSE. Considering the ageing population and large share of the elderly population, the Netherlands is one of the countries at risk of experiencing TRSE in the elderly. Therefore, this study analyzes TRSE among the Dutch elderly. For this purpose, the methodology includes both quantitative and qualitative approaches. The quantitative approach brings an understanding of TRSE using the 2019 Dutch National Travel Survey. As a first step, this approach assesses TRSE based on the travel behaviours of the elderly and the other disadvantaged groups under the elderly in urban and rural areas. As part of the second step, a transport disadvantage index is developed based on the results of disadvantageous travel behaviour characteristics. This index is later on used to see the spatial distribution of transport disadvantage as an approximation of TRSE problem areas. As a result of these two steps of the quantitative approach, gender, car-ownership status, and migration status are defined as disadvantaged groups while Haaksbergen and Rotterdam are defined as rural and urban problem areas respectively. Next, a qualitative approach is conducted in these problem areas by using semi-structured interviews. Theory-driven thematic analysis is used to analyse these interviews. This analysis helped to have a detailed understanding of the relational and multi-dimensional structure of the TRSE together with the quantitative analysis. Both studies have pointed out the dependency on car use as well as dependency on others in the travels of the elderly. However, contrary to quantitative analysis, qualitative analysis illustrated that both urban and rural areas carry disadvantages leading to TRSE. Moreover, whereas the quantitative analysis concluded that there is a strong relationship between age and transport-related social exclusion, the qualitative analysis refuted this relationship by explaining this relationship with abilities rather than the age of an individual.

Keywords: transport-related social exclusion, travel behaviour, transportation disadvantage, transport disadvantage index, elderly exclusion, mixed methodology, thematic analysis

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"Umuntu ngumuntu ngabantu."
"A person is a person because of other people"

Anonymous Zulu Phrase

I come across this quotation in one of the first pieces of literature I read for this study. And here, it made me think about all the people that helped me through this research process with all their moral and academic support.

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"Scientia Dux Vitae Certissimus"
"Science is the truest guide in life"

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1. INTRODUCTION

1.1. Background

Social exclusion has been considered a critical problem around the world that has deepened due to the effects of the COVID-19 Pandemic (Lucas, 2004; UN Committee for Development Policy, 2020). Social exclusion is individuals' inability to fully participate in social life which is caused by either denial, or lack of access, to services, rights, and activities that the majority of people have access to (Levitas et al., 2017; Litman, 2003; Popay et al., 2008). Many authors describe social exclusion as a process arising from changes in different interrelated dimensions (Levitas et al., 2017; Lucas, 2003). These dimensions have been summarized as social, spatial, and economic in the World Bank Inclusive Cities Report (Shah et al., 2015). Exclusion in one of these dimensions will have consequences on other dimensions. For example, the social dimension relates to a lack of participation in society which causes difficulties in acquiring and securing access, rights, or opportunities in spatial and economic life. And spatial exclusion may be a result of the clustering of socially excluded groups in a remote, underserviced area which is caused by a lack of economic resources (Shah et al., 2015). In addition to this, a lack of access to job opportunities as well as skill mismatch causes exclusion from the job market and opportunities creating an economic exclusion (The World Bank, 2009). Therefore, social exclusion is a concept that is interlinked with other dimensions mainly based on cause & effect relations. Due to these consecutive effects of exclusion in one dimension to another dimension, being trapped in social exclusion is likely for the excluded group. Consequently, in order to understand and tackle social exclusion, the interrelations with spatial and economic dimensions should also be considered.

Around the world, recent major trends have contributed to social exclusion as an emerging problem, especially in urban areas. Although increased urbanization and globalization brought prosperity more than ever around the world, the unequal distribution of this wealth increased the gap throughout the years (European Economic and Social Committee, 2019; Shah et al., 2015; United Nations, 2016). In addition to this, service provision for different groups of the community couldn't keep up with the rapid pace of urbanization creating deprived, excluded areas causing social exclusion to thrive (Shah et al., 2015). Social exclusion and the outcomes of social exclusion such as decreased quality of life, well-being, and participation have attracted worldwide attention. Therefore, the topic has been included in several global conferences, world summits, and global agendas (Dugarova, 2015). Foremost comprehensive examples of social exclusion related policy measures are set out to work by including it in the 2030 Agenda of Sustainable development (United Nations, 2016). This agenda adopts the notion of "No one Left Behind" by aiming all the targets and goals will address all components of the society, especially the vulnerable groups (United Nations, 2015, 2016).

The Sustainable Development Agenda sets one of the goals as providing access to "safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations" (United Nations, 2015, p.24). This goal helps to address social exclusion because, as mentioned earlier, lack of participation in activities and access to resources are indications of social exclusion in urban areas (Levitas et al., 2017). In addition, analyzing social exclusion within the context of transport will allow understanding the problem in a *multi-dimensional*, *relational* and *dynamic* manner (Lucas, 2012). Accordingly, investigating social exclusion in urban areas within the context of transport and access will bring more understanding to the ongoing problems of social exclusion.

The concept of accessibility can be defined as the ability of individuals to reach desired destinations via transport modes (Geurs & van Wee, 2004). Lack of accessibility has been considered by many authors as the main contributor to transport-related social exclusion (Kamruzzaman et al., 2016; Kenyon et al., 2002; Lucas, 2012; van Wee & Geurs, 2011). Increased accessibility allows disadvantaged groups in the area to reach main opportunities such as employment, education, health care, and social services. As a result, these groups may be prevented from being trapped in social exclusion by having access to activities and services (Kenyon et al., 2002). Some of the factors to provide this access are the availability of transport services and access to transport services. The absence of these factors can be defined as a transport disadvantage. On the other hand, transport disadvantage does not necessarily mean transport-related social exclusion. This is because every transport disadvantaged individual might not be experiencing social exclusion and a person who experiences social exclusion might not be suffering from transport

disadvantage. However, combined with socially disadvantaged groups in the area, transport disadvantage might lead to inaccessibility and eventually transport-related social exclusion (Lucas, 2012). Thus, defining and understanding socially disadvantaged groups, their needs, and capabilities in an area is as important as understanding the factors that are contributing to transport disadvantage in that area. Various vulnerable groups are prone to be socially excluded based on the different types of disadvantages they experience. Because socially affected groups and the degree of exclusion differs from one society to another, many studies describe different sets of socially disadvantaged groups (DFID, 2005). In general, the groups that are mainly subject to social exclusion involve women, ethnic minorities, the elderly, low-incomers, people with disabilities, people with health problems, children, and young persons (ESCAP, 2016; Kamruzzaman et al., 2016; Shah et al., 2015). Disadvantaged groups might face difficulties in accessibility resulting from mobility restraints, travel costs, availability of services, geographic location, time budget, and fear/denial of participation (Church et al., 2000; Kamruzzaman et al., 2016).

In relation to increased life expectancy and decreased fertility rates, the increase in the ageing population is considered a prevailing trend around the world (ESCAP, 2016; European Economic and Social Committee, 2019; United Nations, 2016). This ageing population affects society due to their increased needs and decreased capacities or capabilities causing dependency on others for daily life activities of the elderly (ESCAP, 2016). Because of this dependency on others, the elderly is defined as at risk of social exclusion by the United Nations in their report on the World Social Situation (United Nations, 2016). Based on these trends, the elderly require prominent attention while addressing transport-related social exclusion among other vulnerable groups in the contemporary world.

Especially the elderly with mobility or accessibility restraints experience more severe consequences that have influenced not only health or income levels but also their well-being and quality of life (Currie & Delbosc, 2010; United Nations, 2016). Under these conditions, transport plays a vital role in reducing the levels of social exclusion by promoting access to activities and opportunities and increasing the levels of independence of the elderly (Currie & Delbosc, 2010). On the other hand, analyzing social exclusion for certain categories, such as age, carries the risk of overlooking the differences among the groups of people in that category (Church et al., 2000).

Even though old age is typically associated with decreased mobility, the travel behaviour of the elderly might not be uniform (Schwanen & Páez, 2010). For example, countries around Europe, the U.S., and Canada have experienced an increase in travelled distance and car ownership among the elderly (Banister & Bowling, 2004). Despite the common understanding of this increase as a sign of prosperity, this trend might be the result of necessity rather than choice (Delbosc & Currie, 2011b). In addition to this, other combined characteristics/difficulties of individuals such as geographic location might affect how severe the elderly experience social exclusion (Delbosc & Currie, 2011b).

In order to estimate the social exclusion effects of the ongoing ageing population and urbanization trends, it is needed to analyze transport-related social exclusion among the elderly in a further custom-tailored manner. By making this analysis it is possible to understand how urban areas and the ageing population together shape each other. Moreover, this analysis will help to grasp the variation resulting from different spatial, individual, and geographical characteristics that are needed to achieve social inclusion in the future (Schwanen & Páez, 2010).

1.2. Research Gap

The relation between social exclusion and transportation in studies has started to become more explicit, especially after the 2000s (Lucas, 2012). Different approaches and geographical or social contexts have been considered in these studies by using different methodologies. Church et al. (2000) summarize the approaches under the classes of categorical approach and spatial approach. The categorical approach examines the problem by focusing on the social groups and their travel behaviours or needs whereas the spatial approach focuses on transportation problems in certain rural or urban areas. While there are disproportionately high numbers of research addressing social exclusion from a single approach (such as (Delbosc & Currie, 2011b; He et al., 2020; Lättman et al., 2016; Litman, 2003; Oviedo Hernandez & Titheridge, 2016; Shergold & Parkhurst, 2012; Wu & Hine, 2003)), studies linking both approaches are fewer(such as (Allen & Farber, 2020; Engels & Liu, 2011; Lucas, 2011)). However, there is also a variety of different research types in each approach in terms of spatial context or category that is considered.

Depending on the context and definition of the problem, different categories have been considered as disadvantaged groups in social exclusion literature. The majority of the studies have been centred around the working-age population or/and access to working areas, even though the population is ageing especially in more developed countries (Moffatt & Glasgow, 2009). Walsh et al. (2017) analyzed this limited number of studies on elderly social exclusion revealing that only 20 studies (out of 425) have been focused on transport-related social exclusion for this age group. Although all of these research studies have a valuable contribution to the interactions between the elderly and transport, not all of them have direct connections with social exclusion (e.g. (Giesel & Köhler, 2015)).

One of the examples of transport-related social exclusion for the elderly is the study by Shergold and Parkhurst (2012) which has focused on the elderly group in rural South England and Wales. This study is based on the self-reported exclusion via surveys and interviews with elderly people to understand their community involvement and access to services. Even though this perspective will help to understand the perception of social exclusion in the elderly, it does not give an understanding of transportation supply and accessibility in the study areas. Another example similar to this approach is conducted by He et al. (2020) who examine the relationship between perception/satisfaction with travel needs and social inclusion & well-being. As in the earlier example, this study also lacks the spatial links of social exclusion in the elderly by only focusing on perception and not on accessibility conditions.

On the other hand, Engels and Liu (2011) studied the social exclusion among non-driving elderly in Melbourne by combining the survey data on willingness to travel and travel perception with transportation and land-use characteristics of the area. The link between these two approaches is important to understand how transport resources can be used while tackling social exclusion and helps benefit the inclusion of certain groups or areas (Church et al., 2000). Although the study by Engels and Liu (2011) is a successful example of this linkage, limiting their focus group category to only non-driving seniors has a risk to neglect the common needs and capabilities among all elderly. However, considering different groups among the elderly is also important in order not to overlook differences between groups that have different needs and capabilities. Therefore, this study will make use of a mixed approach where both different characteristics of subgroups and the common characteristics belonging to this cohort will be analyzed.

As mentioned, a growing body of literature has been focusing on transport-related social exclusion, whereas a considerable amount of these studies have been conducted in the United Kingdom as well as Australia and Canada (Lucas, 2012; Walsh et al., 2017). Despite that there is a considerable number of studies also around Eastern Europe, especially for the elderly group, these studies lack a direct link with social exclusion (Walsh et al., 2017). Because Europe is among the regions facing the ageing population trend (European Economic and Social Committee, 2019), the need for understanding the relationship between transport and social exclusion in this group is consequential. Yet, mainly the policies addressing this problem focused on inclusion in the labour market (e.g. OECD, 2014) overlooking the limited resources, lack of access to services, or individual's residence location (Walsh et al., 2012).

In the light of the above information, this study will try to address the research gap in transport-related social exclusion in the elderly cohort around Europe. More specifically this problem will be addressed in the Netherlands as part of the ageing countries in Europe. The reason behind this choice is several studies concluded that despite the high percentage of bicycle use in the country, the elderly cohort of the Netherlands is becoming more car-oriented (Böcker et al., 2017; Martens, 2013; van den Berg et al., 2011). Because the availability of a car is not the same for every group among the elderly, car-based mobility might influence social exclusion in urban areas (Knowles, 2006). In addition to this, changing needs and capabilities might result in more changes in trip making and transport mode choices leading to social exclusion. These trends and changes underline the importance of understanding how altering the needs and capabilities of the elderly takes part in social exclusion in this country.

Earlier studies have addressed several issues regarding the trip-making, travel behaviour, and patterns of the elderly. Firstly, Tacken (1998) analyzes the trip-making of the elderly in comparison with the other groups of the elderly (gender, education level, car ownership) and other age groups as well as for different times in the Netherlands. This study is made based on Dutch National Travel Survey and it used quantitative methods for the analysis of trips made by the elderly. Therefore, the study lacks an understanding of the accessibility of the elderly and their accessibility perception. In addition to this, more

quantitative research took place studying travel patterns and travel frequencies of the elderly using the Dutch National Travel Survey (Yang et al., 2013) and travel diary data (Böcker et al., 2017). On the other hand, the study by Hof and de Goede (2010) analyzed the effects of life events on the mobility of the elderly by using a qualitative method. All in all, it is evident from the above examples that there is a lack of understanding and analysis of elderly accessibility, especially in combination with the different methods in the Netherlands. Therefore, this study is planned to address this gap concerning transport-related social exclusion.

1.3. Research Objectives & Questions

This study aims to analyze transport-related social exclusion among the Dutch elderly. The effect of changing needs and capabilities on accessibility will be studied by different modes in this age cohort. The dynamic nature of social exclusion will be captured by understanding how changing age structure in the population affects travel patterns, needs, and behaviours compared to other age groups. By employing the mixed approach of spatial and categorical, the manifestation of social exclusion on different dimensions will be revealed. In other words, understanding the individual characteristics of different groups and linking this information with spatial analysis and perception of TRSE will help to deduce interrelations between social exclusion and other dimensions of the exclusion.

1.3.1. Sub Objectives

Several sub-objectives have been defined to structure a framework of the pathway reaching the main objective:

i. To define transport-related social exclusion & ageing population and to identify typical problems faced by the elderly in different contexts
ii. To evaluate the travel behaviour of the elderly and the problem areas in the Dutch context
iii. To understand the TRSE perception and travel experiences of the elderly in the defined problem area

1.3.2. Research Questions

Objective i. To define transport-related social exclusion (TRSE) & ageing population and to identify typical problems faced in different contexts.

a. What is transport-related social exclusion?
b. What are typical examples of TRSE in different contexts? What are the common spatial and non-spatial variables influencing it?
c. How do we define the elderly in the Dutch context? What are the socially disadvantaged groups in the context of TRSE?

Objective ii. To evaluate the travel behaviour of the elderly and the problem areas in the Dutch context.

a. What is the difference between travel behaviour (transport modal split, travel frequency, trip length) of the elderly compared to other groups?
b. What are the mobility and socio-economic characteristics of the elderly? Which subgroups can be defined as disadvantaged for the analysis?
c. Do the elderly in the Netherlands face transport disadvantages? If so, what is the nature of this transport disadvantage?
d. How is the spatial distribution of the transport disadvantage in the Netherlands? Which areas have high levels of elderly transport disadvantage? Which areas have the higher disadvantage gap between the elderly and all age groups?

Objective iii. To understand the TRSE perception and travel experiences of the elderly in the defined problem area.

a. How is the travel pattern of the elderly by different subgroups?
b. What type of travel barriers do the elderly experience in their daily lives?
c. What is the reason behind the mode choice of the elderly? What is the opinion of the elderly towards different transport modes?
d. Are there any activities/destinations that the elderly are prevented from accessing due to transportation? If so, what are these activities/destinations and the reasons behind prevention?
e. Do the elderly have unmet needs to have a better travel experience? What are these unmet needs of the elderly?

Table 1:Data and Methodology of the Research Questions

Objectives	Research Questions	Data	Methodology
To define transport-related social exclusion (TRSE) & the aging population and to identify typical problems faced in different contexts	What is transport-related social exclusion?	Literature	Literature Review
	What are typical examples of TRSE in different contexts? What are the common spatial and non-spatial variables influencing it?		
	How do we define the elderly in the Dutch context? What are the socially disadvantaged groups in the context of TRSE?		
To understand the travel behavior of the elderly and the TRSE problem areas in the Dutch context	What is the difference between travel behavior (transport modal split, travel frequency, trip length) of the elderly compared to other groups?	Dutch National Travel Survey (ODIN 2019) (Centraal Bureau voor de Statistiek (CBS); Rijkswaterstaat (RWS-WVL), 2020)	Statistical Analysis
	What are the mobility and socio-economic characteristics of the elderly? Which subgroups can be defined as disadvantaged for the analysis?		
	Do the elderly in the Netherlands face transport disadvantages? If so, what is the nature of this transport disadvantage?		
	How is the spatial distribution of the transport disadvantage in the Netherlands? Which areas have high levels of elderly transport disadvantage? Which areas have the higher disadvantage gap between the elderly and all age groups?		
To understand the TRSE perception and travel experiences of the elderly in the defined problem area	How is the travel characteristics of the elderly in the study areas?	Interview	Interview Analysis
	What type of travel barriers do the elderly experience in their daily lives?		
	What is the reason behind the mode choice of the elderly? What is the opinion of the elderly towards different transport modes?		
	Are there any activities/destinations that the elderly are prevented from accessing due to transportation? If so, what are these activities/destinations and the reasons behind prevention?		
	Do the elderly have unmet needs to have a better travel experience? What are these unmet needs of the elderly?		

2. METHODOLOGY

In this part, firstly the problem of transport-related social exclusion will be conceptualized. After that, in relation to this conceptualization, the methodology will be described in three main steps which can be seen in detail in the framework in Figure 2.

2.1. Conceptualization of the Problem

Numerous studies examine social exclusion with its linkage to the transport disadvantage and its multi-dimensional structure. Authors discover social exclusion in different contexts by exploring the social and transport disadvantages (Currie et al., 2007; Gaffron et al., 2001; Lucas, 2012). As mentioned earlier transport-related social exclusion is a byproduct of the transport and social disadvantages causing transport poverty and inaccessibility (Lucas, 2012). Therefore, understanding the factors causing disadvantages is deemed important in many contexts such as London, US, or Scotland (Currie et al., 2007; Hine & Mitchell, 2001a; Lucas, 2004a). As mentioned by Hine & Mitchell (2001), exploring the perceived barriers from individual experience aid the creation of a barrier-free environment via transport planning. Because a barrier-free environment is essential to equality for all, identification of the barriers is needed on the road to social inclusion (Hine & Mitchell, 2001). Therefore, in this study, the barriers/problems will also be examined to find out in which ways they are excluded based on their own attitudes and perceptions (Hine & Mitchell, 2001).

Apart from the barriers experienced during travel, also the factors that affect the way people travel are important. The mode of travel is highly related to the extent and variations of opportunities people can reach (Engels & Liu, 2011; Siraut & Gay, 2009). Therefore, the factors that play a role in people's mode choice affect the participation level of the individual. Moreover, the barriers to accessibility of a destination might also lie under the mode choice factors such as not being able to visit a destination due to the unavailability of a car (Engels & Liu, 2011; Shergold & Parkhurst, 2012). Thus, these factors might be contributing to the exclusion of individuals from different transportation services and could reveal the reasons behind it. For these reasons, mode choice factors can also be considered as part of the causes that might increase the risk of TRSE.

Another approach to understanding the causes of TRSE is analyzing the reasons for unmade trips. Although the social exclusion itself is defined by lack of participation, the literature consists of analyses on realized trips in the majority. Some studies analyzed these reasons under the name of unmet transport needs, blocked desires, or missed opportunities (Cass et al., 2005; Gaffron et al., 2001; Wixey et al., 2003). These reasons reveal the barriers that prevent people from being as socially included as they would like to be. These barriers usually went unnoticed in the studies where the focus is only on the barriers experienced while traveling. Therefore, reasons for unmade trips will also have a part in better understanding the causes of lack of participation.

Social exclusion is analyzed under different dimensions of exclusion by different researchers however there are large overlaps between these dimensions (Currie et al., 2007). Church et al. (2000) list these dimensions in seven categories which are Physical Exclusion, Geographical Exclusion, Exclusion from Facilities, Economic Exclusion, Time-based Exclusion, Fear-based Exclusion, and Space Exclusion. Although mostly their dimensions overlap with the dimensions of Church et al. (2000), Halden et al. (2005) and Wixey et al., (2003) also add Information Exclusion in their dimensions. These dimensions can be explained as can be seen below (Church et al., 2000; Lucas, 2012):

Physical Exclusion: This relates to the physical barriers that restrain people from accessing their destination or being excluded from the transport network due to physical or psychological problems.
Geographical Exclusion: Exclusion that relates to having inaccessibility due to a lack of transport service provision in the area, especially in rural areas and urban fringe areas.
Exclusion from Facilities: Not being able to have access to amenities and basic services in excluded areas due to long distances and individuals' time and money limitations which cause exclusion from these facilities.
Economic Exclusion: Being excluded from the job market due to not having access to jobs. Also, high travel costs avoiding individuals from having their travels causing exclusion can be included here.
Time-based Exclusion: Being excluded from their destinations due to time poverty which is a result of having multiple responsibilities in a limited time.
Fear-based Exclusion: The individual concerns of fear, worry, or terror affects the access and thereon inclusion to the built environment and transport facilities.
Space Exclusion: The management and the security system of the spaces might cause exclusion from that space such as in the gated communities.
Information Exclusion: Being excluded from the facilities and transport systems due to not having access to information such as timetables or maps.

Although each dimension is affected by different factors, these dimensions are also interrelated and have an effect on one another (Burchardt et al., 1999; Church et al., 2000). For example, being unemployed due to an economic exclusion might have an effect on geographical exclusion because of the unaffordability of central locations. However, analyzing these factors altogether because of these interlinkages will be overgeneralizing. Because, by analyzing transport exclusion in different dimensions it is possible to acknowledge different factors that create barriers to individuals' travels (Hine & Mitchell, 2001b). Moreover, this separate analysis aid policymakers in creating relevant solutions for local areas and linking the investments with existing factors (Church et al., 2000). Thus, while analyzing the varying factors, barriers, and reasons in this study, the dimensions will be in high consideration.

The interrelationship between different dimensions causing exclusion in another dimension due to several barriers is a cyclical process. Transport plays a role both as a cause and a consequence in this dynamic exclusion process (Wixey et al., 2005). Therefore, exclusion in different dimensions might affect the travel characteristics of the individuals negatively compared to people who are not at risk of exclusion. Some examples of this might be a dependency on certain modes due to economic exclusion or relying on others for travelling due to physical exclusion. These effects are observed in different country contexts in socially disadvantaged groups (e.g. Grahama Currie et al., 2010; Lucas et al., 2001). Because these effects on travel characteristics might cause even further exclusion, these characteristics should also have a place in the TRSE analysis.

Other than the reflection on travel characteristics and travel behaviour, this circuitous process also results in several needs from the excluded in different dimensions. While addressing the exclusion with investments, it is necessary to address also local needs or "micro-scale needs" to increase participation in society (Rajé, 2007). Otherwise, the introduced investments without being locally aware have a risk of introducing more barriers to socially disadvantaged people's accessibility (Rajé, 2007). Earlier, these needs are classified by Musselwhite (2018) in their study on elderly accessibility. Musselwhite (2018) defines three tiers of hierarchical mobility needs. In this study primary needs are defined as reaching their destinations in a safe, reliable, and affordable manner. The secondary needs are related to the feeling of control and independence in the travel of the elderly. Finally, enjoying the travel itself as a journey,

relaxing, and visits are categorized as the tertiary, the highest level of the needs. This hierarchy will be used as a reference to understand the level of needs in different contexts for this study. Consequently, the needs of the individual as well as different travel characteristics will also need to be addressed in this study to understand the overall picture of TRSE in problem areas.

The figure below shows the explained structure of the TRSE process based on the literature. This structure also shows how the mentioned causes and effects situate in this process. These causes and effects are namely: barriers/problems faced while travelling, factors affecting mode choice, reasons for avoiding or missing a travel, travel characteristics, and needs of excluded groups. Based on this structure the nature of TRSE will be analyzed under these elements paying attention to the multi-dimensional, relational, and dynamic disposition of social exclusion.

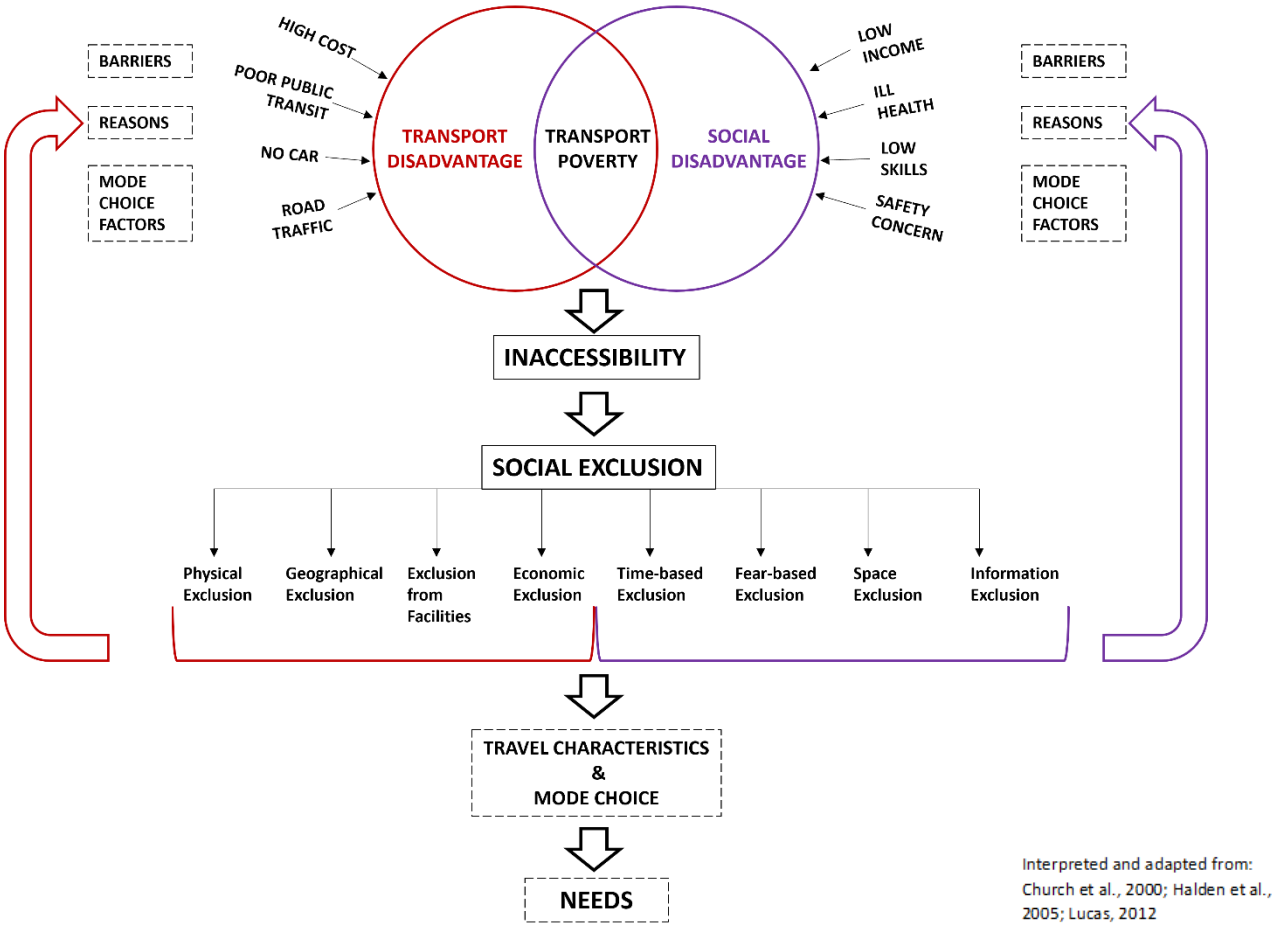

Figure 1: Conceptualization of TRSE process

2.2. Defining TRSE and Aging Population

In this step, the two main topics of transport-related social exclusion and the aging population will be explored both separately and in relation to each other in accordance with Objective 1. Doing this, it is aimed to establish a conceptual framework and create an understanding of the main characteristics of the TRSE in different country contexts before starting the analysis. After that, the elderly definition will be established to be used in the rest of the study. In addition to this, variables that affect elderly TRSE will be searched to be used in the evaluation. This step will also provide a list of transport disadvantaged groups (such as low-incomers, immigrants, women, and non-car owners) which will be used in the other steps based on the literature.

2.3. Methods for the Assessment of TRSE

The next two steps will be the identification of TRSE in the study area; however, there isn't yet any systematic robust method to assess transport-related social exclusion in different contexts (Lucas, 2012). Several methods have been used to assess TRSE; but, in a very broad perspective, the studies used the assessment of mobility or/and accessibility (Kamruzzaman et al., 2016). While the former focuses on the individuals' mobility in space, the latter focuses on whether people can access certain locations. Considering access to services is required to ensure participation in society, the measurement of the (in)-accessibility has been used as a way to evaluate transport-related social exclusion. Many authors (e.g. (Engels & Liu, 2011; Litman, 2003; Titheridge et al., 2009)) have accepted accessibility as an effective measure of TRSE in their studies. However considering the complex structure of the TRSE, it is important to understand the disaggregate experiences of different socially disadvantaged groups. Several studies use the indexing method with area/group-specific indicators (e.g. Casas et al., 2009; Delbosc & Currie, 2011b; Hine & Mitchell, 2001a; Social Exclusion Unit, 2003). By using the indicator approach, it is possible to include different characteristics in the analysis and compare different individual characteristics (income, migration status, education level). For accessibility analysis, it is hard to directly address these individual characteristics and incorporate them into the TRSE analysis(Casas et al., 2009). Therefore, this study will make use of the indicator approach in combination with travel behavior analysis while evaluating TRSE.

Both qualitative and quantitative approaches have been used by several authors in assessing accessibility in the context of TRSE. Some studies only assess the accessibility based on a qualitative (Hine & Mitchell, 2001a; Shergold & Parkhurst, 2012) or quantitative approach (Schönfelder & Axhausen, 2003), and some combine these two approaches (Engels & Liu, 2011; Titheridge et al., 2009). Pure qualitative approaches are commonly used in TRSE studies to understand how individuals respond to opportunities that are available to them (Church et al., 2000). However, Church et al. (2000) explains that these studies should be supported with a quantitative assessment. Because it allows an objective assessment of how transport factors affect the social exclusion experience of individuals.

This study will analyze the TRSE by using the combination of these two approaches in the assessment. Overall, three main reasons can be mentioned why the mixed method is considered best to asses transport-related social exclusion in this study. Firstly, combining these methods offer effectiveness and generalizability thanks to quantitative while still offering an understanding of causality thanks to insights offered by qualitative analysis (Mathieson et al., 2008; Rao & Woolcock, 2003). Secondly, while quantitative analysis explains the problem objectively, qualitative analysis reveals both historic and current influences in effect for TRSE (Mathieson et al., 2008; Rao & Woolcock, 2003). Finally, together both approaches help to discover the premonitory signs of marginality by looking at the experiences, opinions, and behaviors of the individuals (Gacitua-Mario & Wodon, 2001). Therefore this study will make an understanding of the TRSE by taking advantage of both methods to complement each other and eliminate the weaknesses of one method with the strength of the other. Further steps will explain how these approaches will be used and how each will contribute to the analysis in detail.

2.3.1. Quantitative Analysis

This step is aimed at understanding the TRSE problem areas in the context of the Netherlands and seeking answers for objective 2. By making use of the 2019 Dutch National Travel Survey (Onderzoek Onderweg In Nederland), two main analyses will be conducted. These analyses are respectively: travel behavior analysis and transport disadvantage analysis. The aim is to understand TRSE by analyzing the transport disadvantage in combination with the social disadvantage with reference to the Chapter 2.1.

Firstly, the travel characteristics of the elderly will be analyzed in the Netherlands in comparison to other age groups based on the indicators found in the earlier step based on the literature review. Later, the most disadvantaged age group will also be analyzed by different socially disadvantaged groups that are listed in the literature. After this analysis, the groups that stand out as more transport disadvantaged will be used as elderly subgroups in further analyses for the qualitative part. Also, the indicators that demonstrate a transport disadvantage will be found for later use. In the end, this step will provide input to the step with the selection of indicators and to the next analysis with the selection of sub-groups.

Secondly, for understanding the areas of higher TRSE risk, the transport disadvantage of the elderly will be analyzed in comparison to all age groups in the Netherlands. The evaluation will be made by analyzing transport disadvantage with the indicators that show the most disadvantage for the socially disadvantaged group. By using transport disadvantage analysis tailor-made for the disadvantageous group of elderly, it is aimed to reach the approximation of TRSE risk around the Netherlands. With the help of this analysis, the disparities and disadvantages experienced by the elderly will be shown spatially. The case study area will be chosen based on two criteria: where the disparity of transport disadvantage between the elderly and other age groups is high and where the level of elderly transport disadvantage is high. Hence, the problem area for the next step will be selected based on the spatial distribution of the elderly transport disadvantage and the disparity of this disadvantage with other age groups.

2.3.2. Qualitative Analysis

Studies that follow a qualitative approach assessed the TRSE with different perspectives such as perceived accessibility or qualitative analysis of TRSE. Some studies used the qualitative methods either to provide input to quantitative analysis (Titheridge et al., 2009) or to complement the findings of quantitative analysis using surveys (Delbosc & Currie, 2011b). Although both provide a valid proxy for TRSE, the main use of these studies is contributing to quantitative analysis as the main assessment methodology. Therefore, these approaches do not explain multidimensional cause-effect relations in TRSE. Another approach to qualitative analysis of TRSE focuses on gathering data on issues bringing explanatory and unquantifiable value to the analysis. These issues can be exemplified as the self-reported exclusion of individuals, the experienced travel barriers, reasoning behind mode choice, or inaccessible desired activities (e.g. Hine & Mitchell, 2001a; Shergold & Parkhurst, 2012; Siraut & Gay, 2009). This study will make use of the second approach to better understand the TRSE experience of the elderly in the study area conforming with Objective 3.

For this purpose, semi-structured interviews will be conducted in the study area. The intention is to explore the experiences and perspectives of a diverse group of elderly rather than only describing the travel characteristics of these elderly. This interview will not be regarded as a representation of all other individuals' opinions but it is aimed to offer an understanding of the opinions of the elderly. Therefore, the interview firstly will seek answers for travel barriers they experience, the mode choice factors, and reasons for not having a trip. To have a full understanding of the activities they are prevented from participating in due to transport-related issues. In addition to this, their travel characteristics and travel needs will be questioned to understand the possible effects of TRSE or transport disadvantage. In conclusion, with this interview, the overall travel experience of the elderly will be understood in search for TRSE.

The qualitative analysis has two main connections with the quantitative analysis. Firstly, the interviews will be conducted in the problem areas that have been chosen based on the results of quantitative analysis. Secondly, the respondents will be selected following the disadvantaged groups defined in the quantitative analysis. By doing these, it is aimed to fully combine social disadvantage with transport disadvantage and understand TRSE in further detail thanks to qualitative analysis.

All in all, two main analyses will be used to understand the context of TRSE in the problem area. However, it should be noted that both analyses will have different contributions and complications. For example, the qualitative methods are considered constrained due to being dependent on individuals' understanding of accessibility. However, qualitative results offer irreplaceable/unmeasurable information on real TRSE experiences of the elderly. For example, in this study, the reasons behind people's unmet travels, needs, and barriers can only be comprehended in a cause-effect relationship with the help of qualitative analysis. Furthermore, quantitative approaches are criticized for involving value judgments of individuals' accessibility desires in the evaluation (Farrington & Farrington, 2005). Yet, it provides objectivity while assessing the transport disadvantage in larger areas. For instance, the quantitative analysis will be helpful to have a top-down approach by offering an objective assessment of country extent analysis. Therefore, the final discussion of TRSE will be made based on a separate evaluation of both approaches. By doing this, it is aimed to take advantage of each approach's strengths while *offsetting* their weaknesses to have a more complete interpretation of TRSE in the study area (Bryman, 2006).

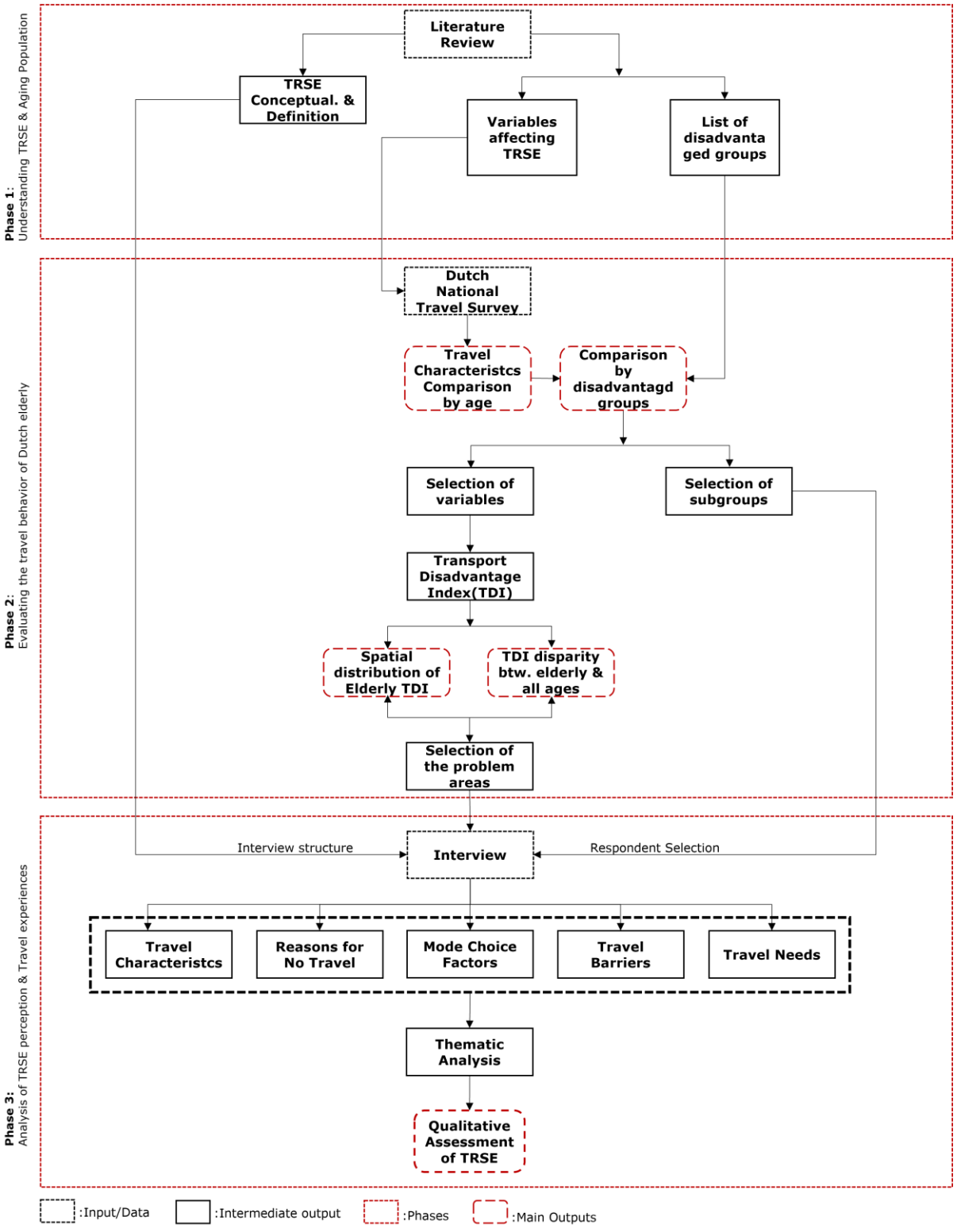

Figure 2: Methodological Framework

3. UNDERSTANDING THE EXCLUSION USING QUANTITATIVE TRAVEL BEHAVIOR ANALYSIS

This section of the study will mainly analyze the state of transport-related social exclusion by identifying the travel behaviour of the elderly in the Netherland from a comparative standpoint. For this purpose, first, the understanding of transport-related social exclusion and the elderly will be set to be used in the rest of the study. Secondly, the indicators that will be used in this chapter will be defined based on the literature. Next, the travel behaviour analysis for the elderly will be conducted based on the ODIN 2019 data mainly in two steps. These two steps will include travel behaviour analysis by age and travel behaviour analysis among disadvantaged elderly groups.

3.1. Defining the TRSE and the Target Population

The transport-related social exclusion will be framed under the definition of "individuals' inability to fully participate in social life which is caused by either denial or lack of access" throughout the study. Additionally, as mentioned in chapter 2.1 multi-dimensional, relational, and dynamic structure of the TRSE will be sought where possible in this study. It is also important to report the definition of the elderly that will be used in the rest of this study before starting the analysis. United Nations prefer the definition of elderly as the people who are over the age of 60 (United Nations, 2019). Additionally, the older people or elderly is defined as over the age of 60 or 65 in the other studies related to transport disadvantage in the Netherlands (Böcker et al., 2017; Hof & de Goede, 2010; Jittrapirom et al., 2019; Pot et al., 2020). Therefore, considering the average common retirement age as 60-65 (Hof & de Goede, 2010) and to offer comparability with other studies, people over 60 will be defined as elderly in this study.

3.2. Indicator Selection For Transportation Disadvantage

Many authors have investigated the reasons behind people's inaccessibility to their destinations or desired activities. These studies that are also shown in Table 2 follow different methodologies for different contexts but each investigates the factors for transport disadvantage or transport-related exclusion. Although there are different country contexts in these studies, it is expected that the common indicators will indicate similar problems in the Dutch context. Therefore, especially the indicators from the Dutch context and the common indicators between different country contexts will be included in the transport disadvantage analysis. Because some of these studies include qualitative data or primary data, the availability of indicators in Dutch National Survey Data will be another criterion in the selection of indicators.

Table 2:Indicators used to identify transport disadvantages in studies

Source	Type of Study	Study Area	Indicators considered
Böcker et al., 2017	Quantitative/elderly mobility	The Netherlands	Daily trip frequencies, Transport mode choices, Weather
Delbosc & Currie, 2011	Qualitative/ Transport disadvantage& exclusion	Australia	Car reliance, Travel quantity, Fuel price
Engels & Liu, 2011	Quantitative/ Transport disadvantage& exclusion	Australia	Distance to key services, Access to Public Transit services, Car ownership, Driving license
Gates et al., 2019	Quantitative/Transport and Inequality	United Kingdom	Trips per person, Expenditure on travel as a proportion of income,

			The relative length of the journey by public and private transport
Jeekel, 2019	Quantitative/Transport Disadvantage	The Netherlands/ Rotterdam	Urban: Public transport availability at late night or early morning, affordability, Rural: loss of services and public transportation services
Kamruzzaman et al., 2016	Literature review/ Transport disadvantage& exclusion	XXX	Travel Distance, Accessible opportunities within the personal mobility limit, Number of opportunities that are participated, Frequency of activity participation, Duration of activity, Distance to public transit services, Distance to Essential services, Car ownership, Driver's license
Lucas, 2012	Theoretical/ Transport disadvantage& exclusion	XXX	Car ownership, Quality of PT services, Travel cost, Travel information, Fear of crime
Pot et al., 2020	Qualitative/rural transport poverty	The Netherlands	Availability of a car, Public transport availability, Travel Information, Service reliability, Comfort and ease of use, Weather conditions, Safety perceptions, Delays, Service quality, Travel times,
Social Exclusion Unit, 2003	Transport barriers& exclusion	United Kingdom	Availability and Physical accessibility of transport, Travel safety and security, Travel cost, Travel information and individuals' Limited travel horizons, The location of services
van Wee & Geurs, 2011	Theoretical/Transport equity & exclusion	XXX	Availability and location of transport services, Travel cost, Travel information, Safety & Security, Physical accessibility, Availability of shops and services Car availability
Walsh et al., 2012	Qualitative/Transport barriers for exclusion	Ireland/Rural	Car ownership, Public Transport services, Cost of Public transportation serv., Physical barriers

Based on these criterion indicators list will include: Trip Frequency, Mode Choice, Travel Distance, Car Ownership, Car Driving License Ownership, and Reason not to Travel. The main aim of these indicators will be first to understand if and how the elderly have experienced transport disadvantages compared to other age groups. Secondly, the elderly's common travel characteristics will be understood.

3.3. Social Exclusion and Selected Indicators

People who are not connected to the social structure can be considered to be at more risk of social exclusion. And establishing this connection and participation requires transport and mobility (Stanley et al., 2011). Therefore higher *trip frequency* levels can indicate higher activity participation and lower risk levels for social exclusion. Also, with the help of *travel distance*, the extent or range of activities that could be reached can be measured which indicates the activity spaces of individuals. This can show the level of involvement in everyday life in a community (Paez et al., 2009). Together with the trip frequency, the participation can be interpreted.

Some studies have found that people might experience lower levels of trip frequency or activity participation due to their characteristics such as disability, not having a car, or driving license(e.g. (Delbosc & Currie, 2011b). On the other hand, it is also possible that lower trip frequencies are not directly related to a lack of opportunities or abilities (Church et al., 2000). Thus, other indicators are also needed to understand the level of participation and reasons behind unmade trips to come to conclusion about social exclusion.

For understanding why a certain category of people travels less, the reasons behind people who do not travel will be inquired. Thanks to this, the different problems experienced by different groups of people will be found such as disability, disease, transport availability, or weather conditions. This indicator will help to understand what type of disadvantage unmade trips can indicate. Although the reason not to travel partly indicate possible exclusion among different groups, the further differences among people who travel are also important. That being the case, different transportation characteristics that relate to social exclusion also need to be analyzed in addition to *reasons for unmade trips*.

For example, the lack of public transport services in rural areas and the lack of availability of transportation services in urban areas in the Netherlands are identified as one of the main transport disadvantages (Jeekel, 2019). Also, several studies have found that the elderly are more car-dependent, especially for their long-distance travel needs (Böcker et al., 2017; Schwanen & Páez, 2010). By analyzing *the mode share* in overall trip making, the possible disadvantaged groups and areas in terms of dependency on certain modes will be analyzed.

In addition to this, Pot et al. (2020) found that *car ownership* and availability of transport modes have a significant role in the transport disadvantage, especially in Dutch rural areas. Also, Paez et al., (2009) have found that car ownership highly affects the traveled distance and trip frequency. Therefore, car ownership might affect the elderly's transport experience and consequently social exclusion.

On the other hand, another limitation in the case of the elderly is health requirements for holding a driving license after the age of 75 according to Article 25a under the Dutch Driving License Regulation (Reglement Rijbewijzen, 2015). By analyzing car ownership and *driving license ownership* together, the possible exclusion that the elderly is experiencing for car use compared to other groups will be analyzed.

As mentioned by Kamruzzaman et al., (2016), social exclusion can not be identified only with the main effects causing transport disadvantage but also with the interplay between explanatory variables such as socio-economic, spatial, or temporal characteristics. This is also exemplified as although different groups might own a car in the same area, high-incomers might afford to travel longer and more frequently than the people who are forced to own a car (Currie & Senbergs, 2007). On the other hand, more frequent travellers are as likely to experience transport problems due to temporal restrictions. Therefore, to avoid overly simplistic identification of transport disadvantage and social exclusion different explanatory variables will be involved in the analysis (Delbosc & Currie, 2011a).

3.4. Descriptive Analysis of the Data

Characteristics of the ODIN 2019 data have been shown in Table 3 based on the distribution of the sample over different population characteristics. It can be seen from the age distribution that the elderly, especially the oldest-old (80+) group, has lower representation levels. However, the percentage of the elderly population in the overall country population is also low. In addition to this, non-urban areas, low-income groups, people with lower education levels, and the migrated population also have lower representation in the data.

Table 3: Frequency Characteristics of the Data

Variables	Classes	N=179091	(%)
Residential Area's Class	Very strong urban	52662	29
	Strong urban	52729	29
	Moderate urban	28093	16
	Little Urban	34253	19
	Non-urban	11354	6
Age	6-19	30601	17
	20-59	105949	59
	60-64	11748	7
	65-69	10552	6
	70-74	8228	5
	75-79	6830	4
	80+	5183	3
Income	Up to 101% of the social minimum	5145	3
	From 101% up to 120% of the social minimum	4768	3
	From 120% up to 150% of the social minimum	7148	4
	150% of social minimum or higher	153277	86
	Unknown	8753	5
Gender	Man	88284	49
	Woman	90807	51
Education	No Education	2015	1
	Primary education*	6409	4
	Lower vocational **	24032	13
	Secondary vocational***	52602	29
	Higher vocational or University	71777	40
	Other	3789	2
	Not asked(<15 years old)	18467	10
Migration Status	Dutch	141864	79
	Western migration	17755	10
	Non-western migration	19472	11

*:Basisonderwijs, lager onderwijs

**:VMBO, VBO, LWOO, VSO, VGLO, MAVO, ULO, MULO

***:HAVO, Atheneum, Gymnasium, MMS, HBS

3.5. Travel Behavior Analysis by Age

Figure 1 represents the mode share between different age groups in rural areas. The age groups have been created considering the average school-age(until 18-19), working age (20-59), and detailed 5-year interval age groups for the elderly after the average retirement age(60-65) (Hof & de Goede, 2010).

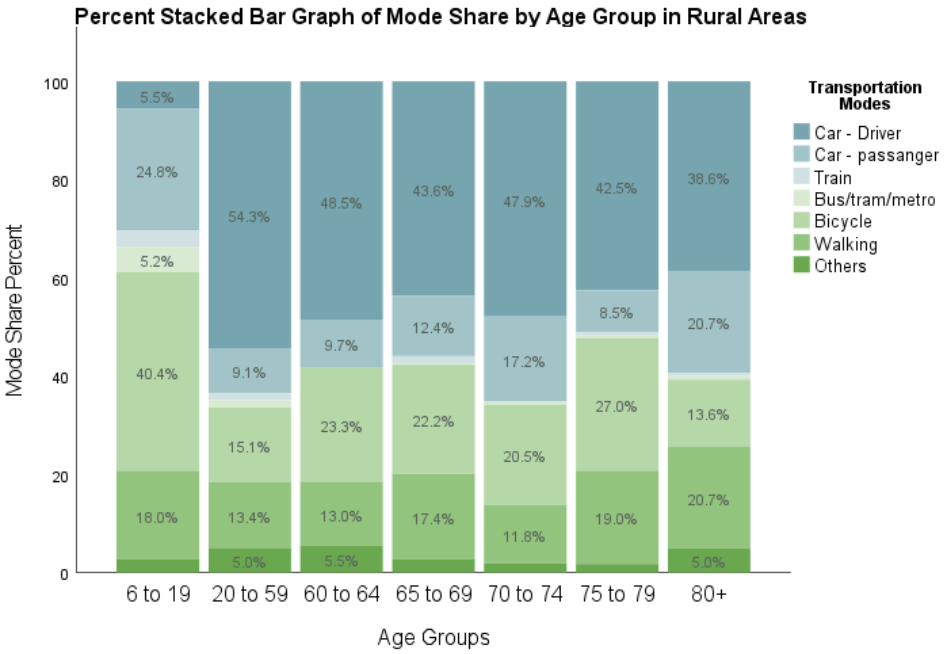

Figure 3: Transportation Mode Share by Age Group in Rural Areas

Figure 3 and Figure 4 show that there is more car reliance in rural areas compared to the areas with very strong urban characteristics. On the other hand, this high share of car use is common also in the non-elderly group in the rural areas. Whereas, car use among the elderly increases with age in urban areas especially as a passenger rather than a driver. Overall, the rates of car use both as a passenger or as a driver is higher in rural areas than in urban areas for all age groups.

Contrary to car use, the rate of walking is higher in urban areas for all age groups. This could be the result of the closer distance to services in most of the urban areas while in the rural areas these services might not be available in the city requiring travelling longer distances to another city. Although one might expect to see lower rates of walking by increasing age due to degrading health, the rates of walking slightly increase towards the oldest age group. However, the distances walked and whether they can walk without assistance is another issue to be considered.

Similar to walking, public transportation and train are also used more by the urban age groups than rural ones. This result is highly expected, considering the lack of public transportation services for most of the rural areas it might not be possible or feasible to use public transit for their travel. However, even if public transit is available in urban areas, the share of transit is low compared to other modes.

For bicycle use, no clear relationship can be observed when comparing urban and rural figures. Only clear comparison could be made for working age which has a much higher bike use share in urban than rural areas. This could be explained by the shorter distances to workplaces in urban areas. Additionally, in both rural and urban areas the oldest-old age group holds the lowest rate of bike share among all other ages. This could again be reasoned with the degrading health conditions and abilities of this age group.

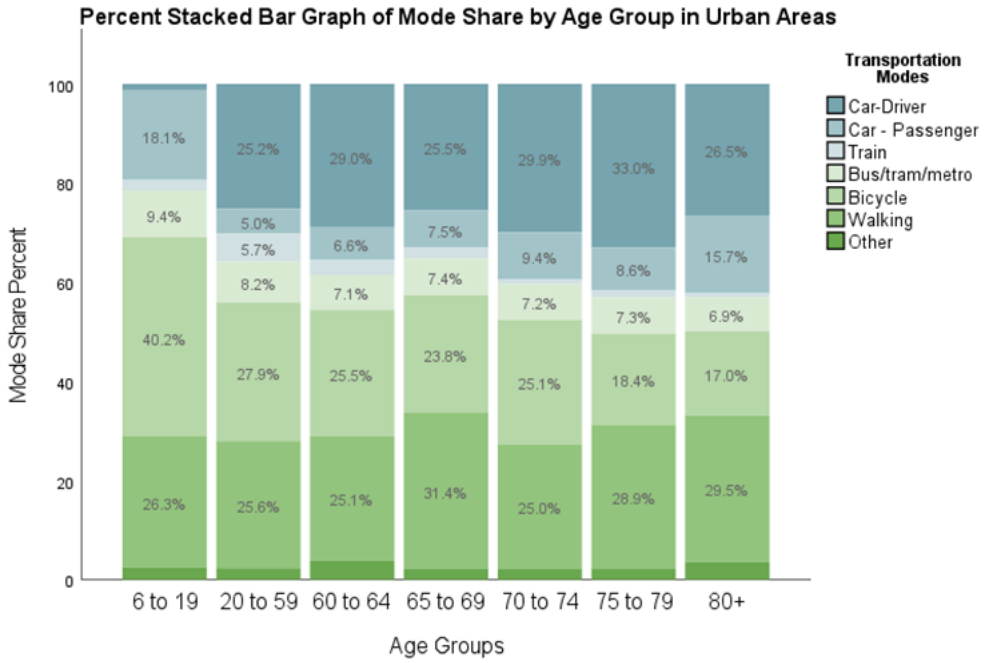

Figure 4: Transportation Mode Share by Age Group in Urban Areas

On the other hand, how frequent and how far different age groups are able to travel is another important point to understand the level of interaction and access to different destinations. Although the urban and rural areas do not differ much in terms of their trip frequency (ranges between four and two trips a day for both urban and rural), the travel distances show different patterns for age groups and geographical areas.

The travel distance rates shown in Figure 5 indicate a similar pattern to the car driving comparison in figures 3 & 4. Hence, rural areas have high levels of travel distance compared to urban areas for almost all the age groups except the oldest age group. However, in the urban areas travel distance gradually decreases from the working age group to the oldest age group. The reasons behind this might be closer essential services in the urban areas. Whereas the reason for the shortest travel distances in the oldest group can also be linked to decreasing pattern of car driving among the older age groups.

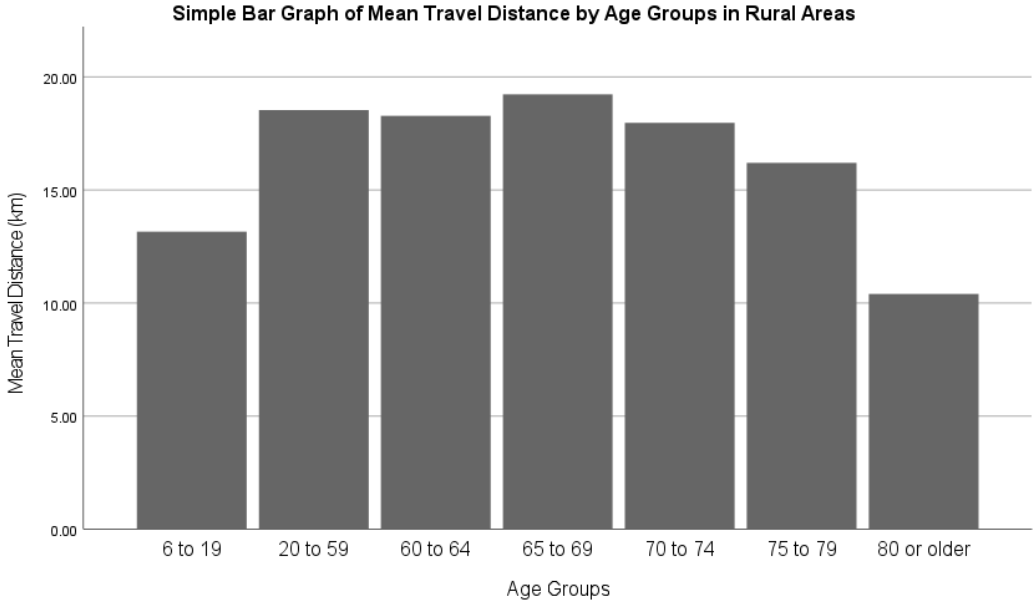

Figure 5: Average Travel Distance by Age Group in Rural Areas

Although the mean travel distance for the eldest age group is the same between rural and urban areas, the travel distance figures dropping gradually after working age show an inverse relationship by age only in urban areas. One of the main reasons behind this trend could be closer services in urban areas and not having to travel longer distances compared to rural areas. However, this could also be interpreted as the oldest age group in rural areas being more disadvantaged. Because this age group can not travel long distances. Yet, access to services usually requires travelling long distances in rural areas as can be observed from the longer travel distances of other age groups

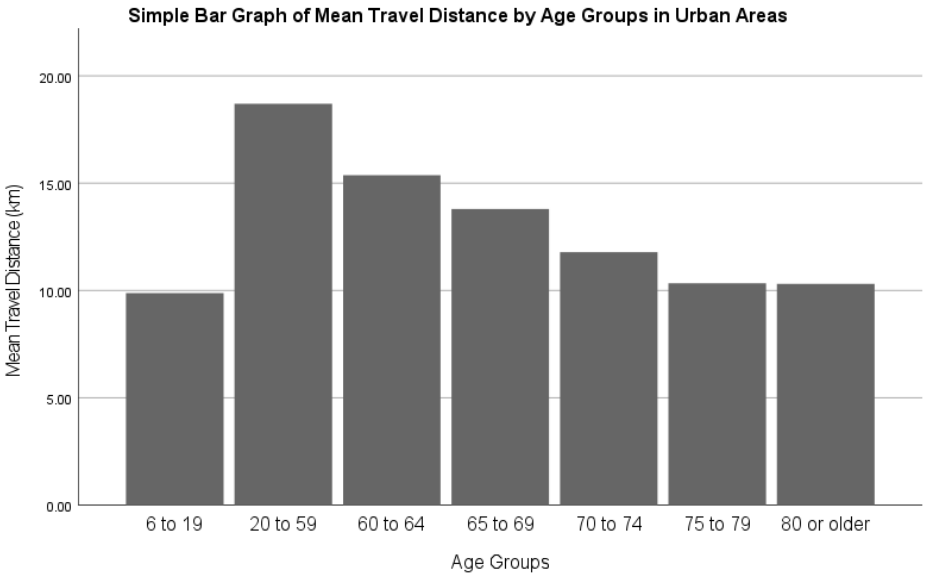

Figure 6: Average Travel Distance by Age Group in Urban Areas

The availability of a car is another possible reason for decreasing travel distances among the elderly. Also, the car has higher mode shares among the elderly compared to other age groups, especially in rural areas. Table 4 shows the distribution of car ownership in urban vs rural areas. It can be seen that rural areas have higher levels of car ownership for all age groups. However, in urban areas, there is clearly a higher car ownership difference between the working-age and elderly. This pattern can be explained as the lesser need for travelling long-distances for the working age group in urban areas due to closeby working opportunities. Whereas, after the working age the urban elderly might be keener on car ownership considering the increasing available time and money for them. For both urban and rural areas oldest-old group seem to have lower levels of car ownership compared to other elderly age groups which might be due to the decreasing ability to drive at this age. Since car constitutes the highest mode share for the elderly, especially in rural, this situation might point out higher levels of transportation disadvantage for the 80+ age group.

Table 4:Percentage of Car Ownership Status by Age Groups

	Car Ownership(%)					
	No Car		**1**		**2 or more**	
Age Groups	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
6 to 19	100	98	0	2	0.0	0.0
20 to 59	65	42	32	49	2.7	8.3
60 to 64	50	42	46	47	3.9	10.4
65 to 69	46	43	49	50	4.3	6.7
70 to 74	43	35	53	58	3.6	6.7
75 to 79	41	38	56	57	2.2	4.5
80 or older	55	44	44	55	1.4	1.4

Table 5:Percentage of Driving License Ownership by Age Groups

	Driving License Ownership Rates (%)	
Age Groups	**Urban**	**Rural**
6 to 19	9.4	12.4
20 to 59	81.1	94.5
60 to 64	85.2	96.2
65 to 69	84.5	92.9
70 to 74	87.6	94.1
75 to 79	73.1	87.7
80 +	57.4	67.9

In addition to owning a car, also owning a license is an important part of car availability. Therefore, license ownership has a significant effect on preventing dependency on others in the elderly age group. Although the ownership of a license increase until the age group of 70-74, after this point license ownership decrease as well as car ownership. This might explain the higher car-passenger rate as well as lower car ownership rates in both rural and urban areas, especially for people aged 80 and over. From the perspective of car and license ownership, the requirement of health check and renewal of license or capabilities looks like affecting the travel behaviours that change over age such as mode choice or travel distance.

Table 6:Rate of Trip Making by Age Groups

	Rate of Travel Made(%)	
	Urban	**Rural**
6-19	96.4	97.3
20-59	96.8	96.4
60-64	95.1	94.4
65-69	94.3	90.6
70-74	92.4	86.5
75-79	87.8	85.3
80+	78.2	76.1
Total	95.7	94.5

Table 6 shows the percentage of travel that has been made for each age group. In general, except for the youngest age groups, urban areas have a higher rate of trip-making. The reason behind this trend favouring urban areas might be due to the more available services and amenities within close distances. Because nearby services allow realizing a trip a day to desired services even for the people who can not use any other mode than walking In addition to this, the gap between urban and rural areas is higher for the age group of 65-69 and 70-74. These age groups are mainly retired having more time to travel but also under the age of health check requirement for a driving license. These situations might offer more opportunities for travelling to plenty of destinations available in urban areas on the contrary of rural areas where the number of opportunities that can be accessed is limited without having a car.

Tables 7 and 8 show the distributions of "reasons for not travelling" in urban areas and rural areas. The reasons that have the higher share are common in both areas such as "No outdoor activities" and "Another reason". Similarly, the reasons that have the lowest share are also common in urban and rural areas which are "Too Expensive Transport" and "no suitable transport". However, care for family members is a more common reason for not having a trip for people in rural areas than in urban areas for the elderly.

On the other hand, the "Physical limitations and/or disability" reason has a higher share in urban areas than in rural areas. However, this reason category is the highest for the 80+ age groups both in urban and rural areas. This is the second-highest reason for not travelling for 80+ age groups which might be a sign of a transport disadvantage for this age group.

Hence, age is also an important factor affecting the share of different reasons. For example, apart from the "Physical limitations and/or disability", the"Illness and/or injury" reason has a higher share for the elderly groups in both area types, while it's not a big concern for working and underage groups. Additionally, the "Weather conditions" becomes a more prominent reason for not taking a trip after the age of 70 in urban and rural areas. On the other hand, the "Stayed abroad" as a reason shows a sharp

decrease for the same age group. Also, expectedly, the "Work from home" and "Study at home" as a no trip reason plummets by age.

Table 7:Reasons for not Traveling by Age in Very Strongly Urban Areas

	Reason for Not Traveling (%)										
	Illness and/ or injury	Physical limit. and/or disability	Weather conditions	Work from Home	Study at home	Care for family members	No outdoor activities	Too Expensv Transp.	No suitable transp. available	Stayed abroad	Another reason
6-19	9.0	1.1	7.6	0.0	11.6	1.1	39.4	1.4	0.4	10.8	17.7
20-59	9.2	2.4	4.8	7.0	6.5	7.3	36.0	1.3	0.7	12.7	11.9
60-64	17.7	5.0	7.1	6.4	0.0	2.1	40.4	0.7	0.7	5.7	14.2
65-69	6.6	3.3	6.6	3.3	0.7	7.2	46.7	1.3	3.3	9.2	11.8
70-74	10.2	7.6	10.8	1.3	0.6	2.5	47.1	0.0	0.0	4.5	15.3
75-79	8.8	8.8	13.3	0.0	0.0	2.8	49.2	0.0	0.0	2.8	14.4
80+	9.3	24.9	8.9	0.0	0.4	1.8	38.2	0.4	0.0	1.8	14.2
Total	9.6	5.6	6.9	4.2	4.8	4.9	39.5	1.0	0.7	9.3	13.4

Table 8:Reasons for not Traveling by Age in Rural

	Reason for Not Traveling (%)									
	Illness and/ or injury	Physical limit. and/or disability	Weather conditions	Work from Home	Study at home	Care for family members	No outdoor activities	No suitable transport available	Stayed abroad	Another reason
6-19	4.8	0.0	6.5	0.0	14.5	0.0	41.9	0.0	14.5	17.7
20-59	6.3	2.3	3.2	14.0	2.3	8.1	35.1	0.9	9.0	18.9
60-64	17.0	6.4	4.3	6.4	0.0	2.1	44.7	0.0	6.4	12.8
65-69	4.5	4.5	6.1	1.5	0.0	1.5	48.5	0.0	12.1	21.2
70-74	6.1	6.1	16.7	1.5	0.0	4.5	36.4	0.0	7.6	21.2
75-79	10.1	5.8	10.1	2.9	0.0	4.3	46.4	0.0	0.0	20.3
80+	10.2	20.5	9.1	0.0	0.0	5.7	38.6	0.0	1.1	14.8
Total	9.6	8.6	9.2	2.5	0.0	3.6	42.9	0.0	5.4	18.1

All in all, it can be summarized from this part that rural areas in general experience higher levels of transport disadvantage for all ages compared to the areas with very strong urban characteristics. However, urban areas show more differences between the elderly and working-age groups indicating the possible transport-related exclusion of the elderly due to higher levels of transport disadvantage. Furthermore, urban elderly indicate higher levels of unmade trips due to transport availability reasons. Also, age is resulted as having a strong relationship with transport disadvantage. This relationship is especially strong for the 80+ age group due to its disadvantageous characteristics in all indicators. Even though these facts together state different types of transport disadvantages between urban and rural areas, further research is needed to link these disadvantages with TRSE. Therefore, because the 80+ age group indicates higher transport disadvantage compared to other age groups, to establish the connection of travel behaviour and social exclusion, a detailed analysis is needed for this group.

3.6. Travel Behavior Analysis among the 80+ Age Group

Among the different age groups, 80+ states more indications of transport disadvantage. However to better understand travel behaviour and its connection with social exclusion further detail is needed to avoid overgeneralizing this diverse population group. For this analysis again aforementioned indicators will be used with the help of explanatory variables which are income, gender, education, car ownership, migration status, and household composition. The analysis has been repeated over all the indicators for all the explanatory variables. However, based on these analyses two main reasons occurred causing to limiting these results to only gender and migration status as final explanatory variables. The first reason is that not enough relationship between the other explanatory variables and indicators is observed which could be interpreted as a transport disadvantage. The second reason is the disaggregation levels have caused not enough respondents in some categories especially the categories that have been observed as disadvantaged. The already low response rate in these groups (see Table 3) decreased to no or extremely low respondents when disaggregated for explanatory variables inside the 80 + age group. Therefore, only the results disaggregated for gender, car ownership and migration status categories will be presented and interpreted in this part of the study. These explanatory variables will be analysed using the earlier indicators which are respectively Trip Frequency, Travel Distance, Mode Share, Car and Driving License Ownership, and Reason for not travelling.

3.6.1. Trip Frequency

The below table shows the number of regular trips in a day for the 80+ age group for different segments of gender, car ownership and migration backgrounds in urban and rural areas. The figures show that the gender gap for regular trip-making exists in different geographical areas but this gap is even larger in rural areas. However, this difference is not that high in different geographical areas for the same gender such as women in urban areas and women in rural areas. Also, the more frequent trips such as more than four times a day are mainly made by men in comparison to women in rural areas. However, this is not the case for urban areas where the higher trip frequency (4+) rates for men and women are close.

Similarly, in the case of car ownership, people who do not have a car have much higher rates of having no trip than people who have at least one car. Expectedly, the rural non-car owners have even much higher shares of not having a trip than their urban counterparts. Also, the non-car owners most commonly take 2 trips a day whereas this frequency for car owners is 80+. Considering the degrading abilities of the elderly, the advantage of owning a car is apparent from these results.

Furthermore, migration status also shows a gap between different groups. Whereas the no-trip rate of Dutch people is 23% in urban and rural areas, this number is 39% for western immigrants in rural areas but 13% for urban non-westerners. Additionally, non-western immigrants in urban areas also have higher no-trip rates with 32%. However, for rural areas, no representation of non-western immigrants exists in the data therefore comparison is not possible. These gaps can be a result of the specific characteristics of these immigrant groups such as language barriers and cultural differences. On the other hand, western immigrants in urban areas are more active than their rural counterparts. Therefore, it could also be seen that type of spatial area also has an impact on the level of trip-making.

This table overall could tell that women, people with no car and immigrants are more at risk of transport disadvantage than other groups in terms of trip frequency. Because lower trip frequency levels might be an indication of less inclusion in society or access to social life, these groups should be further examined for TRSE. However, the indicators of travel distance, the purpose of their travel, and which mode they are excluded from also need to be analyzed for understanding more about the possible exclusion in these groups.

Table 9: Trip Frequency of 80+ Age Group

			Trip Frequency (%)										N
			No Trip	1	2	3	4	5	6	7	8	9	
Gender	Man	Rural	20	4	24	11	26	10	3	4	0	0	200
		Urban	20	7	29	16	18	8	2	0	0	2	532
	Woman	Rural	29	7	30	13	8	6	8	0	0	0	168
		Urban	24	5	31	8	18	4	7	0	3	0	500
Car Ownership	No Car	Rural	33	6	32	9	11	6	4	0	0	0	162
		Urban	26	6	34	8	13	8	3	0	2	0	566
	1	Rural	16	5	22	13	24	10	7	4	0	0	201
		Urban	16	5	24	17	24	3	6	0	2	2	452
	2 +	Rural	0	0	100	0	0	0	0	0	0	0	4
		Urban	21	0	29	21	29	0	0	0	0	0	14
Migration Status	Dutch	Rural	23	5	26	11	19	9	6	2	0	0	345
		Urban	23	5	30	12	18	6	4	0	2	0	866
	Western migration	Rural	39	4	43	13	0	0	0	0	0	0	23
		Urban	13	6	25	15	16	8	10	0	0	7	122
	Non-western migration	Rural	0	0	0	0	0	0	0	0	0	0	0
		Urban	32	11	32	7	18	0	0	0	0	0	44

3.6.2. Travel Distance

The travel distance figures might represent the population groups' activity space approximation, which might be interpreted as higher access to different types of activities and services (Kamruzzaman et al., 2016; Schönfelder, 2001; Schönfelder & Axhausen, 2003). Together with the frequency of visits, the higher levels of distance might indicate higher inclusion in the community. The travel distances are analyzed by the mean distance that is travelled and the rate of travel distance brackets to avoid the effect of outliers. Travel distance brackets are established based on median and mean walking distance, mean and maximum biking distances, maximum public transit distances, car distances, and extreme distances based on survey data.

Table 10 indicates that, in general, the 80+ age group most commonly travel distance in the range of 1 to 5 km for almost all groups. This table also shows women tend to travel shorter distances on average than men in both rural and urban areas in addition to their lower rate of trip frequency. Although the most (1-5 km) and least (100+km) travelled distance range is the same for different gender, the longest distances are mostly travelled by men and the shortest are travelled dominantly by women.

Table 10 also shows that the mean distance travelled is shorter for people with no car as expected. Although people who own two or more cars also travel shorter travel distances, this could be an outlier in this group due to the low number of respondents. Additionally, the shortest trips are more dominantly realized by non-car owners both in urban and rural areas. However, more urban non-car owners travel longer distances than rural ones. This difference probably is a result of the improved public transit systems in urban areas.

Surprisingly, non-western immigrants travel longer distances than their dutch and western counterparts in urban areas. Although this shows that they are able to travel longer distances, it is also possible that they have to travel long distances due to locational disadvantaged such as living in the urban fringe. However, the travel bracket distribution shows that most of these distances are over 100 km. Therefore, this result might also be an outlier in this low-represented group.

Overall, travel distances mainly indicate clear disadvantages for women and non-car owners in the 80+ age group. As an unanticipated result, no striking relation between the rurality of the area and travelled distance has been found despite the prevalent association of rural areas with long distance to services.

Table 10: Travel Distance of 80+ Age Group

			Travel Distance (km) (%)									N
			0.1-0.5	0.5-1	1-5	5-10	10-30	30-50	50-100	100+	Average	
Gender	Man	Rural	2	9	39	22	18	5	3	2	12	161
		Urban	4	6	44	19	17	4	4	2	11	428
	Woman	Rural	8	13	33	24	12	8	2	0	8	119
		Urban	11	12	42	15	13	3	3	1	9	379
Car Ownership	No Car	Rural	6	13	37	27	8	8	1	0	7	108
		Urban	10	10	46	12	17	2	2	1	9	418
	1	Rural	5	10	35	21	19	5	4	2	12	168
		Urban	5	8	41	23	13	4	5	2	12	378
	2 +	Rural	0	0	50	0	50	0	0	0	8	4
		Urban	0	36	0	0	64	0	0	0	7	11
Migration Status	Dutch	Rural	5	12	36	23	15	6	3	1	10	266
		Urban	7	9	44	16	16	4	3	1	10	671
	Western migration	Rural	0	0	43	21	29	7	0	0	10	14
		Urban	9	9	42	21	17	0	2	0	6	106
	Non-western migration	Rural	0	0	0	0	0	0	0	0	-	0
		Urban	3	17	30	23	7	0	7	13	23	30

3.6.3. Mode Share

In addition to possible signs of social exclusion from the analysis of travel distance and trip frequency, the modal split and mode availability can confirm whether exclusion from certain modes exists for disadvantaged groups. Therefore, how the mode share changes between different groups might show a problem experienced by a specific group towards the use of certain modes such as affordability, safety, or accessibility.

The mode share distribution in Table 11 shows that the 80+ age group mostly uses a car in total for their travels among all the modes. However, the male segment of this age group travels using the car mostly as a driver whereas their female counterparts prefer to use the car mostly as a passenger. Also, men tend to use public transport and train more than women do. On the other hand, in both rural and urban areas women use active modes (walking and biking) more than men do. Especially in rural areas women have a higher percentage of biking and walking than men. This could be due to problems women face using cars such as driving anxiety and health requirements for the license, or men face with biking or walking such as mobility restraints.

Table 11 also indicates that the mode share differs among the different statuses of car ownership. Although it might be expected that driving a car is the highest mode share for car owners, also non-car owners prefer using a car as a passenger as the most common travel mode. The non-car owners also still have a share of car use as a driver more than their public transit mode share in rural areas. This might highlight the importance of cars in these areas

Based on the migration background, the most common car drivers in this age group is people who have a Dutch background. Whereas the Dutch 80+ groups travel by driving a car in rural areas, the western

migrants still travel by car but as a passenger. Although the most common mode used is walking in urban areas, the second highest mode share is again car either as a driver or passenger. However, similar to rural areas, also in urban areas the Dutch travel by car as a driver as well as western migrants while non-western migrants travel by car more as a passenger.

Table 11:Mode Share of 80+ Age Group

			Transportation Modes (%)							N
			Car - Driver	Car - Passenger	Train	Public Transport*	Bike	Walking	Other	
Gender	**Man**	**Rural**	53	11	1	1	12	16	5	161
		Urban	34	9	1	8	20	25	3	428
	Woman	**Rural**	19	34	0	0	15	27	5	119
		Urban	18	24	1	5	13	34	4	379
Car Ownership	**No Car**	**Rural**	11	39	0	0	15	25	10	108
		Urban	7	26	1	9	16	36	6	418
	1	**Rural**	55	10	1	1	13	19	2	168
		Urban	47	5	1	5	18	23	1	378
	2 +	**Rural**	100	0	0	0	0	0	0	4
		Urban	54	0	0	0	27	18	0	11
Migration Status	**Dutch**	**Rural**	40	20	1	0	14	22	4	266
		Urban	27	15	1	8	18	29	3	671
	Western migration	**Rural**	14	43	0	14	0	0	29	14
		Urban	26	18	0	2	15	32	7	106
	Non-western migration	**Rural**	0	0	0	0	0	0	0	0
		Urban	13	23	3	10	10	33	7	30

*: Bus, Metro, and Tram

These different shares of car use between the areas and groups as a passenger or driver might be a result of different car ownership levels between these different groups. Table 12 shows the level of car ownership by gender and migration status groups to reassure these points that are made. In agreement with their mode share, fewer women own cars both in urban and rural areas than men do. Also, the rural man has higher shares of car ownership supporting their higher use of a car as a travel mode. Likewise, the migration groups who are more dependent on the other modes or cars as a passenger are related with the lower shares of owning a car. Among all these groups the non-western group shows more signs of disadvantage with their lowest level of car ownership and car share as a second most used travel mode.

Table 12: Car Ownership by Gender and Migration Status

			Car Ownership (%)			
			No Car	1	2	N
Gender	**Man**	**Rural**	21	77	3	200
		Urban	37	61	2	532
	Woman	**Rural**	71	29	0	168
		Urban	74	26	1	500
Migration Status	**Dutch**	**Rural**	43	56	1	345
		Urban	55	44	2	866
	Western migration	**Rural**	57	39	4	23
		Urban	48	51	1	122
	Non-western migration	**Rural**	0	0	0	0
		Urban	75	25	0	44

In terms of mode share, it is also important to analyze for which purposes and distances this age group rely on different modes. This analysis will help to understand more about the travel behaviour and patterns among the most disadvantageous age group.

3.6.3.1. Mode Share by Travel Distance

Table 13 illustrates the modes share by the distance travelled for the 80+ age group. For this age group, the car is one of the dominant mode choices in rural areas for distances longer than 500 meters and it is the most preferred travel mode from any distance longer than 1 km. Also, for distances longer than 50 km car is the only preferred mode for the 80+ age group. In the urban areas, public transport is considered an option mostly for distances longer than 1 km. On the contrary, in rural areas, this situation is really rare which might be due to the availability or quality of the services. Furthermore, the active modes are preferred mostly for the distance range of 1-5 km and especially biking is still an option up to 30-50 km distance range.

Table 13:Mode Share by Travel Distances

			Transportation Modes (%)							N
			Car - Driver	Car - Passenger	Train	Public Transport*	Bike	Walking	Other	
Travel distance in km	0.1-0.5	Rural	0	0	0	0	0	100	0	13
		Urban	0	0	0	2	7	91	0	58
	0.5-1	Rural	19	0	0	0	16	52	13	31
		Urban	5	3	0	0	18	74	0	73
	1-5	Rural	35	12	0	0	23	24	7	101
		Urban	25	15	0	6	24	25	5	349
	5-10	Rural	57	28	0	0	11	5	0	65
		Urban	40	18	0	9	12	15	6	138
	10-30	Rural	37	37	5	5	7	2	7	43
		Urban	34	23	1	11	11	16	4	125
	30-50	Rural	35	59	0	0	0	6	0	17
		Urban	44	8	8	4	24	12	0	25
	50-100	Rural	71	29	0	0	0	0	0	7
		Urban	44	33	7	15	0	0	0	27
	100+	Rural	100	0	0	0	0	0	0	3
		Urban	25	50	8	17	0	0	0	12

Table 14 shows that for the majority of travel purposes car is the most used travel mode and the rural areas have a higher car share for all purposes other than travelling for social recreation or having a tour. Also, both geographical areas preferred to be driven rather than driving the car while travelling for Services and Personal Care. However, while rural areas travel to and from work only by car urban areas have other options. The reason behind these patterns might be the distances they travel for these specific purposes. Therefore, the most common travel distance for each purpose also needs to be analyzed to indicate whether it is the preference or spatial conditions of certain areas causing higher car dependence in rural areas.

Table 14:Mode Share by Travel Purposes

			Transportation Mode Share (%)							N
			Car - Driver	Car - Passenger	Train	Public Transport*	Bike	Walking	Other	
Travel Purposes	From and to work	Rural	82.4	11.8	0.0	0.0	0.0	0.0	5.9	17
		Urban	41.9	0.0	0.0	9.7	32.3	12.9	3.2	31
	Business and professional	Rural	0.0	0.0	0.0	0.0	0.0	0.0	100.0	2
		Urban	0.0	0.0	0.0	100.0	0.0	0.0	0.0	2
	Services / Personal care	Rural	15.2	48.5	0.0	0.0	15.2	9.1	12.1	33
		Urban	24.6	23.1	0.0	10.8	9.2	24.6	7.7	65
	Shopping / Grocery Shopping	Rural	49.5	16.1	0.0	0.0	17.2	17.2	0.0	93
		Urban	25.1	10.2	0.0	5.4	19.3	35.9	4.1	295
	Education / Following a Course	Rural	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
		Urban	0.0	0.0	0.0	0.0	0.0	100.0	0.0	2
	Visit / Staying over	Rural	46.9	31.3	0.0	0.0	0.0	15.6	6.3	32
		Urban	27.0	42.0	1.0	5.0	7.0	14.0	4.0	100
	Social, recreational, other	Rural	24.6	15.8	3.5	3.5	12.3	31.6	8.8	57
		Urban	27.1	20.6	2.6	9.7	14.8	24.5	0.6	155
	Touring / Walk	Rural	4.2	4.2	0.0	0.0	37.5	54.2	0.0	24
		Urban	7.1	4.8	1.2	4.8	26.2	53.6	2.4	84
	Another Purpose	Rural	59.1	22.7	0.0	0.0	4.5	13.6	0.0	22
		Urban	49.3	5.5	0.0	5.5	16.4	17.8	5.5	73

3.6.3.2. Travel Distances by Different Travel Purposes

Table 15 shows that for almost every purpose in both geographical areas most travelled distances are in the range of 1-30 km. In addition to this, except than the purpose of touring/walk, the rural areas higher share of travels with a distance over 5 km. Whereas the travels in urban areas held more for the distances under the 5 km compared to rural areas. For example, for the trips from and to work rural areas most commonly travelled distance range is 5-10 km, whereas in urban areas this range is 1-5 km including some occurrence for under 1km distance. Considering the facts stated in Table 14, it could be said that the reason behind high car use for work travel might be this higher travel distance ranges. Therefore, it is understandable that rural areas have higher shares of car use (see Table 11) and a higher percentage of car ownership (see Table 3). This could be due to the provision of transport services or capabilities of these people which can not be explained with the available data.

Table 15:Travel Distances for Different Travel Purposes

			Travel Distance (km) (%)								N
			0.1-0.5	0.5-1	1-5	5-10	10-30	30-50	50-100	100+	
Travel Purposes	From and to work	Rural	0.0	0.0	35.3	47.1	17.6	0.0	0.0	0.0	17
		Urban	6.5	3.2	41.9	19.4	12.9	3.2	12.9	0.0	31
	Business and professional	Rural	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	2
		Urban	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	2
	Services / Personal care	Rural	0.0	9.1	39.4	30.3	3.0	18.2	0.0	0.0	33
		Urban	13.8	7.7	43.1	21.5	7.7	0.0	3.1	3.1	65
	Shopping / Grocery Shopping	Rural	5.4	14.0	39.8	26.9	11.8	2.2	0.0	0.0	93
		Urban	8.8	14.2	52.9	12.2	11.9	0.0	0.0	0.0	295
	Education / Following a Course	Rural	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
		Urban	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
	Visit / Staying over	Rural	0.0	12.5	25.0	6.3	21.9	12.5	15.6	6.3	32
		Urban	0.0	6.0	30.0	28.0	16.0	8.0	8.0	4.0	100
	Social recreational other	Rural	14.0	15.8	33.3	8.8	28.1	0.0	0.0	0.0	57
		Urban	6.5	5.8	40.0	11.6	21.3	7.1	7.1	0.6	155
	Touring / Walk	Rural	0.0	0.0	50.0	29.2	12.5	4.2	4.2	0.0	24
		Urban	1.2	6.0	33.3	23.8	25.0	6.0	0.0	4.8	84
	Another Purpose	Rural	0.0	9.1	22.7	36.4	4.5	18.2	4.5	4.5	22
		Urban	11.0	6.8	43.8	19.2	15.1	0.0	2.7	1.4	73
	N	Rural	13	31	101	65	43	17	7	3	---
		Urban	58	73	349	138	125	25	27	12	---

3.6.4. Reason for Not Traveling

It is important to see why different segments in the 80+ age groups do not or can not travel in the urban and rural areas to have a better understanding of the lack of participation in this age group with its reasons. Table 16 shows that the main reasons for not traveling among all different groups are common which are having no activities out of the house and "Physical limitations or disabilities". Furthermore, none of the groups show the availability of transport or work from home as their reason for not traveling. Considering the retirement age no apperance of the work from home as a reason might be expected. However, for availability of transport there can be severeal reasons such as high availability of car,bike and public transit or availability of someone to give a ride. Also, the cost of the travel is not a reason for not traveling for most groups.

Women show weather conditions as a reason for not traveling more than men do. Also, women in urban areas do not travel due to their physical limitations or disabilities more than women in rural areas and men in general. The people in rural areas indicate care for their family members as a reason more than urban residents show this as a reason, especially women.

Overall, Table 15 indicates the same pattern also for car ownership such as having no activity and physical limitations as the main reasons. However, the share of not travelling due to physical limitations is higher for people who do not have a car than any other group. This might be due to the convenience of a car for this group of people might be offering an advantage over people with disability and no car available.

The comparison based on migration background indicates that western and non-western immigrant groups are more disadvantaged than people with a Dutch background. This could be observed from the high shares of the reasons "Physical limitations and disability" and "Illness and injury" for not travelling in the immigrant groups.

Table 16:Reasons for not Traveling by 80+ Age Groups

			Reason for Not Traveling (%)								
			Illness and/or injury	Physical limit. and/or disability	Weather conditions	Study at home	Care for family members	No activities outside	Too Expensive Transport	Stayed abroad	Another reason
Gender	Man	R	5	21	8	0	8	41	0	3	15
		U	12	20	7	1	3	44	1	3	10
	Woman	R	14	20	10	0	4	37	0	0	14
		U	7	29	11	0	1	33	0	1	18
Car Own.	No Car	R	3	31	6	0	6	28	0	0	25
		U	8	31	11	1	1	33	0	1	15
	1	R	15	14	10	0	6	44	0	2	10
		U	9	20	5	0	3	44	1	2	15
	2 +	R	0	25	25	0	0	50	0	0	0
		U	25	8	17	0	0	42	0	8	0
Migration Status	Dutch	R	9	20	9	0	5	41	0	1	15
		U	9	23	9	1	2	39	1	2	15
	Western	R	22	22	11	0	11	22	0	0	11
		U	13	38	6	0	0	25	0	0	19
	Non-western	R	0	0	0	0	0	0	0	0	0
		U	14	36	7	0	0	36	0	7	0

All in all, women, people with no car, and immigrants are the most disadvantageous groups in general. Based on these results it is possible to say the availability of different activities and physical limitations as the reason behind unrealized trips. These reasons can be considered as one of the main barriers to social inclusion among the most transport disadvantageous groups. However, it is not possible to see the reason why one mode is chosen over the other or which travel purposes could not be realized to further understand the transport-related problems faced by these groups.

3.7. Discussion

The transport disadvantaged groups and areas were investigated from two different perspectives. The first is by understanding the disparity between different age groups in terms of their travel characteristics. The second is by understanding the disparity between different population groups in the transport disadvantaged age group.

The first part indicates that the elderly especially the 80+ age group show transport disadvantage characteristics more than any other age group based on the selected indicators. Apart from this, this part also points out different disparities of vulnerable groups in rural and urban areas separately. For example, rural areas have more dependency on cars as a travel mode and own more cars than the urban elderly do.

In addition to this rural areas have higher rates of not having a trip than urban areas and the gap between the elderly and working-age group for no trip is higher than in urban areas. On the other hand, urban areas have a higher disparity in terms of the travel distance between the working-age and elderly. Also, despite cars being the dominant travel mode, car and license ownership rates are lower in urban areas. Another, disadvantage signal of urban areas is that having a physical limitation is a more common reason for not having a trip than in rural areas. Therefore, in the first part both rural and urban areas show the disparity between the working age and the elderly for different travel characteristics. Although this finding conflicts with the study of van den Berg et al. (2011), their study was mainly based on social trip rates of the elderly which results in having similar rates with other age groups. In this study, the findings are based on all trip purposes to be able to understand the exclusion from any possible desired destination.

The second part analyzes the travel behaviour of the most disadvantaged age group which are the people who are 80 years or older. This age group again has different disparity levels in rural and urban areas between gender and income categories. However, especially the gap between women's and men's travel characteristics show a higher disparity in rural areas. For example, rural women in this age group travel less frequently and less far than men and these gaps are higher than the gap between urban women and men. Also, like men women prefer the car as the main travel mode yet they usually travel by car as a passenger which indicates their dependency on others. Although the distances and modes differ by travel purposes, for most common travel purposes (Grocery Shopping, Services, Visit) rural areas usually travel longer distances and prefer the car as a mode of transport. However again in this part, urban women show disability as a reason for not travelling more than any other group. In addition to this, people with no car indicate physical limitations as a reason for not travelling more than people with cars.

Finally, car ownership and migration status also have a relationship with the transport disadvantage. The non-car owners and migrants especially the non-western migrants resulted in having higher shares of not having a trip and travelling mostly by car as a passenger as well as not being able to travel due to the physical limitations and illnesses more than other groups. Additionally, considering the higher levels of transport disadvantage in rural areas, having no non-western migrant respondents in rural areas underscores the need for further research.

Based on these results, only a limited part of TRSE dimensions can be inferred. The main dimensions of exclusion that might be existent in the areas based on these results are "Physical Exclusion", "Geographical Exclusion" and "Exclusion from Facilities". The geographical exclusion can only be derived for main area types based on these results. The fact that rural areas show less trip-making rates, have higher rates of car dependency and travel longer distances for different travel purposes might indicate that the rural areas are more vulnerable to experiencing *geographical exclusion* than urban areas. Secondly, a slight recognition of *exclusion from facilities* is possible, especially for non-car owners. Because in rural areas the travel purposes seem to require longer trips, people who don't own a car can experience exclusion from these facilities. Finally, *physical exclusion* can be interpreted based on the different groups' reasons for not travelling. The disadvantaged groups which are women, non-car owners and immigrants, resulted in a high share of not being able to travel due to the illness/injury and disabilities they experience. This situation might point out that these people can not travel or use the modes for travelling due to physical barriers they experience on a vehicle or while on the road. Therefore, the existence of physical exclusion can be argued among disadvantaged groups.

Overall, the rural areas signal more transport disadvantages for the elderly than urban areas do especially for underprivileged groups which are women, immigrants, and non-car owners as well as the 80+ age group. However, the representation is lower for the elderly, especially for people in rural areas. Even

though rural areas indicate more transport disadvantages apart from this instance, more investigation is needed to understand the level of transport disadvantages for different travel purposes and modes. It shouldn't be forgotten that the "no trip" rate is much higher for disadvantaged groups and only some of the barriers can be explained by this survey. The reason behind not travelling is explained with 11 categories where another reason is one of the highest categories among them. Thus, a more in-detail investigation is needed especially among these population groups to better understand what kind of barriers they experience for travel, the reasoning behind their experiences and how these barriers, reasons or factors relate to their social exclusion.

4. IDENTIFYING THE PROBLEM AREAS

Based on the findings from chapter 3, the spatial distribution of the transport disadvantage is going to be discussed in this chapter. By doing this, it is aimed to see whether or not there are areas with spatial clusters of high transport disadvantage in the Netherlands. This step will help to point out the problem area to conduct further parts of the research.

This spatial distribution has been made based on an index created by 7 indicators relating to disadvantages detected in the earlier chapter. These indicators are namely: Mean Travel Distance, Median Trip Frequency, Share of Car Ownership in the Area, Share of not having a Driving License, Share of Car Mode as a Passenger, Share of not Having a Trip, Share of People who don't travel due to disadvantages (Illness/Injury, Physical Limitations, Care or Family, No Transport Options, Expensive Transport, Weather Conditions). The index has been calculated by using an equal weight after normalizing the values by using the min-max formula: $x' = \frac{x-min}{max-min}$. Finally, an index in the range of 0 to 1 has resulted indicating a higher transport disadvantage for higher values.

For these calculations, different spatial units have been used for aggregation. The main reason behind this is to see the overall patterns across the country with larger units and observe more accurate results and variations with the smaller units. The analyses are conducted for all population groups and the elderly by each spatial unit which are Postcode 4 Zones, Municipalities, and COROP Regions (EU NUTS3 Regions).

Table 17 shows the descriptive analysis of the selected indicators for Postcode 4 unit distribution of the data. The other units also indicate similar values, especially for the standard deviation. The Trip Frequency indicator has a low standard deviation and explains less about the variation in the data. Thus the calculations will also be held without the effect of this indicator since it doesn't explain much about the differences in the data.

Table 17: Descriptive Analysis of the Indicators (Postcode 4 Aggregated)

	Min.	Max.	Mean	Std. Deviation
Share of Car Mode as Passenger (%)	0	100	11.06	14.18
Share of No Car (%)	0	100	10.62	16.70
Share of No Driving License (%)	0	100	24.00	22.22
Share of No Trip (%)	0	100	7.18	15.27
Share of Disadvantageous Reasons (%)	0	100	1.73	6.56
Travel Distance (km)	0	212	16.98	14.53
Trip Frequency (N)	0	17	3.63	1.37

4.1. Transport Disadvantage by Postcode 4 Zones

Figure 7 and Figure 8 show the spatial distribution of the index for all age groups and the elderly. The categories on the maps are based on the natural breaks in data. The motivation behind this choice is the uneven distribution of data could be best represented using the grouping of similar values together which

is achieved by applying natural breaks. For being able to make a comparison between elderly and all groups the same data categories of elderly also applied to all age maps
As can be seen, the used data (The Dutch National Travel Survey, ODIN 2019) have high rates of no respondent areas, especially for the elderly groups. These areas are usually located in the northern part of the country which already has less population than the other parts of the country.

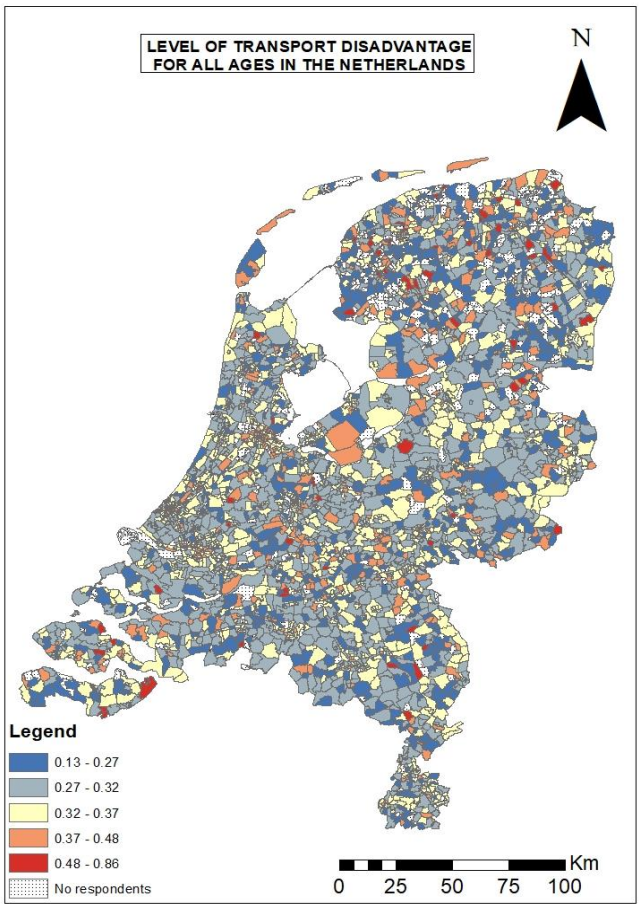

Figure 7: Map of Transport Disadvantage for All Age Groups by Postcode4 Units in the Netherlands

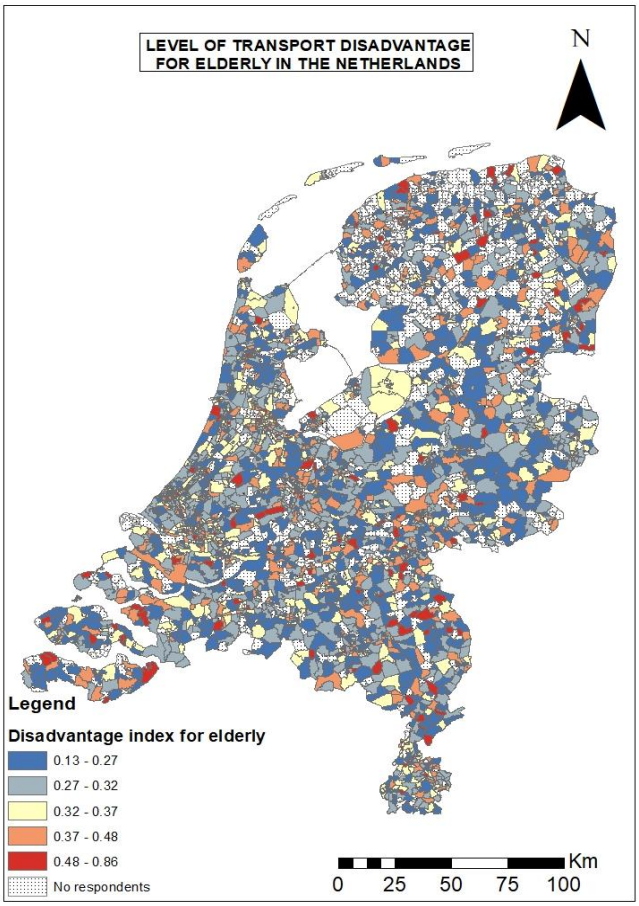

Figure 8: Map of Transport Disadvantage for Elderly by Postcode4 Units in the Netherlands

The transport disadvantage index shows high dispersion all over the country, especially for the highest values. Although for all age groups the northern part relatively has higher values, for the elderly these values can also be seen as spread over other parts of the country. The highly transport disadvantaged areas are mainly neighbouring the areas with low transport disadvantage level. To exemplify, between these neighbouring areas in Rotterdam the travel distance and trip frequency levels are similar to each other. However, the high areas have lower rates of driving license, car ownership, and trip rates causing higher transport disadvantage levels. Hence, the analysis at this spatial unit level indicates a great variation for every area and it does not point out any overall patterns for transport disadvantages.

4.2. Transport Disadvantage by Municipalities

The maps in Figure 9 and Figure 10 show higher levels of transport disadvantage in the elderly than other ages for most of the municipalities. Whereas the higher disadvantage can be observed especially in the northern part for all age groups, for the elderly also the southwestern municipalities indicate high transport disadvantage. Even though not as clustered as the northern and western areas, eastern areas also have municipalities with high transport disadvantage levels. The index is also calculated without the

effect of the trip frequency indicator inflating the results (See Annex A.). However, the rank of the highest elderly transport disadvantage municipalities does not change drastically.

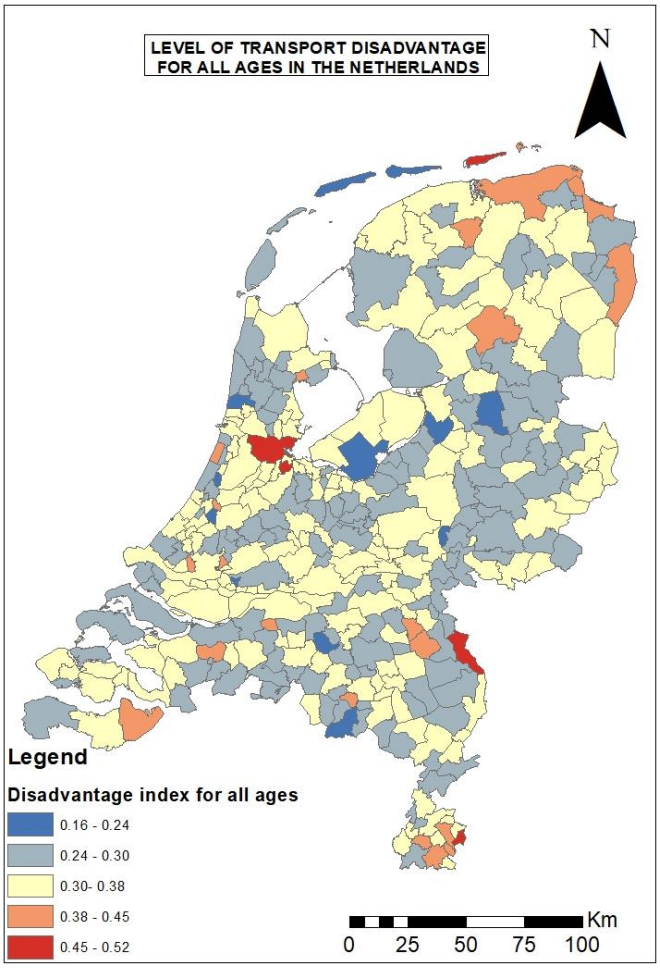

Figure 9: Map of Transport Disadvantage for All Age Groups by the Municipalities in the Netherlands

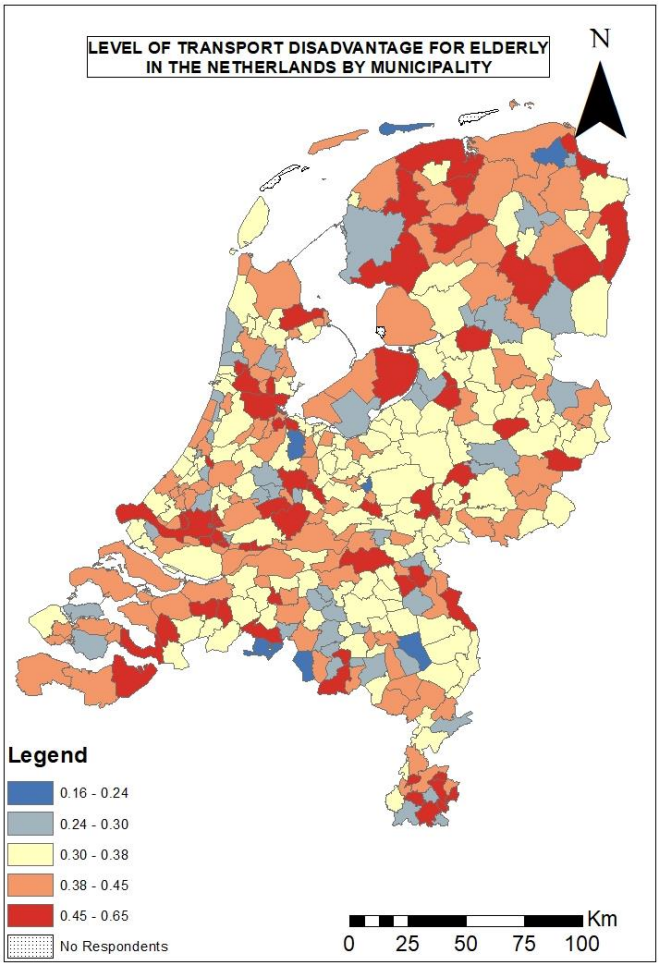

Figure 10: Map of Transport Disadvantage for Elderly by the Municipalities in the Netherlands

As can be seen from Table 18, the areas with the highest values for elderly transport disadvantage mainly resulted from the travel distance and trip frequency indicators. In these areas elderly mainly less frequently and prefer to have shorter trips. This pattern can also be observed in general for all age groups however elderly transport disadvantage scores are higher than all age groups. Furthermore, the most disadvantaged areas for the elderly score higher for the indicators of not having a license or car and especially having no trip. On the other hand, the disadvantageous areas for all ages are characterized by higher values for using a car as a passenger and having no trip due to disadvantageous reasons. Overall, having no trip or shorter and less frequent trips is more common for elderly transport disadvantage. However, it is more prevalent for all age groups to have disadvantageous reasons for not travelling as defined in this dataset even though no trip rates are lower.

Table 18: Municipalities with the highest elderly transport disadvantage rates and their standardized indicators

Name	Travel Distance	Trip Frequency	Car Use Passenger	No Car	No Driving License	Having No Trip	Reasons for No Trip	Transport Disadvantage Index(elderly)
Hattem	0.96	0.50	0.54	0.38	0.69	0.58	0.93	0.65
Leiderdorp	0.82	1.00	0.13	0.65	0.75	0.49	0.66	0.64
Heerde	0.81	1.00	0.39	0.00	0.21	1.00	1.00	0.63
Rhenen	0.72	1.00	0.41	0.48	0.62	0.83	0.21	0.61
Delfzijl	0.67	1.00	0.00	0.36	0.39	0.92	0.92	0.61
Haaksbergen	0.38	1.00	0.00	0.45	1.00	0.88	0.39	0.59
Etten-Leur	0.73	1.00	0.37	0.20	0.62	0.60	0.43	0.56
Kerkrade	0.78	0.75	0.31	0.39	0.73	0.39	0.53	0.55
Bunnik	0.96	0.50	0.35	0.53	0.91	0.27	0.36	0.55
Bergeijk	0.92	1.00	0.76	0.42	0.55	0.22	0.00	0.55

4.3. Transport Disadvantage by COROP Regions

The largest unit maps underline the pattern found in the municipality level analysis. As can be observed from the earlier analyses in different units, also in this unit the northern regions show higher transport disadvantage levels for both the elderly and other ages. In addition, Figure 11 and Figure 12 show the higher values in southwestern areas as well as western areas, especially for the elderly.

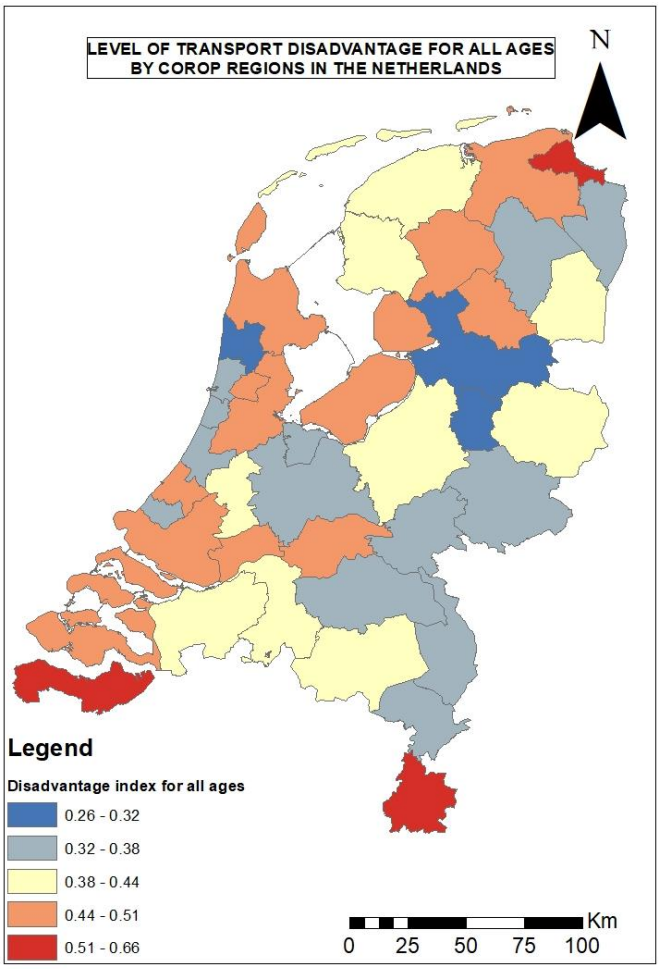

Figure 11: Map of Transport Disadvantage for All Age Groups by COROP Regions in the Netherlands

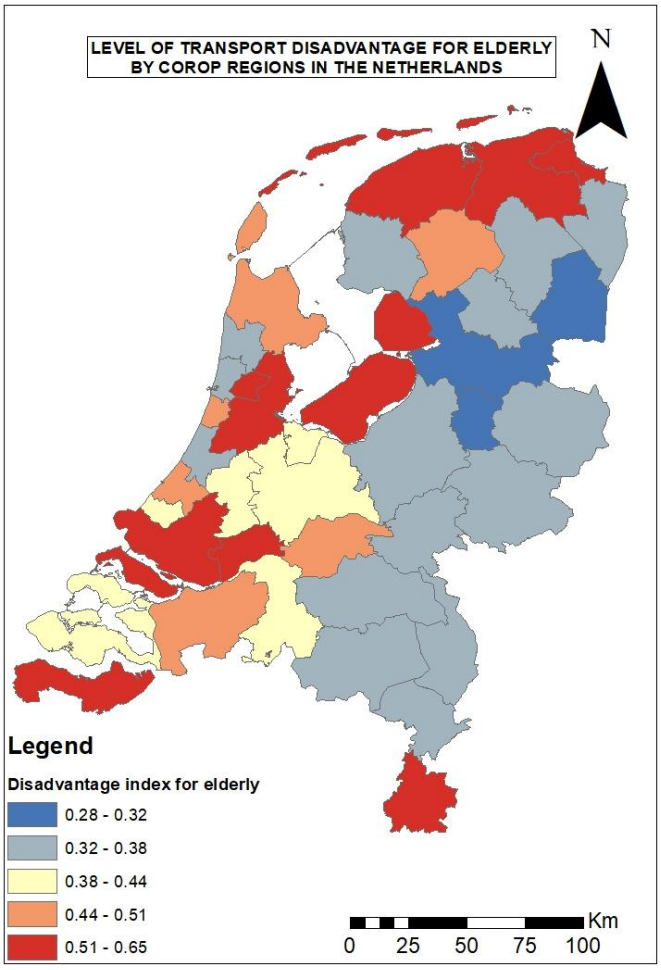

Figure 12:Map of Transport Disadvantage for Elderly by COROP Regions in the Netherlands

This analysis is also repeated without considering the effect of Trip Frequency indicator. The results from this analysis expectedly show lower ranks for the most northern region where the index value was higher due to trip frequency. In addition to this also, the difference between the index value of the elderly and all age groups is calculated. The result of this calculation might show in which areas specifically the elderly experience transport disadvantage (see Annex B). Again this calculation also ranked lower in the most northern and the most south-western area. This situation is because all age groups are almost equally or even more disadvantageous than the elderly in these areas. On the other hand, the western regions are in majority in the highest ranks in terms of the gap and the elderly index value.

Table 19 shows the detailed distribution of the Transport Disadvantage Index (TDI) over different indicators. Overall, the highest values are derived from the Travel Distance indicating shorter travel distances in these areas and high car use as a passenger. The western regions, comprising the highest values, have similar patterns with low ownership rates of car and driving licenses as well as shorter travel distances and high car use as a passenger. Although this pattern might be due to the close-by services in these urbanized areas, the high share of car use as a passenger and short travel distances might sign problems related to transport disadvantage.

Table 19:Corop Regions with the highest elderly transport disadvantage rates and their standardized indicators

Name	Travel Distance	Trip Frequency	Car Use Passenger	No Car	No Driving License	Having No Trip	Reasons for No Trip	Elderly TDI
Zaanstreek	0.68	0.50	0.71	0.72	1.00	0.50	0.48	0.65
Delfzijl en omgeving	0.74	1.00	0.00	0.27	0.54	1.00	1.00	0.65
Zeeuwsch-Vlaanderen	0.79	0.50	1.00	0.47	0.52	0.60	0.44	0.62
Groot-Rijnmond	0.82	0.50	0.68	0.80	0.79	0.36	0.35	0.61
Groot-Amsterdam	0.73	0.50	0.57	1.00	0.89	0.21	0.29	0.60
Zuid-Limburg	0.91	0.50	0.79	0.41	0.48	0.35	0.45	0.56
Flevoland	0.60	0.50	0.61	0.33	0.35	0.75	0.66	0.54
Noord-Friesland	0.00	0.50	0.83	0.72	0.55	0.58	0.51	0.53
Overig Groningen	0.49	0.50	0.55	0.58	0.34	0.61	0.62	0.53
Zuidoost-Zuid-Holland	0.58	0.50	0.67	0.46	0.55	0.46	0.43	0.52

4.4. Problem Areas

The analysis has shown that geographical differences do not matter in the smallest unit analysis because variation exists almost all over the country in terms of transport disadvantage. However, larger unit analyses indicate more clustering in terms of the level of disadvantage. On the municipality-level analysis, most of the municipalities with the highest transport disadvantage values have only moderate or little urban characteristics based on the ODIN categorization. On the other hand, COROP Region analysis points out the regions with the most urban municipalities such as Groot-Rijnmond and Groot Amsterdam. Therefore, based on the municipality analysis Haaksbergen has been chosen as a rural problem area due to having the 6th highest elderly TDI value. For comparison purposes, Rotterdam is chosen as an urban problem area due to having one of the highest values for TDI and the largest TDI gap between all ages and elderly based on COROP regions analysis.

4.4.1. Haaksbergen

Haaksbergen is located in the Twente region in the eastern part of the Netherlands. The municipality has a population of 24,229(CBS, 2019). Figure 13 shows how the municipality's rate of vulnerable population distribution is compared to the country's population distribution. Although in terms of most of the vulnerable group in Haaksbergen has a lower rate than the country average, the 80+ age group has a slightly higher density in the municipality than in the country.

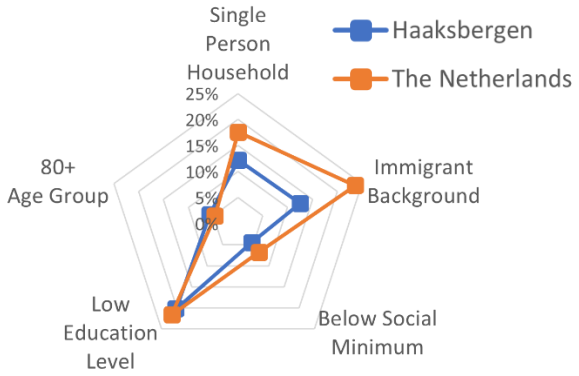

Figure 13:Population Profile of Haaksbergen Compared to the Netherlands(CBS, 2019)

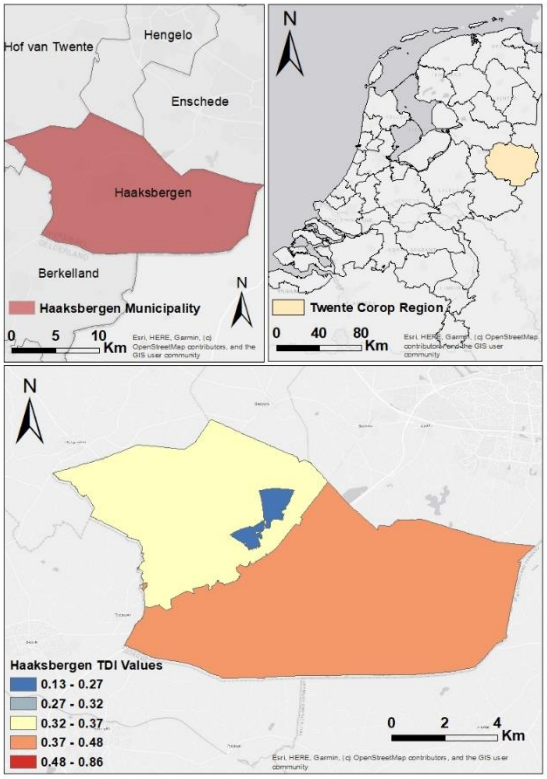

Figure 14:The Location and TDI Distribution of Haaksbergen

Haaksbergen has the sixth highest transport disadvantage among all the Dutch municipalities. The surrounding municipalities and the overall Twente region are ranked lower pointing out the need for further analysis. The overall transport disadvantage composition of the Haaksbergen is different from the other highly transport disadvantaged areas with higher distanced but less frequent travel characteristic. As it can be seen from Figure 13, Haaksbergen's elderly transport disadvantage is also characterized by lower trip rates and low driving license ownership rates. On the contrary, the share of not owning a car, car use as a passenger, and rate of having disadvantageous reasons of not traveling are low. The postcode 4 level analysis, detailed in Figure 10, shows that the higher disadvantage area in the municipality is mainly characterized by lower trip rates and low rates of car and driving license ownership.

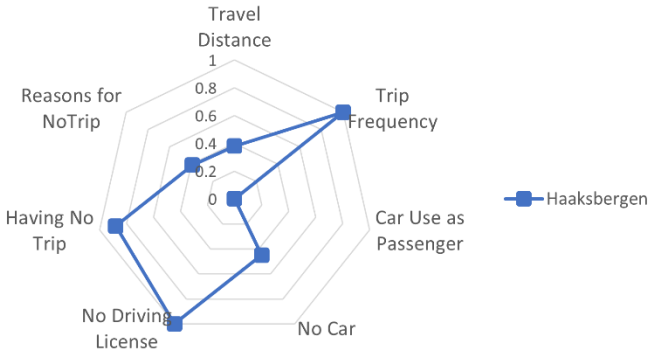

Figure 15: Haaksbergen Elderly Transport Disadvantage Profile

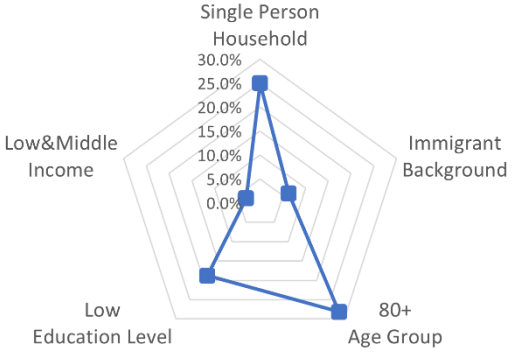

Figure 16: Haaksbergen Elderly Population Profile (ODIN)

4.4.2. Rotterdam

Groot Rijnmond region is located in the southwestern part of the Netherlands as shown in Figure 18. The total population of this region is 1,441,452 of which 644,618 of this population belong to the Municipality of Rotterdam. Figure 17 shows the composition of this population compared to the total population of the Netherland. This figure indicates a higher share of immigrants and single person households in Rotterdam than country average.

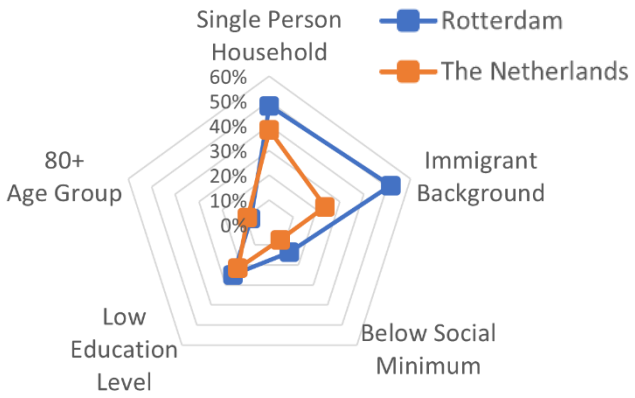

Figure 17:Population profile of Rotterdam compared to the Netherlands(CBS, 2019)

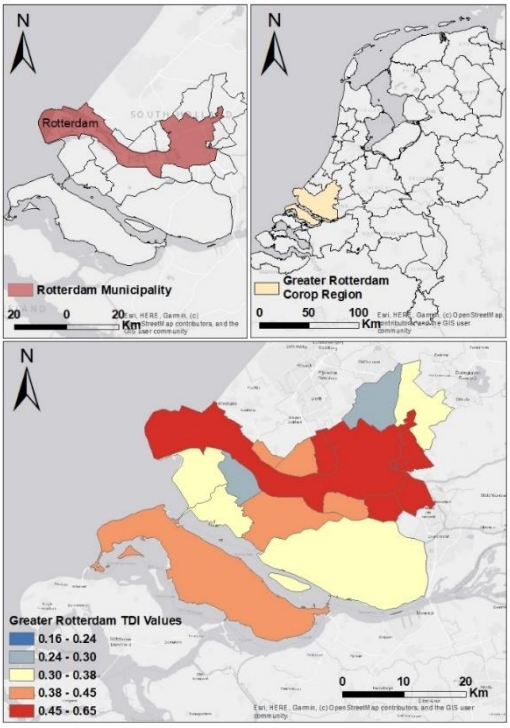

Figure 18:Rotterdam Elderly Population Profile (ODIN)

Groot Rijnmond ranks the fourth highest elderly TDI among the COROP regions of the Netherlands. Although there are regions with higher rankings, this region has a high rank also in terms of the TDI gap (see Appendix B). Additionally, even though the Zaanstreek region has higher ranks in all categories, Groot Rijnmond has more urban characteristics making the region more suitable for comparison. Figure 19 shows that TDI in the region is characterized by shorter travel distances and higher rates of car use as a passenger besides the lower rates of having a car and license. Similar to composition in the general population, the composition of data also includes higher shares of the immigrant group and people living alone. Although the shorter travel distances can be explained by closer services in urban areas, the high share of car use as well as lower rates of car ownership depicts a dependency and thereby exclusion risk.

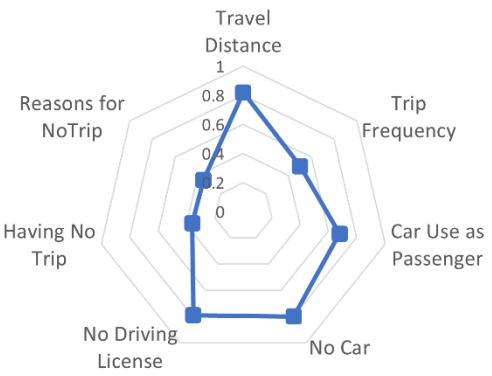

Figure 19:Rotterdam Elderly Transport Disadvantage Profile

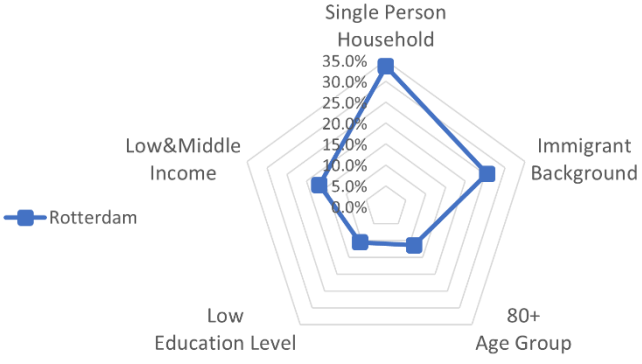

Figure 20:Rotterdam Elderly Population Profile (ODIN)

5. UNDERSTANDING THE EXCLUSION PROCESS USING QUALITATIVE ANALYSIS

5.1. Introduction

Earlier, chapter 3 of this study has given an overall picture of transport disadvantages in the Netherlands. The quantitative method employed helped to create an objective assessment of transport disadvantages in a wider context. However, the quantitative GIS analysis often lacks detailed information on physical environments and conditions as well as the social landscape (Dodson et al., 2006). Although travel behaviour analysis gives a valuable understanding of the relations between background data and travels, it cannot explain causal mechanisms (Røe, 2000). The quantitative methods based on supply/demand often cannot incorporate the subtleties and complexities affecting individual travels as well as the travels that are not undertaken (Hine & Mitchell, 2001b).

Contrary to what the quantitative analysis offer, transport disadvantage, and social exclusion include dynamics of actions and relations rather than a fixed state of being socially excluded or not (Schwanen et al., 2015). Consequently, individual experiences are important as they offer insights over transport exclusion or disadvantage over many levels (Hine & Mitchell, 2001b). Therefore, a qualitative method is needed to complement quantitative analysis to better understand the TRSE process. Thus in this chapter qualitative analysis will be held aiming to understand the individual experiences and causalities of transport-related social exclusion in selected problem areas.

Different qualitative techniques have been employed in various studies to understand transport-related social exclusion in different contexts (Hine & Mitchell, 2001a; Hurni A., 2006; Lucas et al., 2001; Shergold & Parkhurst, 2012). These techniques include interviews, focus groups, or travel diaries. In this study, the interview method has been used for data collection because the study is focused on individual experiences of different elderly rather than the experience of the elderly as a group. The reason behind this emphasis on individual experiences is because the experiences will reveal how and which individual circumstances affect the level of participation as well as explaining the causalities in the TRSE process. To illustrate, an aggregated quantitative analysis might show a correlation between a factor and lack of participation but it can not claim that the reason for this lacking is these factors. Whereas the individual experience provides a chance for individuals from different groups to explain their reasons in relation to different factors. Additionally, the real experiences will show how the individuals perceive their travel which in the end what matters when deciding on whether to participate or not.

5.2. Interview Design

The interview method aims to gain insight into the travel experiences of the elderly in the selected study areas of Rotterdam and Haaksbergen by understanding their travel characteristics, attitudes, and needs. This analysis does not aim to be representative of any of these areas or groups. By understanding these characteristics and factors it is only intended to frame the disadvantages increasing the risk of transport-related social exclusion of the elderly.

While starting the TRSE problem from the qualitative perspective, first the output from the quantitative analysis has been taken into account. Because the effects of transport disadvantage may vary from one context to another as well as between different individuals (Gray et al., 2006). In addition to this, the aging population shows different mobility characteristics in different contexts due to different interactions in the household, community, and society (Schwanen & Páez, 2010). Thus, while conceptualizing this

problem, the contextual results from the analysis and the concepts from the existing literature have been used.

Four main disadvantages are underlined as a result of the quantitative analysis of elderly and disadvantaged groups under the elderly. As can be seen from the Figure 21, these factors are adapted into the qualitative analysis in three main categories. Although quantitative analysis points out a problem in these characteristics for the elderly, it lacks to link these different behaviors of the elderly with social exclusion. It is essential to recognize the causal links to understand the interaction between transport and social exclusion to tackle this problem better (Schwanen et al., 2015). Therefore, the reasons for these underlined problems have been questioned in the qualitative analysis under three main categories. The first category is the travel characteristics to understand the disadvantageous travel characteristics that may exist in the elderly's trip-making. The second one is mode choice factors aiming to understand the underlying factors of mode dependency and relation with mode unavailability. The last one questions the reasoning behind the high no-trip rates among the elderly. Although the reasons are also analyzed with survey data, the categorical structure of the question might have led to disregarding important causes of this pattern. Apart from these, there are also other factors explored in the conceptualization of the problem that quantitative analysis fails to explore which are the experienced travel barriers/problems and needs for better travel .

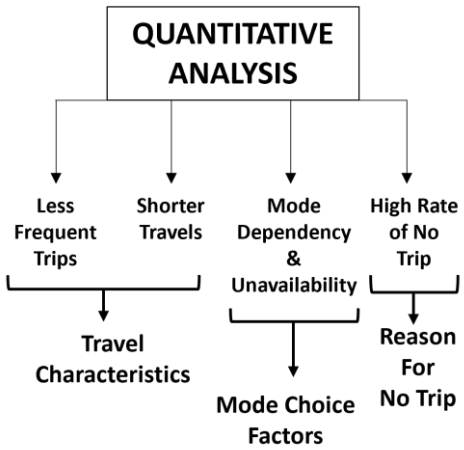

Figure 21: Linking Quantitative Analysis to Qualitative Analysis

There are two main interview designs possible in qualitative interviewing which are unstructured and semi-structured design. Both types offer flexibility and emphasis on the individual's understanding and framing of events and issues (Bryman, 2012). However, the semi-structured interview design is used for this study. The reason behind this is to allow cross-case comparability in this multi-case study as mentioned by Bryman (2012). In addition to this, the study is prepared in three different languages which are: Dutch, English, and Turkish. Therefore, having a semi-structured guide helped in this process to have comparability also between different languages. The interview guide is prepared based on the research questions for this purpose. The main topics that are discussed in the interview are, general trip-making characteristics; mode choice factors; experienced travel barriers/problems; reasons for no trip/missed opportunities; needs for a better travel experience. These main topics can also be seen in detail in Table 21.

In social exclusion research, it is important to make sure that the perspectives of different vulnerable groups at risk of social exclusion are included (Levitas et al., 2017). Not representing the diversity in population groups may cause overlooking the individual differences in perspective (Walsh et al., 2012). In this study, the categories are mainly the ones derived from the travel behaviour analysis (see Chapter 3) as

transport disadvantaged which are women, non-western immigrants, and non-car owners. For this recruitment, first, the elderly care houses, sports clubs with elderly-specific events, and senior clubhouses have been contacted via phone. Only several positive responses have been gathered from this attempt. Therefore, the rest of the recruitment has been made in the field. The respondents were gathered from public areas such as parks and streets and also from a gym and a restaurant in Haaksbergen. In Rotterdam, some of the respondents were also gathered from streets, squares, and parks as well as from an elderly care house and library. Considering the small share of the non-western immigrant group in the overall population, these respondents were the most hard to reach group among all. Therefore, also the neighbourhoods mainly resided by non-western immigrants were visited in both cities to reach out to non-western participants. The characteristics of the respondents in each study area are shown in Table 20.

Table 20: The Composition of the Respondents

Name	Categories	Haaksbergen (N)	Rotterdam (N)
Age	60-65	3	2
	65-69	2	1
	70-74	1	3
	75-79	1	3
	80+	2	2
Gender	Man	4	7
	Woman	5	4
Migration status	Dutch	6	8
	Western	X	X
	Non-western	3	3
Car Ownership	Yes	7	4
	No	2	7
Total	Respondents	9	11

In total nine interviews were made in Haaksbergen and 11 interviews were made in Rotterdam. The interviews were stopped when it was observed that theoretical saturation has been reached. In this study theoretical saturation has been understood as not having new insights from new data (Bryman, 2012). This could be exemplified as getting answers to the questions that indicate similar travel characteristics and similar barriers. When new data starts inferring similar experiences to the same category, it is decided to not have any more interviews.

All interviews were held face-to-face and recorded by both voice recording and note-taking with the verbal permission of the respondents before starting the interview. The consent information is read to the interviewees or given to them if they wish to read it themselves before starting the interviews(see Appendix C for the leaflet). In Haaksbergen two respondents refused to be voice recorded consequently seven respondents are voice recorded and all of them had notes taken. Whereas in Rotterdam, all 11 cases have interview notes and nine of them have voice recordings. In addition to this, after each interview, additional notes are taken to describe the interview setting such as the quietness of the environment, attitude of the respondents, and main highlights of the respondents. These notes have offered an opportunity to remember the insights and conditions in each interview while analyzing the data.

5.3. Data Analysis

The thematic analysis method has been used to analyze the interviews after data collection. There are several reasons why thematic analysis is chosen among the other qualitative analysis methods such as

analytic induction or grounded theory. Firstly, as mentioned by Kiger & Varpio (2020), thematic analysis is well suited to understanding experiences, thoughts, or behaviours. Since the main aim of this study relates to understanding the experiences and behaviours of the respondents, the analysis is well suited to the aim of the study. Secondly, using thematic analysis can help underline the similarities and differences across the data thanks to coding and creating themes in its methodological process (Braun & Clarke, 2006). Furthermore, the thematic analysis could help summarize a dataset over its main features (Braun & Clarke, 2006). These qualities of this thematic analysis make it a suitable method for this study to explore experiences and compare data from different study areas.

Several pathways could be followed while using thematic analysis. Figure 22 shows the main steps and inputs used in this study which is adapted from the study of (Braun & Clarke, 2012). Although mostly similar steps are followed, the creation of themes could be either etic (theory/literature-driven), emic (data-driven), or sometimes a hybrid of these (Braun & Clarke, 2006; Musselwhite, 2018). Because the interview design has been made based on the literature-based conceptualization of the problem to answer specific research questions, themes are also created based on this conceptualization in a more etic style. Yet, the codes are generated without searching for certain concepts in the data. This allowed generating more unanticipated insights rather than repeating the existing explored concepts of TRSE.

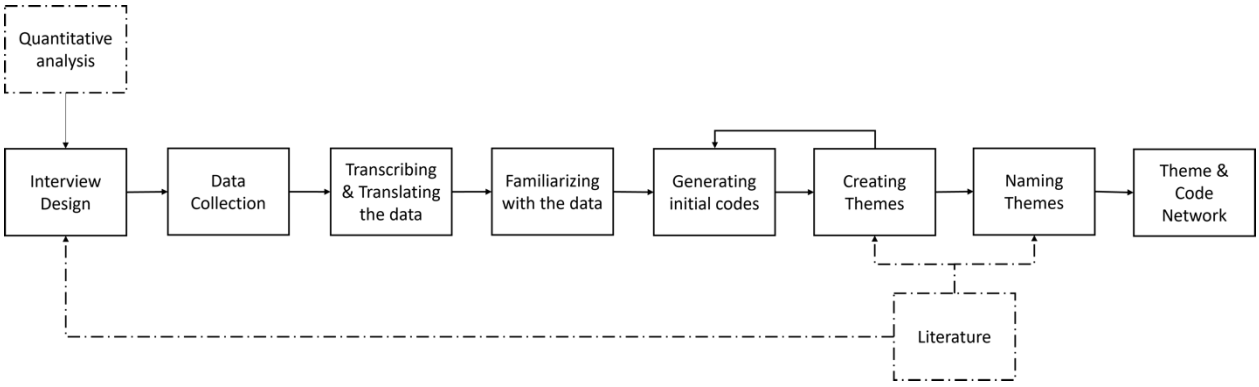

Figure 22: Thematic Analysis Methodology

Five themes have been used as a result of this study namely: Travel characteristics, Barriers/Problems faced while travelling, Factors affecting mode choice, Reasons for no travel, and Travel needs. Table 21 explains the relationship between the interview questions and themes in light of the research questions. The interview questions stated in this table are only the main questions and examples of follow-up questions can be found in the interview guide in Appendix C. Under travel characteristics, the disadvantageous travel characteristics that might induce the risk of TRSE have been coded. These travel characteristics might be exemplified as being dependent on a certain mode which might increase the risk of TRSE due to having less flexibility in case of unavailability of that mode. These characteristics might be the result of already experienced transport disadvantage or exclusion. The barriers/problems indicate the obstacles or inconveniences faced during their travels. These barriers are grouped into two as; soft barriers relating to mainly management or capacity problems and hard barriers relating to physical or design problems. Examples of these barriers could be respectively an inaccessible design of a vehicle and safety/security issues. The third theme is mode choice factors which include the factors affecting the choice of transportation mode while travelling. These factors could be related to ability among many other things limiting the options of travel for the target group. Another theme is the reasons for no travel which aims to address the factors that prevent people from travelling. Health or mode unavailability could be examples of the codes relating to this theme. The last theme is travel needs which groups the codes that related to the needs of respondents to have better participation. These needs mainly reflect the effects of transport disadvantage or exclusion. An example of these needs can be better or safer travel options. Although each theme has reference to questions in the interview, the answers might also appear

in different parts of the interview. This is because of the interactive and flexible nature of the interview methodology. Even though there is a certain guide while conducting an interview the flow of the conversation and the place of the answers are determined by how the conversation progresses.

Table 21: The relationship between the research questions, interview questions, and themes

Research Questions	Interview Questions	Themes
How are the travel characteristics of the elderly in the study areas?	**Q1.** Could you please tell me about your trip making?	Travel Characteristics
What is the reason behind the mode choice of the elderly? What is the opinion of the elderly towards different transport modes?	**Q2.** Do you always prefer the same transportation modes to go to these places?	Mode Choice Factors
What type of travel barriers do the elderly experience in their daily lives?	**Q3.** Do you experience any problems or obstacles related to the trips you are making? **Q9.** Do you experience any negative effects from travelling or transportation systems?	Barriers/Problems in Travels
Are there any activities/destinations that the elderly are prevented from accessing due to transportation? If so, what are these activities/destinations and the reasons behind prevention?	**Q4.** Do you think you can travel as many times as you want or need? **Q5.** Are you able to travel to any place you want whenever you want/need? **Q7.** Have you ever decided to avoid a trip? **Q8.** Have you ever experienced a situation where you couldn't participate in an activity or missed an opportunity due to not being able to access a place?	Reasons for not Traveling
Do the elderly have unmet needs to have a better travel experience? What are these unmet needs of the elderly?	**Q6.** How do you think your travel experience could be improved?	Travel Needs

5.4. Results

This section will discuss the results of the interviews separately for both study areas, Rotterdam and Haaksbergen. The results will be discussed with reference to the five themes which are travel characteristics, mode choice factors, barriers/problems faced while travelling, reasons for not travelling, and travel needs.

5.4.1. Haaksbergen

5.4.1.1. Travel characteristics

In Haaksbergen, the main trip-making includes the purposes of shopping, social visits, hobby, work, and sports. Although some of these day-to-day trips are done in and around the city, respondents mentioned also needing to visit nearby cities (Hengelo, Enschede, Goor) often for the services that are not available in the city of Haaksbergen. This need for frequent intercity trips combined with the lack of public transit services creates a high dependency on the car use. This was one of the most common travel characteristics among the respondents in Haaksbergen. Even the respondents who own a car, might

prefer a pick-up from friends or family, especially in their long-distance travels. For the trips in the city the majority prefer biking, and respondents especially the ones who mention being ill prefer getting a lift from someone even for in-city trips. This situation is also one of the main causes of the next observed travel characteristic which is the dependency on others. Because most of the travels are made by car, in the situation where one can't drive, they need help from someone to drive them to the destinations or call a taxi. This situation is said to occur on some occasions such as having a drink, catching a train, or a plane. In the case stated in Quotation 1, for this respondent to socialize and have a drink, he needs a taxi or someone to help him.

> *"Well, if you want to go to a festivity here around in the environment, you have to either take the bike, if you want to drink something, there's no public transport, so you have to call a taxi or Uber or you have to call somebody to help you out."*

Quotation 1: Haaksbergen, Male, Dutch, 60-65 (HGYM60)

Furthermore, two cases stated that they need their children or wife to be able to drive. One respondent (HHOF70: Female, 70-75, non-western migrant) explained: "*Well, here's the thing. My children take me there (grocery shopping), for example. Thanks to my grandchildren every moment if I call them they come to help.".* Because she has trouble walking long distances and cannot bike, she needs help from someone. The other person (HSTM80: Male, 80-85, Dutch) says *"I am lucky to have a car trip. My wife usually drives me.".* This person is unable to drive due to his eyesight problem and he can only travel alone by walking. This situation brings out another related disadvantageous travel characteristic: Limited travel range. Apart from these two people, the other two female respondents stated that they don't prefer to go long distances (inter-city trips) alone. These two separate cases mentioned that one of them needed a travel buddy and the other needed her husband who can drive for their trips to far destinations such as Amsterdam. This might indicate that these people have a more limited range of travel when there's no one there to accompany them even if a car and license are available to them.

Finally, half of the respondents mentioned how their trip-making changed over the years due to not working anymore, changing household compositions, the pandemic, or change of residence location. A participant (HGYM60: Male, 60-65, Dutch) also mentions how his travels changed after he moved from Amsterdam to work in Haaksbergen: "*So everybody has a car here. So for me, it was very weird when I moved to Haaksbergen I had no license at all. When I moved to Haaksbergen I needed a license to be mobile. So that's, that's very weird in this region.".* He explains how he needed a car to be as mobile as he was in Amsterdam. This excerpt underlines the importance of the car in Haaksbergen. However, some respondents changed their behavior due to changes over age or the loss of their partner. One respondent (HSTM80: Male, 80-85, Dutch) answered the question about his trip making as *"I don't have much travel no more, back then I had a lot".* Also, two female participants mentioned how during corona they either decreased their trip frequency or stopped having any trips. Although one of them adapted to their earlier routine already, it was not the case for the older participant (HHOF70: Female, 70-75, non-western). She explained this situation as below:

> *"There are only a few trips that I have right now. I haven't even been to a neighbor for a few years, but more or less for two years. I didn't even go to my kids in particular. You know. I didn't go ehm so no one came. It's (visits) just getting started recently."*

Quotation 2: Haaksbergen, Female, non-western migrant, 70-75 (HHOF70: Female, 70-75, non-western)

Overall, four main travel characteristics groups noticed in the data from Haaksbergen that indicate limited participation or the risk of limitation (See Figure 24). The characteristics were observed in the participants from different backgrounds, gender, and age groups. Therefore it is not possible to claim exclusion related to certain social groups based on these findings. Yet, the people who experience some type of illness affecting their abilities show more than one disadvantageous characteristic in their trips.

5.4.1.2. Mode Choice Factors

As mentioned, the respondents mainly use a car and bike for their travels. Although the distance to the destination is one of the factors, several other reasons are also causing this dependency on a certain mode. However, two different participants from different backgrounds (HHOM65: Male,non-western,65-70; HOPF60: Female, Dutch, 60-65) expressed that they prefer travelling by car just because they want to. Additionally, some respondents (HSTM80: Male, 80-85, Dutch; HOPM65:Male Dutch,65-70) prefer to travel by car because it is more convenient and brings more utility to some of their travel purposes. One of these respondents (HOPM65: Male,non-western,65-70) also stated that he chooses to travel by bike based on the factors such as weather or sport.

The mentioned factors do not strictly include necessity but rather include preference or even taste. However, some other respondents have to travel by car due to a lack of ability or insufficient transit service quality in the area. Two of the respondents (HTCF70:Female, Dutch,70-75; HGYM60: Male, 60-65, Dutch) showed long travel times and low frequency of public transit services to their destination (Zeeland, Goor-Hengelo) as their reason for using the car as their main travel mode.

Interviewer: *Do you always prefer the car to go to these places that you are mentioning?*
HGYM60: *Exactly! Because public transport to Goor and Hengelo. Goor is quite difficult Hengelo also because you are dependent on limited bus times. When I go to Amsterdam, it's much easier because it's a long trip and I can prepare it before. So that's the reason for me.*

Quotation 3: HGYM60: Male, Dutch, 60-65

Furthermore, another two respondents explained their limited choices based on their abilities. One of them (HSTM80: Male, 80-85, Dutch) uses a bike when he needs to go somewhere by himself because he has a 70-80% vision loss. He mentions this situation as: *"I don't drive anymore. I can't drive anymore, because of my eye. So, I have to rely on the bike."*. The other participant (HHOF70: Female, 70-75, non-western) mentioned how walking is not an option for her due to her health condition and how she has been given a mobility scooter by her doctor instead. Both of these participants stated fewer trips and being driven to destinations as their main transportation methods. On the other hand, there is also one female respondent who mentions not being able to bike due to her husband's negative opinions towards women cycling. Although she doesn't mention any restrictions on her travels, she states this as a reason for her to only use the car as a transportation mode. Contrary to the other two respondents, this one didn't mention any problems with her current participation level. This could be due to being able to drive and having a car available for her most of the time.

These findings reveal different factors that affect the high share of car use among the respondents. Because most of the respondents own a car, they mainly state the reasoning as their preference. On the other hand, some of the respondents are showing a lack of options as their reason for choosing the car or lift for travelling to their destinations. Under the Dutch Social Support Act, people who have a restriction in their mobility are eligible for monetary help to get aid such as a mobility scooter or taxi pass (CBS, 2009; Nederlandse Zorgautoriteit, 2022). However, it is possible to see from the examples that even with such mobility aid provision, a dependency on someone might still exist for meeting the needs of the elderly. It is not surprising to notice that people who need to choose their travel mode based on their abilities also experience dependency on someone. Additionally, these people also report that their trip frequencies changed after they started experiencing the degradation in their abilities.

5.4.1.3. Barriers/Problems Faced While Traveling

Regardless of the modes used, respondents mentioned different obstacles they faced while they travel. Some of these problems are related to physical structure grouped as hard barriers, whereas others are

related to personal or organizational factors (See Figure 28). The former group, firstly, includes road unavailability problems directed by some of the car users. These respondents mentioned traffic congestion and construction work as the problems they faced on the road. Because there are a large number of trips to other cities among them, the rush hour traffic increases their travel time. Secondly, the quality of public transit services is specified as a problem in terms of the access range of bus routes and service times. One person (HGYM60: Male, 60-65, Dutch) mentioned both bus routes covering fewer destinations he desires in and limited bus services on Sundays. The respondents stated that the changed bus route in the city does not cover the recreation areas and fewer houses are served on this new route. Another person (HOPF60: Female, Dutch, 60-65) confirms this by saying bus routes only cover 2-3 destinations. One other person (HTCF80: Female, Dutch, 80+) also mentions a cancelled bus service to the hospital in Enschede and there is not any hospital in Haaksbergen with the same services. This brings out the last barrier of this group which is the lack of services. The last person (HTCF80: Female, Dutch, 80+) also mentions the lack of services in the city by saying *"Inside Haaksbergen there are not many things to do because if you've seen it, the centre is small."*. Another participant (HHOF70: Female, 70-75, non-western migrant) raised a similar point by indicating the lack of markets nearby her house by saying: *"Also, markets are far away from me. So it's a little bit hard for me to go. But when you drive by car, then it's easier."*.

The second group has obstacles related to organizational, financial, or individual related problems. Unrelated to their backgrounds, different participants expressed that the cost of transport is high. Three of the respondents reflect on this issue by indicating public transit cost is high. And, one person stated his concern about increasing fuel prices as below.

> *HHOM65: "We know that you can travel comfortably now. Let's say you've traveled 100 to 200 kilometers a month and it doesn't affect you financially so far. But now a little bit because of this issue of increased prices. We will see what happens in the coming years."*

Quotation 4:Haaksbergen, Male, non-western migrant, 65-70 (HHOM65)

Although this person has not stated any problems with his current travels, it can be seen that he is worried that this might not be the case in the future. Additionally, one person (HGYM60: Male, 60-65, Dutch) describes his experience with construction works on roads as having a lack of information especially compared to bigger cities. He explains that no indication is given about how to proceed on the road in these situations when he is traveling. Apart from these, one interviewee(HHOF70: Female, 70-75, non-western migrant) adds her experiences of taxi service use for her hobby course trip to the nearby city Hengelo. She tells about the time that she lost her belongings due to forgetfulness in the taxi and it took her hours to get them back with the help of others. Moreover, she also mentions that using the taxi card by herself is challenging for her because she doesn't know the Dutch language very well.

This section has described the several obstacles experienced and observed in Haaksbergen. Some of these problems such as travel costs, and lack of services are not causing an exclusion so far. The reason behind this is high access to a car in the city however it is also important to understand if this car ownership is voluntary or forced. Banister (1994) defines forced car ownership as having no alternative to a car. He also points out that because having a car is one of the more essential expenditures in rural areas, forced car ownership is more prevalent in rural than urban areas. Considering the problems raised concerning the low public transport quality and lack of services in the area, it is possible to say forced car ownership is existent based on these cases. Moreover, individual abilities are again revealed as an important factor for the level of experienced barriers seeing the variety of problems experienced by one interviewee (HHOF70: Female, 70-75, non-western migrant).

5.4.1.4. Reasons for not Traveling

Some of the participants specified reasons for not preferring to travel in a day and reasons for the times when they were not able to travel to their preferred places. Some other participants stated that they actually do not experience these situations often. They (HHOF60: Female, non-western, 60-65; HHOM65: Male,non-western,65-70) indicated that the main reason is usually not wanting to have a trip or considering an event not worthy of traveling long-distance.
One person (HGYM60: Male, 60-65, Dutch) explained that he sometimes needs to skip some trips if he wants to travel by train and no one could drive him to stations in Enschede or Hengelo. He adds that the reason for this situation is that no option of public transit exists at particular times such as early Sunday morning or late evenings. Furthermore, the most repeated reason by participants was traffic. Different groups of elderly(HOPM65: Male,non-western,65-70, HTCF70:Female, Dutch,70-75, HTCF80: Female, Dutch, 80+) stated that when it's rush hour and traffic congestion is expected on their route they prefer to plan their travels to another time. Another reason for not having travel was health(HOPF60: Female, Dutch, 60-65, HHOF70: Female, 70-75, non-western migrant) such as skipping travel due to the Covid-19 pandemic. Finally, one of these people (HHOF70: Female, 70-75, non-western migrant) also mentioned that she is not having many travels anymore after she lost her husband.

Although several problems and factors were mentioned in the earlier sections, this section only has limited factors that lead to cancelation or inaccessibility of their destinations. This could be because even though problems exist in their travels, the respondents still prefer taking their trips or only rescheduling them. Only two interviewees revealed not being able to access the places they wanted whereas the rest of them states rescheduling their travels. This result might indicate no participation problems exist consequently no exclusion should be considered. However, the mentioned reasons for rescheduling are the fragilities which might be the triggers leading to exclusion.

5.4.1.5. Travel Needs

For overcoming the mentioned causes some needs are mentioned by the participants. Some of these needs include more individual solutions such as health improvement. This participant (HST80) with macular degeneration thinks a solution for him can not be created by transport adjustments but rather by improving his vision. Another participant (HHOF70: Female, 70-75, non-western migrant) with dependency on others states that she needs independency by saying *"Of course, I don't want to upset my children. I want to be active, but unfortunately, the pain has started because I have diabetes."*.

Three participants report their needs as relating to transportation-related solutions. Two of these participants agree with each other that transportation systems should be cheaper. One of the participants (HTCF80: Female, Dutch, 80+) reasoned her need by explaining: *"Train is not cheap even when you're older. You only get seven free days in a year which is not enough. And you can't travel during rush hour"*. The principal railway operator company, NS, has an offer for people over 60 years old that enables them to travel any 7 days a year for a discounted cost (NS, n.d.). Additionally, another participant (HGYM60: Male, 60-65, Dutch) adds his need of having more frequent busses in the city.

Overall, only five respondents reported having needs for a better travel experience. Addressing these needs is important to eliminate the disadvantages that cause them. For example, the quality and cost of the transit system have been mentioned as a barrier or as a reason for not traveling while the improved and affordable transit system is mentioned as a need. In the case of this need staying unmet, the current barrier will stay prevalent due to the lack of solutions. This concludes the emergent nature of addressing the needs in order to help decreasing the disadvantages and thereon the risk of social exclusion in the area.

Additionally, throughout this section, some characteristics are revealed to cause higher levels of disadvantages. These characteristics could be summarized as the level of ability, car ownership status, and migration background. The first two characteristics have been stated to have caused a dependency on others in their travels. The migration background of individuals is noticed to have relations with the problems related to language and culture on their travels.

5.4.2. Rotterdam

5.4.2.1. Travel characteristics

The travel purposes of the respondents in Rotterdam include shopping, peer visit, work, and leisure. The transportation modes used by these respondents are mainly public transit, walking, and biking, they rarely use the car. Usually, mentioned travels are taken within the city of Rotterdam and only people who live on the periphery and nearby villages mentioned visiting the city center by car. Although most of the participants stated being able to travel by themselves thanks to public transit, dependency on others for some travels was still reported. The reported tendency has no relationship with any social characteristics but rather has a relationship with car ownership. Because the majority of the residents do not have a car available for them to use, long-distance, especially intercity trips, are made by getting a ride from someone with a car. It should also be noted that some of the respondents also need to be driven because they are not able to drive or they have no driving license in addition to having no car. As can be seen from the below excerpt these travels are usually dependent on the availability of the others who ride them to these destinations.

RMVM65: "In long-distance, there are friends and relatives in other cities and we go to them. But we go if there is someone who goes there by car. And I do not go by driving a car myself, only with them."

Quotation 5: Rotterdam, non-western, male, 65-70 (RMVM65)

Furthermore, two participants (RSLM80:Male, Dutch, 80-85, RSPCM80: Male, Dutch, 80-85) deal with dependency on a single transport mode for their travels they take by themselves due to the mobility restrictions they experience. Both of them are only able to travel by using their mobility scooter and cannot walk or use other modes by themselves. They get help from their family when there is a need to travel long distances. Therefore, another travel characteristic these two people and another two respondents(RMVF60: Female,non-western, 60-65, RMVM65: Male, non-western 65-70) carry is a limited travel range. One of these participants expressed this situation as followed: *"When I go to the open street market, I can go like that (by metro). I go to nearby places, not far away. I can go by myself for one stop or two, I can't go any further."*. On the other hand, the first two respondents have limited range due to their dependency on a mobility scooter causing limited travel extent. These two respondents as well as another respondent (RSPLM75: Male, Dutch, 75) mentioned how they experienced a change in their travel behaviors due to the change in their health conditions. The two mobility scooter users naturally described this as going to destinations more by walking before than they do now. The other respondent mentioned a time that he could not drive a car due to a problem with his eyesight. Another two respondents explained selling their cars due to having access to the free and accessible public transit systems in the city. One of the respondents (RMHF70: Female, Dutch, 70-75), explained that *"I sold the car when I left to come here and live in Rotterdam because of the good train, bus, metro network. "*. The other participant draws attention to a similar point by acknowledging no need for a car is required after being retired and getting a free travel pass.

Briefly, the travel characteristics of the respondents in Rotterdam resulted in some disadvantageous travel characteristics especially based on travel distance, ability, and car ownership. The dependency on someone is observed to exist mainly for the long-distance inter-city travels by non-car owners and online systems by one person. Additionally, dependency on a mode and changing travel behavior are mostly

stated by people with mobility restrictions. Limited travel range is also indicated by the mobility restricted as well as non-westerns. On the other hand, there are also positive travel behavior changes thanks to the well-developed and affordable public transit system of the city. The residents of Rotterdam city are eligible for free travel in the city after the age of 66 (RET, 2022).

5.4.2.2. Mode Choice Factors

The respondents choose their travel mode based on factors that require necessity or just out of preferences. Mainly only two participants(RMHM75:Male, Dutch, 75-80, RSLM60:Male, non-western, 60-65) stated that they never use a bike as a mode because they just don't like biking. Another person mentioned using a bike only at close distances as a sport to stay fit. Additionally, two other participants(RMHF70: Female, Dutch, 70-75, RSPLM75: Male, Dutch, 75) emphasize the importance of good sunny weather in their choice of whether or not to use a bike for their travel.

The ability of a person is also a strong factor affecting the decision-making process of mode choice among the respondents. People who choose their travel modes due to their inability of using others need to decide out of necessity rather than preference. All three respondents(RSLM80: :Male, Dutch, 80-85, RSPCM80: Male, Dutch, 80-85, RSPLM75: Male, Dutch, 75), who stated their inabilities as a factor, are over the age of 75. These people stated their problems concerning eyesight, memory, and walking as a reason for not being able to use public transit or a car. Another person (RMVM65: Male, non-western 65-70) stated not choosing a bike as a mode due to his partner's inability to ride a bike.
Although the earlier step underlined the high satisfaction level with public transit systems, one person (RKPM70: Male, Dutch, 70-75) criticizes the network for being crowded and slow as a reason for mainly using a car or a bike. Another two people criticized the traffic congestion(RSLM60: Male, non-western, 60-65) and parking (RMVM65: Male, non-western 65-70) and stated these problems as a reason for never using a car when visiting the city center even if it is available. Finally, another person (RCSF75:Female, Dutch, 75-80) who mainly uses public transit mentions preferring to be driven to her inter-city destination because she could not renew her driving license.

Overall, despite the several different factors mentioned, the purpose of travel and travel distance are mainly in effect in every participant's decision-making process of travel mode. Because the conditions of public transit in-city trips and inter-city trips are changing. Also, most people prefer not to use a car when visiting the city center and rather travel by using public transit, biking, or walking. Even people who do not own a car prefer being driven by a car for their out-of-city trips rather than using a train or a bus. Apart from this, similar to earlier findings, people with an inability to use certain modes are another group with a higher dependency and limitation on their travels.

5.4.2.3. Barriers/Problems Faced While Traveling

Four main structural problems were stated by the respondents. Firstly, mobility scooter users mention two of these problems which are inaccessible design and lack of bike road. For the former one (RSPCM80: Male, Dutch, 80-85), a respondent explained the obstacles he faced when visiting markets due to narrow aisles restricting the ability to navigate in the store with a mobility scooter. Another scooter user (RSLM80:Male, Dutch, 80-85) introduces the unavailability of a separate bike path as his reason for not being able to visit the city center at all. One of the former car users (RMVM65: Male, non-western 65-70) highlights that even if he has a car it would be problematic to travel even if he wants because the parking system is complicated and fees are high in the city. The final structural barrier is remarked by a respondent (RSPLM75: Male, Dutch, 75)) living in a village close to Rotterdam. He says he regularly visits the city to use the library and sometimes the hospital because these services are not as good in his location.

The soft barriers include three categories which are safety/security, inability to use online digital transportation systems, and language barriers in the order of the most mentioned to least. For the safety category, one person(RMVF60: Female,non-western, 60-65) expresses her anxiety about getting lost while trying to use public transit services due to her insufficiency in the Dutch language. This problem also refers to the language barriers stated by the same person because she always needs someone with her when travelling for help with the language. Continuing with safety problems, two bike path users refer to the bike roads as being unsafe. Among these two users, one of them is using a bike (RKPM70: Male, Dutch, 70-75) and the other one is using a mobility scooter (RSLM80:Male, Dutch, 80-85). The mobility scooter user explains his concern as below:

RSLM80*: "There are fast bikers for delivery. They are young people and especially the flash delivery services are causing this problem. They make the road chaotic and dangerous."*

Quotation 6:Rotterdam, Male, Dutch, 80-85

Finally, using online systems is the last category of soft problems. A person explains that she is having a hard time with online systems and she usually needs someone to help her when it is a complicated task. In short, regardless of the mode they use, there are several barriers listed by the respondents. Some of these problems cause inaccessibility to some areas whereas others are solved by alternating the used mode or by getting help from someone. Although these solutions prevent people from being excluded from their activities, these solutions are either dependent on the availability of another person or cause limitations.

5.4.2.4. Reasons for not Traveling

Although unmade trips are a sign of exclusion from the desired activities, some people only prefer not to travel because they are happy as they are. One respondent (RMVF60 Female,non-western, 60-65) is an example of this issue since she is happy staying at her home and does not miss any necessary trips thanks to the people who help her. Another person (RSPLM75: Male, Dutch, 7)) prefers having fewer trips or cancelling his trips when the weather is bad and even more he prefers to visit warmer countries in rainy seasons. Whereas another person(RSLM80:Male, Dutch, 80-85) specifies not being bothered by the weather but safety is the most important reason for him to cancel a trip such as not going to the city centre.

Two other people explained health as a prominent reason for cancelling trips. Both people exemplified their lack of travel during the Covid-19 pandemic. One of the respondents (RMVM65: Male, non-western 65-70) mentioned limiting his travels by plane for more than two years due to the pandemic. The other respondent (RKPM70: Male, Dutch, 70-75) tells limiting all his travels to possibly crowded places and times such as preferring to stay at home on weekends. The health condition of a partner is also stated as a reason for cancelling trips by a participant (RSPCM80: Male, Dutch, 80-85). He shares his experience of cancelling his trips twice because he needed to take care of his partner.

Transport-related problems are also stated as a reason for cancelling or limiting trips. One person living in the periphery states that he can not travel as much as he wants because it is costly. Considering the inability of this respondent to use public transit or car and living in another municipality than Rotterdam, this difference with other participants is understandable. On the other hand, another person (RKPM70: Male, Dutch, 70-75) who owns and can use a car also mentions limiting his travels, especially on weekends because of the traffic congestion on the roads. One other person (RMVM65: Male, non-western 65-70) tells that he is unable to visit some tourist attraction areas in the country because no mode is available for this purpose. He shares that train trips are too expensive for him and he does not have a

car available. He further explains that before he retired he had a car but he had no time available and now he does not have a car anymore.

Given these points, it is possible to define three major reasons for limiting their travels among participants. Firstly willingness and individual preferences affect the decision of whether or not to have a trip. Secondly, health-related restrictions of the individual as well as their partners are one of the causes of having fewer or no trips for a while. Finally, access to certain modes including their availability or affordability to the user is important when deciding on realizing a trip. These elements overall result in a lack of participation in desired activities which can further cause or exacerbate exclusion in different areas.

5.4.2.5. Travel Needs

The mentioned causes in earlier sections result in individual needs to realize a better travel experience. One respondent(RSPCM80: Male, Dutch, 80-85) mentioned that only improvement to his health could make him travel as they like and nothing else. However, two non-western respondents underscore their needs related to transport systems. One of them (RMVM65: Male, non-western 65-70) mentions a need for affordable intercity travel options. He further details that the existing options are either expensive such as the train or not available to him such as Valys and vervoer op maat because he does not have health problems. The mentioned intercity options of Valys or vervoer op maat are the door-to-door tailor-made transport systems that are available to people who are not able to use other options (Gemeente Rotterdam, 2022). The other respondent (RSLM60: Male, non-western, 60-65) also shares his concern over increasing fuel prices and his need for cheaper transport.
One respondent with mobility restriction highlights two main needs he has for his travels. The first one is a safer travel option. He thinks that the bike paths are dangerous for him and his mobility scooter does not have any protection against these dangers which leaves him feeling vulnerable. He describes that even an option similar to his mobility scooter but with a protective layer will be enough for him. Secondly, he also explains his need for being independent. He summarizes his needs as below:

RSLM80*: "I want to travel on my own. I don't want anyone else to travel for me. I need something like a small car that is like a scoot mobile covered with an iron. Because scoot mobile isn't safe it's open, they can hit you.*

Quotation 7: Rotterdam, Male, Dutch, 80-85

All in all, together with these travel needs, this section of the analysis has brought some characteristics into prominence in terms of social exclusion. The first and foremost of them is the ability of the individuals. The inability to use certain modes is observed to indicate obstacles and characteristics that relate to social exclusion due to disrupting desired participation. These inabilities are mainly related to the health problems or capability of the individuals as well as their partners. Secondly, the affordability-related problems/needs are mainly raised by the non-western respondents. Finally, although the well-developed public transit network in the city offers accessible transportation, non-car owners experience higher dependency on others, especially when having their inter-city trips.

5.5. Discussion

The aim of the qualitative analysis chapter was to have an understanding of transport-related social exclusion based on people's perceptions and their travel experiences. The result of this chapter has described this under five main themes defined in the conceptualization of the problem corresponding to the sub-research questions (see Section 2.1). These results will be linked to the TRSE dimensions explained in Section 2.1 by discussing the implications of the related themes in the coming sections.

5.5.1. Linking the TRSE dimensions to study findings

Physical Exclusion

Physical exclusion is evident in both study areas based on the interview outcomes such as reported decreasing trip frequency or avoided trips due to inabilities. However, physical exclusion is not dependent on any specific type of inability of the respondents as it is observed across different types of inabilities. Vision deficiency, mobility problems, and illnesses (e.g. diabetes, back pain) are reported as part of these inabilities in the study. However, these inabilities do not have any specific relation to area, age group, migration status, or gender. The relationship between the ability or constraints of individuals with physical exclusion is widely mentioned in different studies, therefore, supporting the findings of this study (Casas et al., 2009; Currie & Delbosc, 2010; Hine & Mitchell, 2001a; Luz & Portugal, 2022).

There are several results of the physical exclusion on the travel behaviours and needs of the respondents. These are shorter travel range, dependency on others, and dependency on a transport mode. For now, these travel characteristics do not cause further exclusion from essential facilities, such as hospital or grocery shopping, with the help of someone. However, in the absence of someone to help or give a lift, respondents who experience dependency due to physical exclusion might also experience exclusion from facilities. Although there are policy measures taken by the municipalities for people with ability problems (e.g. tailor-made transport, public transit credit for carers, mobility aid tool help (Gemeente Rotterdam, 2022)), these measures are more diverse in urban areas such as Rotterdam. Nevertheless, people living in Rotterdam who have mobility problems still describe having primary mobility needs such as travelling safely to the centre of the city (Musselwhite & Haddad, 2010).

Geographical Exclusion

Among both cases, only Haaksbergen shows indications of geographical exclusion due to its limited level of public transportation services in the city especially compared to an urban area such as Rotterdam. The characterization of geographical exclusion in rural areas due to limited public transportation services is also observed in rural areas of other countries (e.g.Farrington & Farrington, 2005; Lieszkovszky, 2018; Shergold & Parkhurst, 2012). Because the lack of public transit demand and car dependency in rural areas cause the provision of public transit to be more problematic than in urban areas. However, the dependency on cars due to lack of transit options in rural areas increases vulnerability in case of no access to a car. Yet, some of the respondents were still satisfied with their current travel experience and level of participation in activities or opportunities. This might indicate that the expectations of these individuals are met and therefore no exclusion problem exists under current circumstances. On the other hand, the expectations of the individuals might change based on their resources and capabilities (Ziegler & Schwanen, 2011). Therefore a change in the access to a car, driving license, or someone to give a lift might change the elderly's satisfaction with their travels. Hence current geographical inaccessibility to transportation services still increases the chances of exclusion in rural areas for the elderly.

This geographical exclusion in Haaksbergen brings out dependency on a car as a dominant travel characteristic in addition to the longer travel distances of the respondents. Furthermore, for the groups with ability problems, this situation also brings dependency on others due to not being able to drive anymore. Based on this, the people with ability problems are open to more vulnerability of geographical exclusion than any other group. Consequently, this category of exclusion also relates to certain needs which are improved transit systems and the need for travelling independently. These needs refer to primary mobility needs such as a reliable transit system as well as secondary mobility needs such as independent travelling ability.

Exclusion From Facilities

The results from Haaksbergen reveal the problem of inaccessible facilities among the respondents whereas no problem related to this was identified in Rotterdam. Two main causes can be given for this difference, which are the few number of facilities in the city and the inaccessibility to the closest facilities. The poor public transport services and long distances to the facilities have driven the respondents to use a car to access the facilities when they need. The respondents, regardless of their socio-economic characteristics, have commented on the lack of facilities in the city and the need to visit other cities to fulfil some of their needs. These factors contribute to the exclusion of many respondents from certain facilities. This type of exclusion is not restricted to a specific group. Yet, to use the example of Haaksbergen, because some facilities such as a hospital or railway stations are only available in another city, non-car-owners are mainly dependent on others causing higher susceptibility to exclusion from facilities.

The inaccessibility of facilities causes changes reflected in travel characteristics such as an increased dependency on the car as a mode as well as dependency on others in the case of no access to a car. These travel characteristics together with exclusion from the facilities lead to the need for improved and cheaper transit systems. However, based on the perception of the respondents the public transit systems in the city are getting worse with introduced recent changes in bus routes rather than improving (Twents, 2021). These characteristics and needs point out that primary mobility needs are in jeopardy in Haaksbergen due to inconvenient public transit systems.

Economic Exclusion

Both Haaksbergen and Rotterdam show signs of economic exclusion for different travel purposes and based on different factors. In Haaksbergen, the high cost of public transit stands out as one of the main problems that respondents observed. On the other hand, the respondents in Rotterdam expressed their gratification toward the affordability of in-city transit costs. However, for inter-city trips, the travel cost is also a problem for the respondents in Rotterdam. Additionally, increased fuel prices are a problem in both cities for non-western migrants. The reason behind this concern is the recent steep increase in fuel prices (see Figure 23) due to the Ukraine-Russia war in 2022 (Adolfsen et al., 2022). It should be noted that the quantitative analysis did not indicate the cost element as a reason for not having a trip or car-owners feeling disadvantaged.

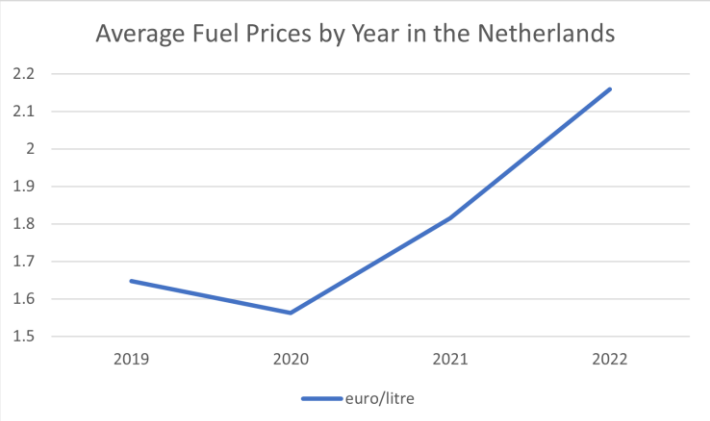

Figure 23: Average Fuel Price Change in the Netherlands (CBS, 2022)

The strong fuel price increase is expected to have a long-lasting effect on energy prices (World Bank, 2022). Therefore, the risk of economic exclusion should be addressed in both areas by providing

affordable and reliable public transit options, especially for respondents that strongly rely on car use. In the absence of such precaution, the effects of increasing energy prices might lead to increased exclusion of the highly car-dependent elderly population. Thereon, as also mentioned in other studies, areas with higher dependency on cars, higher rates of forced car ownership, and longer travel distances to reach facilities are more vulnerable to fuel price increases (Delbosc & Currie, 2011b; Lucas et al., 2016; Mattioli, 2017). Based on this, Haaksbergen is more vulnerable in terms of potential affordability of transport and at higher risk of exclusion. Overall this situation might cause even further problems with meeting the primary mobility needs of the elderly in Haaksbergen.

Time-Based Exclusion

Although there are no mentions of time poverty among the elderly in any of the two study areas, the limitation of travel based on time has been mentioned in both areas based on shared and different factors. The rush hour traffic is mentioned in both areas as a reason for scheduling a trip to another moment in time. In Rotterdam, the rush hour crowdedness is mentioned as a reason for avoiding to visit the centre of the city. Whereas in Haaksbergen, rush hour traffic is only mentioned to avoid inter-city trips. Additionally, the scheduling of the public transit limits the times that respondents can travel using the public transit. In Haaksbergen this causes total inaccessibility of many destinations, especially on Sundays and late nights.

Elderly, especially after retirement, have more time to make trips, even the less essential ones such as more frequent social and leisure trips (Tacken, 1998; van den Berg et al., 2011). Therefore the findings do not reveal a serious risk for time-based exclusion in this group. On the other hand, it should not be forgotten that the elderly still limit their travels to certain times or prefer travelling even longer routes due to traffic as also mentioned by Musselwhite (2018). This situation should be considered as a factor that might contribute to the exclusion in other dimensions. For example, limiting travel to after rush hour might cause exclusion from facilities due to the working hours of the desired facility.

Fear-Based Exclusion

Fear-related transport problems were observed both in Haaksbergen and Rotterdam, particularly due to direct and indirect safety concerns. The direct safety problems mentioned are related to unsafe bike road conditions and occurred in Rotterdam. The indirect factor causing this result in non-western migrated respondents is the language problems leading to feelings of unsafety due to the fear of getting lost. The latter is evident in both study areas. Both types of these factors lead to limited travel ranges in these respondents' travel characteristics. Hence, these experienced fears cause not being able to travel to certain areas or travelling independently only in a short range which are the characteristics of fear-based exclusion.

Improved bike infrastructure in the Netherlands has been found to have effects on avoiding TRSE in an earlier study (Martens, 2013). However, the findings indicated that the unsafety of the roads limits the level of elderly inclusion. On the other hand, the safety need for the Dutch elderly inclusion is also stated by Pot et al. (2020) and van den Berg et al. (2015). Despite that traffic safety is among the prior aims in Rotterdam for 2025 goals, the introduced measures do not include bike paths where the respondents experience the problem (City of Rotterdam, 2020). To improve inclusion and meet the primary mobility needs of the elderly, the safety measures should include measures addressing safety from different perspectives in both cities. For example, physical road safety measures for all modes and assistance for people with cognitive worries of all ages are necessary.

Space Exclusion

The fact that no particular forbidden places or gated communities were observed in the study areas, indicates that no particular space exclusion risk is present among the respondents. On the other hand, some respondents in Rotterdam have stated only being able to visit the city centre by public transit or not at all. While the car users stated the parking and traffic congestion as a reason for avoiding a trip to the city centre, bike path users mentioned the unsafe bike roads as a reason for avoiding the city centre. Although this situation does not restrict access to a certain area, it still leaves out certain groups from visiting the area as they wish.

Information Exclusion

A lack of information problem comes in three forms based on the study results: the first one is insufficient road signs, the second one is digital incompetence, and the last one is a language barrier. In Haaksbergen the road indications provided in the case of a road closure are experienced as insufficient and unclear compared to other urban areas. Such a situation might cause a longer travel time for rural residents. Additionally, some respondents mentioned not being able to or rejecting the use of online digital services such as a journey planner or online timetable. Although this is mostly stated in Rotterdam, this problem should not be considered as specific to this city. The majority of the respondents in Haaksbergen prefer travelling by either car or bike which leaves less necessity to interact with online digital systems for travelling.

The elderly are usually late adopters of technology and the increasing digitalization of transportation services increases their vulnerability (Durand & Zijlstra, 2020; Leppiman et al., 2021). These changes disrupt the secondary mobility needs of the elderly (e.g. control and independence) and lead to exclusion combined with the other disadvantages experienced. Therefore, attention to measures linked to digitalization problems such as the accessible design of digital services for different population groups is needed for better inclusion of the elderly.

Furthermore, non-western immigrants mention language as a barrier to travel information causing an inability to use public transit services independently. This situation causes having a limited travel range and exclusion in the case of no one to help. The relationship between language problems and limited travel range was also observed by other studies such as Lau, 2020; Lucas, 2004; Social Exclusion Unit, 2003. The language barrier is the only ability-related problem that is specific to a certain group of population. However, no certain policy measure is directed to this group contrary to ample examples of measures for physical ability problems. These measures such as travel assistance or tailor-made travel services are mainly provided with the condition of age or physical reports (Gemeente Rotterdam, 2022). Therefore, people with a language barrier who does not belong to these groups are especially at risk of exclusion.

5.5.2. Comparison with Quantitative Analysis

The quantitative analysis has helped provide a complete understanding of TRSE together with the qualitative analysis. The methods explain different and shared explanations of TRSE. Overall, the quantitative analysis highlighted factors in effect for TRSE based on the travel behaviour analysis of different groups and spatial areas. This analysis underlined the 80+ age group, females, people with an immigrant background, and non-car owners as the most transport disadvantaged groups. The results stated that these groups are associated with shorter travel distances, less frequent trips lower trip-making

rates, and higher rates of not travelling due to illnesses and disabilities than other groups. Additionally, it has revealed that these groups prefer travelling by driving as a passenger which shows more dependency on others in these groups. These results underlined the risk of TRSE due to lack of participation, shorter travel range, and inability to travel in some groups of elderly more than others.

An important finding is that the qualitative analysis matches the quantitative analysis in terms of the dependency of disadvantaged groups on others due to higher car use as a passenger. Furthermore, both analyses have indicated a shorter travel range for women, especially women with an immigration background in the qualitative analysis. The qualitative analysis, in addition, revealed that the disadvantages experienced by the 80+ group and by females are highly dependent on the capabilities of the individuals. Immigrant groups and non-car owners are more disadvantaged based on the results of both the qualitative and the quantitative analyses. These two groups experience common barriers among different respondents contrary to females and the 80+ age group. For immigrant groups, these barriers are cultural barriers and language difficulties of immigrant groups, and for non-car owners, the common barrier is the lack of alternative transport mode options. Yet, the qualitative analysis also shows that some of the respondents with immigrant backgrounds or non-car owners are satisfied with their limited travel range. However, due to the nature of the quantitative analysis, it is not possible to differentiate whether people choose or are forced to travel the way they do (Ryan, 2019).

In general, both methods contributed to explaining the TRSE in a multi-dimensional, relational and dynamic manner. In terms of multidimensionality, the methods had contributions to different dimensions of TRSE. The qualitative analysis offered a more in-depth understanding of the travel experiences leading to a better understanding of all the dimensions of TRSE. On the other hand, the quantitative analysis was only able to explain TRSE related to exclusion from facilities, geographical exclusion, and the risk of physical exclusion among disadvantaged groups. In relation to this, the quantitative analysis mainly presented rural areas as more disadvantaged whereas the qualitative analysis has shown different disadvantages in both areas. The reason behind this is the inability of quantitative analysis for explaining some dimensions of TRSE such as fear-based or information exclusion. The qualitative analysis was able to investigate these dimensions and therefore allowed a complete understanding of multidimensionality. Additionally, the qualitative analysis was able to explain the causes and effects of the TRSE more than the quantitative analysis did. The quantitative analysis offered only a limited understanding of the reasons for the presented results. To illustrate, car dependency in rural areas is shown as a result of both methods. However, the quantitative analysis is only able to reason by presenting the travelled distances for each purpose whereas qualitative reveals the lack of facilities, mobility restrictions and low-quality public transit services as a reason. This contribution helps draw the relations causing exclusions in different dimensions. Finally, the quantitative analysis only considered 2019 while explaining TRSE which could not capture the dynamic structure of TRSE. On the other hand, the qualitative analysis also allowed observing TRSE as a process. For example, the interview outcomes revealed the changing travel behaviours of the respondents such as lower trip frequency over years due to their changing abilities or household compositions.

Table 22 shows the advantages and disadvantages of the quantitative and qualitative analysis causing different contributions. The first advantage that quantitative analysis has provided is the objective representation of realized trips. However, this brings the disadvantage of not being able to reveal the causalities that might relate to different dimensions of the exclusion. In this study, complementing the quantitative analysis with qualitative helped to understand these causalities. The qualitative analysis has revealed the causalities thanks to the individual perceptions and experiences explaining the "why" question. On the other hand, these individual experiences are highly subjective and based on the personal interpretation of the specific individuals. This situation makes the analysis highly personal and

ungeneralizable considering the limited sample size. This study is, therefore, only showing a possible approach and it is possible to have a more generalizable outcome only by having a larger extent analysis.

The second advantage quantitative analysis offered is conducting a country extent analysis which contributed to the initial understanding of the Dutch elderly's travel behaviour. Thanks to the disaggregated analysis in this step it was possible to have a general understanding of the characteristics of transport disadvantaged population groups. However, the ODIN data have no respondents or a low number of respondents for some disadvantaged groups in rural areas such as non-western immigrants over the age of 80. Although this group is disadvantaged in urban areas, no inference could be made for rural areas. Yet, the purposive sampling of the interview enhanced the understanding of TRSE among these underrepresented groups. However, the interview method requests more time than a quantitative survey in terms of sampling the respondents and conducting the interview in an in-depth manner.

Apart from the disaggregated analysis for groups with TRSE risk, the quantitative analysis has also shown the TRSE risk areas over different spatial units. Even so, the secondary data used for this analysis was not tailor-made for a TRSE analysis. Therefore, this explanation of travel behaviour is only made based on the available explanatory variables and indicators and could, therefore, not consider some relevant indicators such as travel cost, and frequency of activity participation. Though this situation causes a partial understanding of TRSE in quantitative analysis, the qualitative analysis compensates for this. The semi-structured interview enabled an in-depth and flexible questioning of important indicators for elderly respondents that could not be represented under the quantitative analysis. On the other hand, this detailed analysis is impossible to conduct in a large-scale analysis while including all different perspectives.

Table 22: Advantages and disadvantages of the used methods

Quantitative Analysis		**Qualitative Analysis**	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Offering objective representation of realized trips	Not being suitable to reveal multi-dimensional and causal TRSE process	Offering an understanding of individual perceptions and experiences	Being highly subjective and interpretive
Allowing to conduct a large extent analysis over different units	Not giving indications over individual abilities, constraints, and conditions	The target-specific/ purposive sampling	Having a time-consuming process of data collection
Being able to reflect spatial hotspots for TRSE	Not having secondary data tailor-made for TRSE	Having flexibility and depth in data collection	Having small spatial coverage

6. CONCLUSION

6.1. The Key Results

This study illustrated the transport-related social exclusion among the Dutch elderly by using a mix of qualitative and quantitative methods. This approach helped to explore the multidimensional and relational structure of TRSE by addressing the sub-objectives of the study from a top-down perspective. The key findings of these objectives are as follows:

To define transport-related social exclusion (TRSE) and the ageing population and to identify typical problems faced in different contexts: This sub-objective aimed to set the stage before starting the analysis by defining the TRSE, elderly, and by identifying the indicators based on the literature from different country contexts. Firstly, the elderly have been defined as people over the age of 60 due to the retirement age in the Netherlands and to offer comparability between different studies in future. Secondly, TRSE is understood as the inability of individuals to participate in social life due to lack or denial of access to their desired services, rights or activities that the majority of other people can access in the scope of this research. Also, the multi-dimensional, relational and dynamic structure of TRSE is emphasized while understanding TRSE. Finally, the relevant indicators have been identified to be used for answering the second sub-objective later on. Six main indicators are selected based on the literature analysis of 11 studies and the availability of the data. Trip frequency, travel distance, mode share, car ownership, driving license ownership, and reason for not travelling were selected as a result of this literature analysis.

To understand the travel behaviour of the elderly and the TRSE problem areas in the Dutch context: The first aim of this sub-objective is to understand TRSE based on the transport disadvantage revealed from the travel behaviour analysis of ODIN 2019 data. The travel behaviour analysis is conducted by comparing the different age groups based on selected indicators as a first step. This step demonstrated that the elderly, especially the 80+ age group, are more transport disadvantaged than other age groups. The second step of the analysis compared the travel behaviours of selected disadvantaged population groups based on the same indicators in both urban and rural areas. This step examined that females, people with a migration background and non-car owners are more at risk of transport-related social exclusion. This risk is associated with three dimensions of TRSE which are physical exclusion, geographical exclusion, and exclusion from facilities. Overall, rural areas were reported as experiencing more transport disadvantage and, therefore, being more at risk of exclusion than urban areas.

The second aim of the sub-objective is to identify the problem areas in the Netherlands based on the spatial analysis of the transport disadvantage index (TDI). This index is developed using the variables that show significant transport disadvantages based on the travel behaviour analysis. Although the spatial distribution over the postcode 4 zone areas did not indicate any spatial clustering, the municipality and COROP level analysis showed spatial relations. Based on the comparison of transport disadvantage of all elderly and based on the level of elderly TDI itself, Haaksbergen and Rotterdam are listed as one of the top problem areas.

To understand the TRSE perception and travel experiences of the elderly in the defined problem area: This sub-objective refers to undertaking a qualitative analysis to investigate the TRSE experience of the elderly. This has been achieved by conducting a semi-structured analysis that is set to understand the whole TRSE process of the elderly under five themes which are travel characteristics, mode choice factors, barriers faced while travelling, reasons for no travelling and unmet needs. The travel experiences under these themes which disagreed with the result of quantitative analysis, revealed that both urban and rural areas have different types of exclusions. Overall, in both Haaksbergen and Rotterdam, respondents signalled physical exclusion, economic exclusion, time-based exclusion, fear-based exclusion, and information exclusion in

their travel experiences. On the other hand, geographical exclusion, and exclusion from facilities are mainly observed in the results from the respondents in Haaksbergen while space exclusion risk is more evident in Rotterdam.

Compared to quantitative analysis, the qualitative analysis complemented the study by explaining the different causes and effects in travel experience, understanding the different dimensions of exclusion, and by capturing the travel experience in a dynamic manner. Confirming with quantitative analysis, the qualitative analysis demonstrated that non-car owners and immigrants are more at risk. These risks are mainly linked to the barriers of lack of transportation options, dependency on others, and language difficulties. Moreover, also female car users are defined as more disadvantaged due to their shorter travel range when driving validating the findings of quantitative analysis. Finally, contrary to the quantitative analysis, the qualitative analysis concluded that no TRSE relationship with age occurs but rather the ability of an individual is the main determiner of the TRSE.

6.2. Main Contributions of the Study

The first main contribution of this study is filling the gap in an under-researched area. Although transport-related social exclusion has been researched before in the Netherlands, this concept has never been studied by using the elderly as a target population. Considering the ageing population, this study has examined a topic that needed further understanding. The study, for the first time, explores the transport-related social exclusion of the Dutch elderly with all the causes and effects. By exploring this, the study brings reaching SDG targets 10.2[1] and 11.2[2] one step closer.

Another contribution of the study is demonstrating the importance of using a mixed method in TRSE studies, especially rather than solely relying on quantitative analysis. The literature consists significant share of research that analyzes TRSE based on quantitative analysis. This study stresses the importance of employing both quantitative and qualitative analysis by showing that each contributes to different understandings as explained in Section 5.5.1. Primarily, this methodology emphasizes that without both methods informing the TRSE analyses, the results may cause missing points or misinterpretations of an outcome.

Finally, the study highlights the necessity of disaggregated approach while studying a population group as a whole which is the elderly in the case of this study. The study has highlighted the complexities and diversities of the elderly group by elaborating on the differences between individuals who share similar age groups or socioeconomic characteristics. By observing the elderly transport exclusion as more than a mere reflection of physical frailty, it is possible to see the diverse underlying causes and effects (Walsh et al., 2021). This study underscored this by showing that the abilities are what determines the level of TRSE rather than the age of a respondent.

[1] SDG 10.2: "By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status" (United Nations, 2015, p.23)

[2] SDG11.2: "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons"(United Nations, 2015, p.24)

6.3. Ethical Considerations

Two main data have been used in this study both involving human participants. The ethical considerations relating to these data will be explained below separately.

Dutch National Travel Survey Data

The first data is Dutch National Travel Survey in 2019 (ODIN 2019) which requires "restricted access" to the public. For this purpose, access has been granted by Data Archive and Network Services" institute website with several conditions under license. Under this license, the proper citation of the data has been stated as: (Centraal Bureau voor de Statistiek (CBS); Rijkswaterstaat (RWS-WVL), 2020). This citation has been used following the license condition while introducing the data in this study. The survey is conducted by CBS which is an institution complying with the European Statistics Code of Practice. Accordingly, confidentiality, anonymity, and consent of the participants are ensured as in every other study. The survey does not reveal any personal information such as name or precise location. The participants are identified only by code numbers. The study has avoided generalizing over a whole population by only making interpretations based on the results of data.

The Interview Data

Informed Consent: The interview data is collected in the form of audio recording and/or note-taking with the consent of the participants. Before participating in this research, all respondents are informed about the research by reading the information leaflet. The verbal consent of the participants is taken for the interview participation, audio recording and/or note-taking before starting. Additionally, the consent for using the given answers in direct quotations in the research was also asked before the interview.

Voluntary Participation: Participants were aware that they could stop or reject the audio recording or contribution to the interview at any time. Therefore, the participation in the interview was purely voluntary and no incentive has been offered to the participants to avoid bias.

Right to Privacy: The purposive sampling was done in this study based on the objectives of the study. Therefore, the age group, migration background group, and gender are asked as personal data in the interview. All of this information is necessary for his study and justified based on the results of Chapter 3. No unnecessary personal data has been asked from the respondents. If unsolicited personal information about themselves or someone they know is given during the interview, this information is later on removed after the interview.

Confidentiality: The confidentiality of given data is ensured to the respondents before conducting the interview. They were aware that, the data collected by this study will not be used for any other purpose than this research. The participants are differentiated by their given identifier codes throughout the study. These codes are given immediately after the study and have not been shared with any other person or used software (ATLAS.ti 22).

The details of data management for both data can be found in Appendix E.

6.4. Limitations

Although this study has explained all the defined objectives successfully, several limitations to the study have been observed. These limitations are as follows:

- *The currency of data:* The quantitative analysis is conducted based on the 2019 data which is the only available recent data without the strong effect of Covid- 19 pandemic. Therefore, it was a limitation for this study to not being able to use the most up-to-date data, due to the pandemic-related changes in travel behaviour.

- *The data adaptability:* ODIN 2019 was able to explain the important share of transport-related social exclusion in this study. However, the primary aim of this survey was to provide information on the daily mobility of Dutch people. Therefore, the data had some limitations while explaining the TRSE. The first limitation is the missing variables in ODIN 2019 data that could bring a further explanation to TRSE. For example, some indicators such as indicators relating to affordability, reliability, or physical accessibility of the public transit systems does not exists in the data. Secondly, the data do not allow explaining the temporal component in this study. Because the sampling aims to provide generalizable content over the Dutch population, the number of respondents was not sufficient to make an inference over temporal analysis for the elderly.

6.5. Future Research and Recommendations

Three research areas and recommendations are presented for possible future studies as follows:

- *Understanding policy barriers:* This study was focused on the respondents from the general public. However, the policy level and organizational barriers might also be contributing to the relational framework of TRSE. An analysis directed to policy-makers and transport provider companies will help to reveal these barriers. Additionally, this analysis will also help to understand what is being done to achieve the inclusion of different vulnerable groups as well as understanding the political inclusion of the disadvantaged groups in transport decisions.
- *Additional quantification of the indicators:* A quantification of the transport-related social exclusion based on the explored factors would offer an understanding of how prevalent these factors are. Doing so will also help to analyze the spatial distribution of TRSE in a more multi-dimensional manner.
- *Defining the elderly as the target population:* This study defined the elderly based on the retirement age and common age preferred in other studies for the sake of comparability in future. However, because degrading abilities are one of the main determiners of TRSE, the definition of elderly should also be based on the changing ability levels in the new elderly group. Additionally, the retirement age is also changing based on the changing life expectancy (European Commission, 2021). Therefore, it is advised to conduct an analysis based on the elderly defined by the changes in their abilities and the timing of life-course events such as retirement.
- *The sampling of the disadvantaged groups:* While sampling this study has only considered migration background in three categories (Dutch, Western immigrant, and Non-western immigrant) based on the results of the quantitative analysis. Yet, analyzing the different nationalities under these groups could also contribute to different and more diverse travel experiences while assessing the factors of TRSE.

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8. APPENDICES

Appendix A.

	Name	Index Value Elderly Transport Disadvantage Index	Rank TDI without Trip Frequency	 TDI Gap	 TDI Gap without Trip Frequency
1	Hattem	0.65	1	2	1
2	Leiderdorp	0.64	2	5	10
3	Heerde	0.63	3	3	5
4	Rhenen	0.61	6	6	13
5	Delfzijl	0.61	7	8	7
6	Haaksbergen	0.59	9	11	8
7	Etten-Leur	0.56	14	12	26
8	Kerkrade	0.55	8	183	251
9	Bunnik	0.55	4	15	3
10	Bergeijk	0.55	15	1	2
11	Hendrik-Ido-Ambacht	0.55	16	13	31
12	Brunssum	0.55	18	18	47
13	Weesp	0.55	5	21	9
14	Brummen	0.54	22	4	6
15	Hulst	0.54	10	105	52
16	Mill en Sint Hubert	0.54	23	80	84
17	Heerlen	0.54	11	114	62
18	Staphorst	0.53	27	9	17
19	Simpelveld	0.52	34	97	117
20	Amsterdam	0.52	12	173	69
21	Ridderkerk	0.51	19	35	43
22	Leeuwarden	0.51	40	20	54
23	Opsterland	0.51	41	17	44
24	Noardeast-Fryslân	0.51	42	27	70
25	Rotterdam	0.50	25	50	75
26	Cuijk	0.50	46	14	34
27	Alphen-Chaam	0.50	47	10	18
28	Westervoort	0.50	26	29	33
29	Beek	0.49	13	7	4
30	Sliedrecht	0.49	57	56	180
31	Westerwolde	0.49	60	148	181
32	Rijssen-Holten	0.49	29	30	35
33	Uitgeest	0.48	30	19	20
34	Hardinxveld-Giessendam	0.48	71	32	99
35	Valkenburg aan de Geul	0.48	50	244	328
36	Dronten	0.48	33	25	24
37	Zaanstad	0.48	35	36	49
38	Utrecht	0.48	17	34	16
39	Landsmeer	0.48	80	46	48
40	Reimerswaal	0.48	20	85	55
41	Capelle aan den IJssel	0.48	38	166	103
42	Doesburg	0.48	83	53	59
43	Achtkarspelen	0.47	86	134	160
44	Bergen op Zoom	0.47	21	95	63
45	Medemblik	0.47	89	54	176
46	Vijfheerenlanden	0.47	43	60	89
47	Dongen	0.47	31	37	28
48	Lopik	0.47	104	55	177
49	Midden-Drenthe	0.46	48	45	66
50	Halderberge	0.46	51	239	178
51	Gulpen-Wittem	0.46	36	218	101
52	Veldhoven	0.46	28	137	25
53	Arnhem	0.46	54	79	115
54	Barendrecht	0.46	56	69	105

55	Bergen (L.)	0.46	59	333	320
56	Borger-Odoorn	0.45	131	88	104
57	Oss	0.45	61	52	80
58	De Fryske Marren	0.45	63	66	98
59	Krimpen aan den IJssel	0.45	64	39	51
60	Schiedam	0.45	65	208	138
61	Culemborg	0.45	44	23	15
62	Aa en Hunze	0.45	67	135	76
63	Geertruidenberg	0.45	68	216	146
64	Delft	0.45	32	158	124
65	Amstelveen	0.45	69	112	170
66	Boxmeer	0.45	144	16	41
67	Gouda	0.45	72	38	50
68	Westerveld	0.45	74	211	140
69	Beekdaelen	0.44	76	44	58
70	Het Hogeland	0.44	152	197	231
71	Tiel	0.44	77	101	151
72	Maassluis	0.44	109	68	46
73	Nuenen, Gerwen en Nederwetten	0.44	78	67	100
74	Weert	0.44	37	22	11
75	Bladel	0.44	85	24	23
76	Hollands Kroon	0.44	87	89	135
77	Almere	0.44	88	82	119
78	De Bilt	0.44	39	31	14
79	Alkmaar	0.44	90	33	40
80	's-Gravenhage	0.44	91	136	198
81	Zandvoort	0.44	92	270	211
82	Westerkwartier	0.44	94	146	83
83	Someren	0.43	96	189	257
84	Hoorn	0.43	97	251	193
85	Veenendaal	0.43	24	123	38
86	Grave	0.43	45	113	81
87	Haarlem	0.43	103	64	97
88	Hoogeveen	0.43	70	139	154
89	Vlissingen	0.43	49	41	21
90	Maasdriel	0.43	107	48	72
91	Beuningen	0.43	52	40	19
92	Loon op Zand	0.43	53	81	45
93	Edam-Volendam	0.43	197	131	159
94	Ouder-Amstel	0.42	111	115	64
95	Kapelle	0.42	113	171	241
96	Papendrecht	0.42	114	132	195
97	Lelystad	0.42	115	128	194
98	Stede Broec	0.42	116	110	168
99	Alphen aan den Rijn	0.42	121	78	114
100	Purmerend	0.42	122	99	147
101	Berkelland	0.42	123	75	112
102	Twenterand	0.42	124	106	161
103	Sluis	0.42	125	57	86
104	Vlaardingen	0.42	55	151	118
105	Montferland	0.42	203	93	116
106	Wormerland	0.42	126	28	32
107	Tholen	0.42	127	91	141
108	Woudenberg	0.42	58	43	22
109	Albrandswaard	0.42	128	124	190
110	Eemnes	0.42	129	102	152
111	Krimpenerwaard	0.42	62	92	61
112	Valkenswaard	0.42	133	74	110
113	Roermond	0.42	208	224	260
114	Nederweert	0.42	135	143	82
115	Ommen	0.41	136	63	96

116	Rijswijk	0.41	66	90	60
117	Noordoostpolder	0.41	218	76	209
118	Zwijndrecht	0.41	220	86	233
119	Pijnacker-Nootdorp	0.41	140	150	85
120	Steenbergen	0.41	143	174	111
121	Oude IJsselstreek	0.41	73	107	77
122	Terneuzen	0.41	145	181	249
123	Nissewaard	0.41	148	118	186
124	Duiven	0.41	149	83	123
125	Landgraaf	0.41	150	126	192
126	Olst-Wijhe	0.41	79	259	102
127	Tytsjerksteradiel	0.41	155	219	149
128	Aalsmeer	0.41	157	149	213
129	Helmond	0.41	117	212	228
130	Altena	0.41	158	187	256
131	Enkhuizen	0.41	81	59	36
132	Moerdijk	0.41	235	71	79
133	Waadhoeke	0.41	82	104	68
134	Dordrecht	0.40	84	96	65
135	Dinkelland	0.40	237	254	293
136	Zoetermeer	0.40	93	130	94
137	IJsselstein	0.40	164	152	219
138	Nijkerk	0.40	165	231	294
139	Wijk bij Duurstede	0.40	166	162	93
140	Pekela	0.40	95	61	12
141	Middelburg	0.40	172	157	223
142	Goes	0.40	177	194	262
143	Terschelling	0.40	180	26	88
144	Midden-Groningen	0.40	182	186	254
145	West Maas en Waal	0.40	183	70	107
146	Hilversum	0.40	98	155	122
147	Groningen	0.40	99	241	215
148	Hilvarenbeek	0.40	100	72	42
149	Leudal	0.40	101	179	144
150	Heerenveen	0.40	187	108	163
151	Diemen	0.40	102	236	205
152	Oldenzaal	0.39	189	145	208
153	Ooststellingwerf	0.39	190	156	222
154	Teylingen	0.39	191	47	67
155	West Betuwe	0.39	105	288	133
156	Tilburg	0.39	106	223	189
157	Schouwen-Duiveland	0.39	192	77	113
158	Noordwijk	0.39	193	49	74
159	Goeree-Overflakkee	0.39	108	51	27
160	Oostzaan	0.39	110	65	39
161	Meerssen	0.39	112	292	276
162	's-Hertogenbosch	0.39	118	138	106
163	Den Helder	0.39	119	209	175
164	Smallingerland	0.39	120	120	90
165	Gennep	0.39	201	109	166
166	De Ronde Venen	0.39	202	133	128
167	Oost Gelre	0.39	205	42	56
168	Sittard-Geleen	0.38	130	205	172
169	Gorinchem	0.38	134	176	139
170	Waddinxveen	0.38	212	117	183
171	Harderwijk	0.38	214	147	212
172	Doetinchem	0.38	275	116	281
173	Heemstede	0.38	216	165	235
174	Losser	0.38	277	275	306
175	Woensdrecht	0.38	254	129	244
176	Wassenaar	0.38	138	237	206
177	Velsen	0.38	139	180	145

178	Zwartewaterland	0.38	142	160	126
179	Overbetuwe	0.38	221	210	278
180	Waterland	0.38	223	175	243
181	Voorst	0.37	146	121	91
182	Hellendoorn	0.37	147	84	53
183	Venray	0.37	232	141	203
184	Drimmelen	0.37	233	111	169
185	Huizen	0.37	151	119	87
186	Wierden	0.37	153	62	37
187	Bernheze	0.37	154	164	131
188	Heemskerk	0.37	156	199	164
189	Venlo	0.37	159	188	153
190	Westvoorne	0.37	162	177	142
191	Opmeer	0.37	240	103	155
192	Drechterland	0.37	241	87	132
193	Hoeksche Waard	0.37	243	226	157
194	Winterswijk	0.37	244	182	250
195	Aalten	0.37	245	220	284
196	Bunschoten	0.37	163	273	253
197	Uithoorn	0.37	132	215	130
198	Hardenberg	0.37	246	168	238
199	Langedijk	0.36	167	169	136
200	Voorschoten	0.36	168	184	148
201	Berg en Dal	0.36	169	140	108
202	Best	0.36	170	178	143
203	Nunspeet	0.36	171	100	185
204	Leiden	0.36	173	306	296
205	Landerd	0.36	174	58	120
206	Veendam	0.36	175	191	229
207	Utrechtse Heuvelrug	0.36	176	192	158
208	Ede	0.36	178	233	201
209	Maasgouw	0.36	304	94	247
210	Stein	0.36	181	142	109
211	Molenlanden	0.36	251	125	191
212	Epe	0.36	253	246	304
213	Breda	0.36	184	228	197
214	Nijmegen	0.36	185	265	240
215	Assen	0.36	186	204	171
216	Zevenaar	0.36	188	163	129
217	Beesel	0.36	141	280	216
218	Neder-Betuwe	0.36	257	255	312
219	Uden	0.36	258	299	331
220	Hillegom	0.36	260	332	317
221	Amersfoort	0.36	194	170	137
222	Geldrop-Mierlo	0.35	195	309	298
223	Katwijk	0.35	198	227	196
224	Barneveld	0.35	199	161	127
225	Oosterhout	0.35	200	185	150
226	Zaltbommel	0.35	264	279	326
227	Hellevoetsluis	0.35	204	221	187
228	Leidschendam-Voorburg	0.35	206	248	225
229	Schagen	0.35	207	230	199
230	Kaag en Braassem	0.35	209	285	268
231	Putten	0.35	323	229	334
232	Leusden	0.34	210	222	188
233	Emmen	0.34	211	305	295
234	Dantumadiel	0.34	276	144	207
235	Enschede	0.34	215	318	311
236	Boekel	0.34	137	167	57
237	Westland	0.34	217	206	173
238	Almelo	0.34	219	243	218

239	Soest	0.34	222	232	200
240	Horst aan de Maas	0.34	224	213	179
241	Gemert-Bakel	0.34	225	290	273
242	Zwolle	0.34	226	200	165
243	Rheden	0.34	227	190	156
244	Eindhoven	0.34	228	297	283
245	Raalte	0.34	229	127	92
246	Houten	0.34	230	245	221
247	Peel en Maas	0.34	231	154	121
248	Laren	0.34	75	203	29
249	Apeldoorn	0.34	234	268	245
250	Nieuwkoop	0.34	330	307	346
251	Stichtse Vecht	0.34	288	198	264
252	Wageningen	0.33	236	321	315
253	Steenwijkerland	0.33	290	304	270
254	Laarbeek	0.33	160	296	184
255	Bodegraven-Reeuwijk	0.33	238	253	227
256	Gooise Meren	0.33	161	303	78
257	Meierijstad	0.33	239	234	202
258	Rozendaal	0.33	293	73	30
259	Maastricht	0.33	247	334	333
260	Hof van Twente	0.33	298	202	274
261	Kampen	0.33	249	284	267
262	Blaricum	0.33	301	319	291
263	Harlingen	0.33	305	343	340
264	Roosendaal	0.33	306	261	314
265	Haarlemmermeer	0.33	252	289	272
266	Midden-Delfland	0.32	255	201	167
267	Heiloo	0.32	256	159	125
268	Heusden	0.32	309	249	307
269	Heerhugowaard	0.32	259	235	204
270	Oldambt	0.32	312	214	280
271	Ermelo	0.32	196	262	134
272	Sint-Michielsgestel	0.32	262	301	289
273	Beverwijk	0.32	263	300	287
274	Rucphen	0.32	265	238	210
275	Echt-Susteren	0.31	266	272	248
276	Wijchen	0.31	267	311	301
277	Koggenland	0.31	268	207	174
278	Zeist	0.31	269	295	282
279	Waalwijk	0.31	270	283	266
280	Zuidplas	0.31	271	240	214
281	Veere	0.31	272	322	319
282	Baarn	0.31	320	325	344
283	Cranendonck	0.31	335	172	288
284	Zundert	0.31	322	250	308
285	Oisterwijk	0.31	273	330	329
286	Borne	0.31	274	314	303
287	Texel	0.31	179	267	226
288	Buren	0.31	326	337	347
289	Renkum	0.31	278	276	259
290	Dalfsen	0.30	344	98	252
291	Noordenveld	0.30	279	258	236
292	Weststellingwerf	0.30	280	331	330
293	Stadskanaal	0.30	329	225	290
294	Deventer	0.30	281	315	305
295	Bronckhorst	0.30	282	286	269
296	Hengelo	0.30	283	310	300
297	Scherpenzeel	0.30	285	256	232
298	Gilze en Rijen	0.30	286	217	182
299	Lingewaard	0.30	287	266	242
300	Nieuwegein	0.30	289	327	324

301	Lisse	0.30	333	153	220
302	De Wolden	0.30	291	242	217
303	Appingedam	0.30	242	193	71
304	Meppel	0.29	318	302	318
305	Bergen (NH.)	0.29	294	269	246
306	Vaals	0.29	295	344	345
307	Súdwest-Fryslân	0.29	296	291	275
308	Heeze-Leende	0.29	334	340	348
309	Woerden	0.29	297	260	237
310	Oirschot	0.29	248	335	292
311	Voerendaal	0.29	299	346	323
312	Zutphen	0.29	300	323	321
313	Oudewater	0.29	302	196	162
314	Brielle	0.29	213	271	95
315	Bloemendaal	0.29	303	274	255
316	Sint Anthonis	0.29	250	351	349
317	Coevorden	0.29	307	257	234
318	Borsele	0.29	310	338	337
319	Goirle	0.28	311	329	327
320	Tubbergen	0.28	341	277	325
321	Lochem	0.28	313	247	224
322	Elburg	0.28	314	324	322
323	Mook en Middelaar	0.28	342	281	230
324	Lansingerland	0.28	317	298	286
325	Eersel	0.28	319	282	265
326	Montfoort	0.28	321	336	335
327	Castricum	0.27	336	122	277
328	Heumen	0.27	325	264	239
329	Tynaarlo	0.27	327	294	279
330	Eijsden-Margraten	0.27	328	287	271
331	Zoeterwoude	0.27	345	195	263
332	Zeewolde	0.26	346	263	316
333	Son en Breugel	0.26	331	339	338
334	Vught	0.26	332	320	313
335	Oldebroek	0.26	292	252	261
336	Beemster	0.26	347	313	339
337	Druten	0.25	324	345	285
338	Waalre	0.25	337	312	302
339	Oegstgeest	0.25	338	342	343
340	Boxtel	0.25	308	326	258
341	Noord-Beveland	0.25	339	316	309
342	Haaren	0.25	261	278	73
343	Asten	0.25	340	317	310
344	Roerdalen	0.24	315	328	332
345	Alblasserdam	0.24	316	293	299
346	Reusel-De Mierden	0.23	284	350	336
347	Deurne	0.20	343	347	342
348	Loppersum	0.20	351	349	351
349	Wijdemeren	0.20	349	341	341
350	Renswoude	0.17	348	352	352
351	Baarle-Nassau	0.17	352	348	350
352	Ameland	0.17	350	308	297

Appendix B

	Name	Index Values	Rank		
		Elderly Transport Disadvantage Index	TDI without Trip Frequency	TDI Gap	TDI Gap without Trip Frequency
1	Zaanstreek	0.65	1	1	2
2	Delfzijl en omgeving	0.65	5	9	5
3	Zeeuwsch-Vlaanderen	0.62	2	33	37
4	Groot-Rijnmond	0.61	3	2	7
5	Groot-Amsterdam	0.60	4	5	13
6	Zuid-Limburg	0.56	6	25	33
7	Flevoland	0.54	7	13	21
8	Noord-Friesland	0.53	9	3	8
9	Overig Groningen	0.53	10	12	19
10	Zuidoost-Zuid-Holland	0.52	11	11	17
11	Kop van Noord-Holland	0.51	12	17	29
12	Zuidoost-Friesland	0.49	17	22	32
13	Zuidwest-Gelderland	0.47	18	28	36
14	Agglomeratie Haarlem	0.47	19	4	10
15	West-Noord-Brabant	0.47	21	14	25
16	Agglomeratie 's-Gravenhage	0.46	8	31	24
17	Oost-Zuid-Holland	0.43	13	16	9
18	Delft en Westland	0.43	14	10	6
19	Het Gooi en Vechtstreek	0.43	15	8	4
20	Utrecht	0.42	16	6	1
21	Midden-Noord-Brabant	0.40	20	32	26
22	Overig Zeeland	0.40	22	36	30
23	Noordoost-Noord-Brabant	0.38	23	24	16
24	Oost-Groningen	0.37	37	21	31
25	Arnhem/Nijmegen	0.37	24	23	15
26	Noord-Limburg	0.37	25	19	12
27	Achterhoek	0.36	38	15	27
28	Veluwe	0.36	26	34	28
29	Zuidwest-Friesland	0.36	40	35	40
30	Midden-Limburg	0.36	27	18	11
31	Agglomeratie Leiden en Bollenstreek	0.36	28	20	14
32	Zuidwest-Drenthe	0.35	29	40	39
33	IJmond	0.35	30	30	23
34	Alkmaar en omgeving	0.34	31	7	3
35	Noord-Drenthe	0.34	32	27	20
36	Zuidoost-Noord-Brabant	0.34	33	37	34
37	Twente	0.32	34	38	35
38	Zuidoost-Drenthe	0.31	35	39	38
39	Noord-Overijssel	0.30	36	26	18
40	Zuidwest-Overijssel	0.29	39	29	22

Appendix C
Consent & Information Leaflet

Aim
This interview aims to understand the travel experience of the elderly such as how they travel, the travel choices they made, or the obstacles they face. It also aims to analyze the possible transport-related social exclusion among the elderly.

About the Research
The interview will take around 5-10 minutes. There are no wrong answers to the directed questions. The interview will be used as part of the MSc. thesis research of the interviewer under the University of Twente, Urban Planning and Management program.
For mentioned research purpose, this interview will be voice recorded in addition to note-taking for better text analysis.

Privacy
In this research, participation is completely voluntary. All data will be used anonymously. The data processing will comply with the European Union General Data Protection Regulation (GDPR).

By accepting to participate in this study you agree to the following statements:
- I understand the given study information.
- I consent voluntarily to participate in this study and understand that I can refuse to answer questions and withdraw from the study at any time, without having to give a reason.
- I understand that the given information can be and will be used for this research purpose and not for any other purpose.
- I understand that this research will not mention identity revealing information such as my name and all data will be anonymized in the research. This data will not be shared beyond the interview team.
- I consent that this interview will be recorded by voice recording and note-taking methods while I reserve the right to terminate my consent on the recording of my information. Later, this recording will be transcribed yet all the data will be anonymized by the interviewer.
- I consent that the information I give can be used as quotations in research outputs.

Interview Guide

Q1. Could you please tell me about your trip making?

Which places do you go to?

How do you go to these places?

Q2. Do you always prefer the same transportation modes to go to these places?

Why do/don't you prefer other modes?

Are you able to use other modes? For how long?

Are the other modes available to you (car, bike, PT)?

Do you travel alone or need assistance for your trips?

Q3. Do you experience any problems or obstacles related to the trips you are making?

[e.g. transport cost, availability or scheduling of public transit line, too many stairs, slope,]

If there are, could you give examples of them?

Q4. Do you think you can travel as many times as you want or need?

If not, could you tell me why you cannot?

Q5. Are you able to travel to any place you want whenever you want/need?

If not, could you tell me why you cannot?

Q6. How do you think your travel experience could be improved?

Q7. Have you ever decided to avoid a trip?

Could you describe to me these situations and the reasons for them?

Q8. Have you ever experienced a situation where you couldn't participate in an activity or missed an opportunity due to not being able to access a place?

Q9. Do you experience any negative effects from traveling or transportation systems?

[e.g. noise, air pollution]

How do you experience these effects?

SCREENING QUESTIONS

1. Age:

- ☐ 60-65
- ☐ 65-69
- ☐ 70-74
- ☐ 75-79
- ☐ 80+

2. Gender:

☐ Male ☐ Female

3. What is your migration status?

- ☐ Dutch background
- ☐ Western migration background
- ☐ Non-western migration background

Note: The questions are ordered for reference purposes in this document. The order and the structure of the questions varied depending on the flow of the interview in the field.

Appendix D

Code Network for Travel Characteristics (Q1)

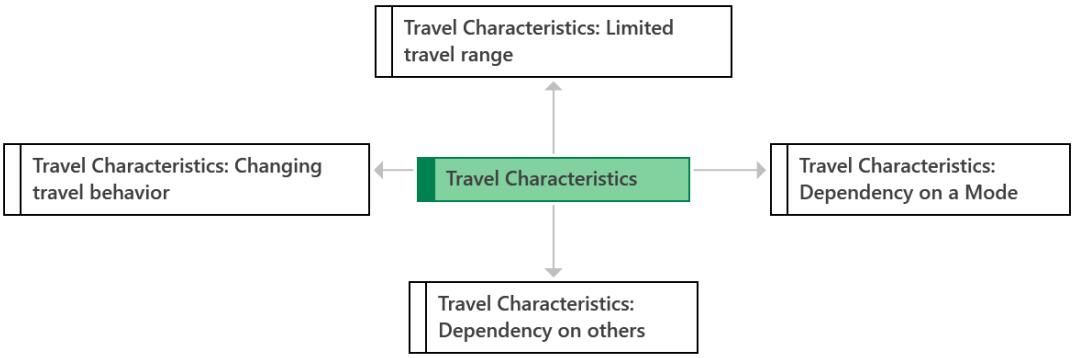

Figure 24: Haaksbergen & Rotterdam Travel Characteristics Network

Code Network for Mode Choice(Q2)

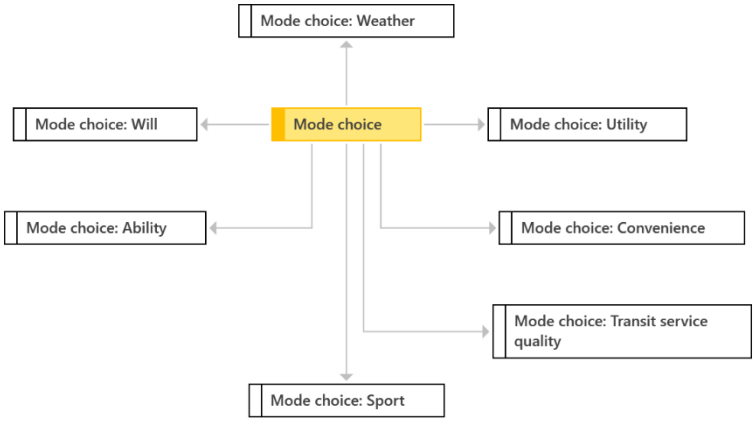

Figure 26: Haaksbergen Mode Choice Network

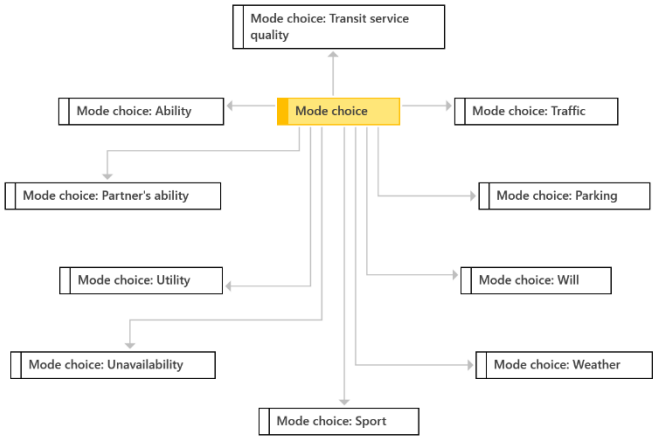

Figure 25:Rotterdam Mode Choice Network

Code Network for Barriers/Problems(Q3&Q9)

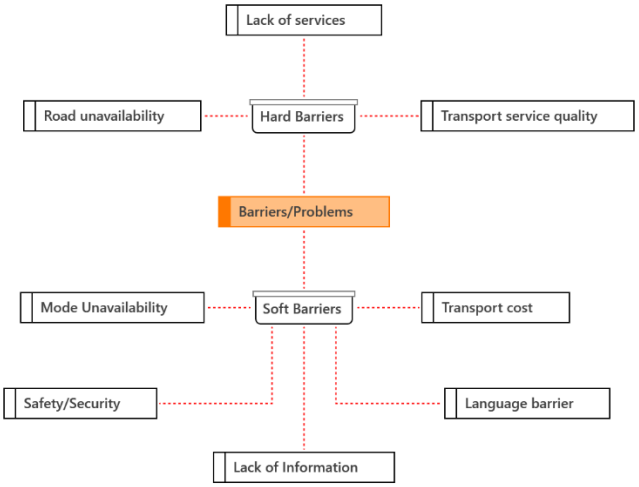

Figure 28:Haaksbergen Barriers/Problems Network

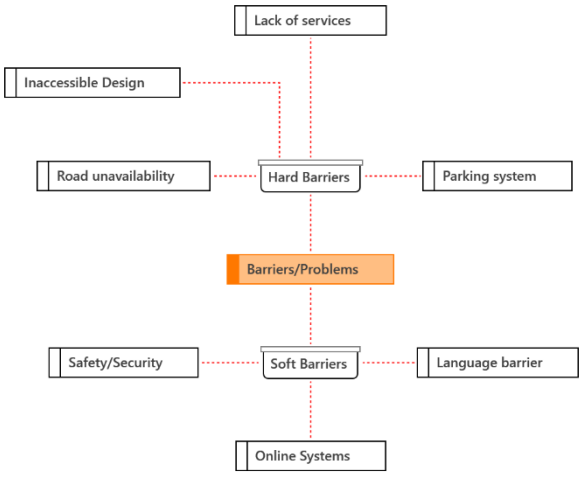

Figure 27:Rotterdam Barriers/Problems Network

Code Network for Reason for not Traveling(Q4,Q5&Q7,Q8)

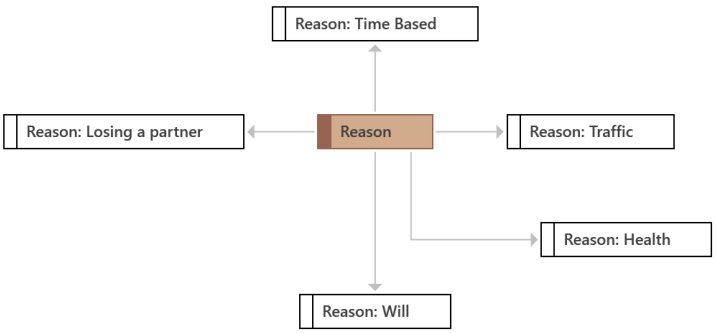

Figure 29: Haaksbergen Reasons Network

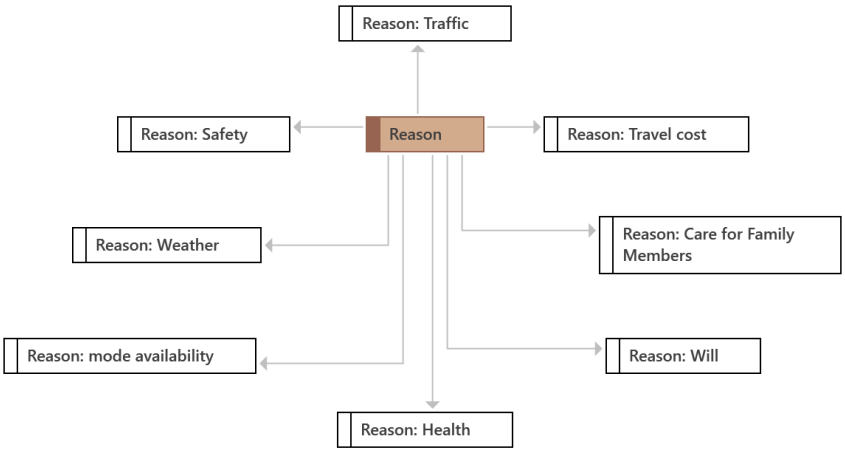

Figure 30: Rotterdam Reasons Network

Code Network for Travel Needs(Q6)

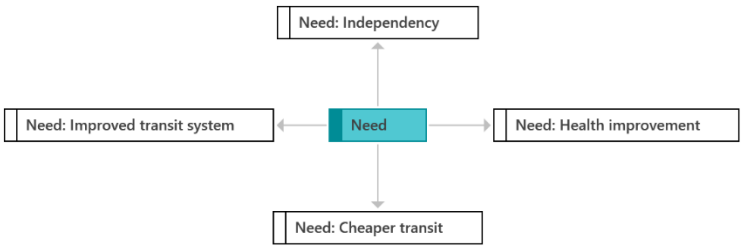

Figure 31: Haaksbergen Needs Network

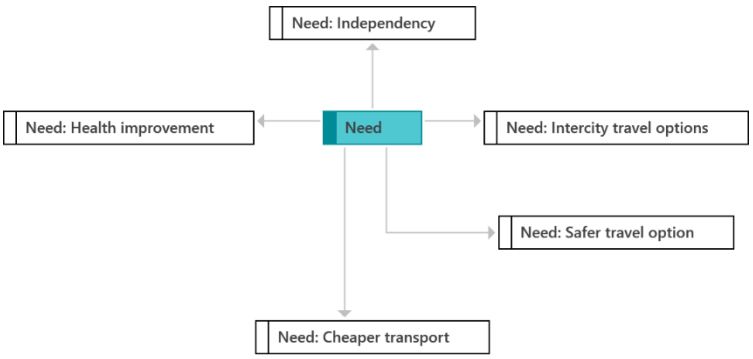

Figure 32: Rotterdam Needs Network

Appendix E

Data Management Plan

Data Sources	Dutch National Travel Survey (ODIN 2019) Interview
Permission to Use the Data	Survey data is obtained from CBS and permission is only given for this research purposes. Similarly, because the interview guide includes sensitive data e.g. migration background, permission is only asked for use under this research purpose.
Data storage and back-up	Both data are stored on a personal computer and backed up on a personal hard drive and one drive cloud. The computer and hard drive can only be accessed by the researcher and are password protected.
Organization of data during the project (e.g. Folder structure & names)	\MSc Thesis_Data Management\Qualitative\Interview\Haaksbergen 30 May\Recordings As represented above, separate files are created for qualitative and quantitative. Also, different folders are used based on the study area and the date of the interview. This helps to easier identification of different files. For the anonymity of recordings and transcriptions files, a key code has been created for each respondent to avoid using the respondents' name. Also, participants are addressed by these codes while reporting the results (e.g. RABF80).
Data preservation and archiving	Data will be securely archived under University of Twente data repository.
Metadata	Detailed descriptive metadata is available for the survey data. For the interview data, a description of the interview progress has been made in the thesis. Additionally, a checklist describing the interview process is also provided in the research.
Is there a missing metadata	No

The Quality of data regarding:
• Accuracy
  ○ Positional
  ○ Temporal
  ○ Thematic
• Completeness
• Consistency
	<u>Quality</u>
	Although both temporal and spatial components exist in the provided survey data, only spatial is being used in this research. The highest spatial accuracy for the data in this research is in the extent of postcode 4 areas.
	The interview data does not involve and aim to collect spatial or temporal information.
	<u>Completeness & Consistency</u>
	Missing or misinterpreted answers are already removed from the quantitative analysis by the author (CBS). Therefore, no missing data exist in the provided final product.
	None of the questions directed in the interviews were rejected by the respondents and all were explained as deeply as possible.
	Inconsistently answered questions are redirected to the participants for further explanation.