

Article

Barriers to Changing Travel Modes: A Case Study of Reykjavík, Iceland

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Abstract

Transportation remains one of the sectors with the highest GHG emissions in urban areas, forming around a third of household footprints in affluent countries like the Nordics and being the main source of particulate matter emissions in urban areas around the world. This study focuses on the Reykjavík Capital Area in Iceland, which is known for its car-centricity and where modal shift remains a major challenge. The study examines barriers to modal shift to understand why Reykjavík residents are reluctant to change their transport modes away from private cars. The study uses softGIS survey data gathered in 2025 of 1801 respondents. The results show that mobility remains car-dominated, with even regular public and active-mode users owning a car for running errands. The main barriers for switching to public or active modes include long travel distances, high travel time need, an unreliable public transport system, and difficulties running errands. Slight differences emerged between native and non-native residents' barriers, with the latter being more likely to be impacted by price and connectivity issues. The study further recognizes the potential impact of climate awareness and education, as people with a stronger belief in individual impact on climate were less likely to find these aspects to be a barrier.

Keywords: urban transport; modal shift; barriers to change; urban mobility; transportation

1. Introduction

Mobility is essential in daily life, yet our heavily fossil-based transport systems still result in high emissions, especially among high-income countries. Transportation emissions are estimated to form about 22% of CO₂ emissions globally [1], or over 30% in Europe, in 2023 [1]. In the Nordic region, transportation emissions are on average higher than globally or elsewhere in the region [2]. It is estimated that around 30% of household footprints are allocated to mobility in affluent countries like the Nordics [3–5]. It is clear that the need for emissions reductions is urgent. Furthermore, private cars are a significant cause of particulate matter emissions [6,7] and related health problems in urban areas around the world [7–9], as well as transport safety problems [10–12]. Moving forward, transportation systems should prioritize active modes and public transport, with a special emphasis on access to essential services and opportunities without needing a car [5]. Understanding local conditions could enhance planning for better-informed policies that tackle emissions from mobility efficiently [13].

This study focuses on the Reykjavík Capital Area in Iceland, which is known for its car dependency both in infrastructure and mobility behaviour. Car ownership is seen as a



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social norm, and few see it possible to live without a car [14]. A recent study shows low active mode and public transport use, with most commuting done by car. These transport mode patterns also result in the highest local travel footprint estimate among the Nordics at 1.26 tCO₂eq [13]. A recent Gallup survey [15] on travel modes to and from work indicated similar patterns as have been observed in research. Nearly 65% of adults travel by car as drivers to work or school and 5% as passengers in a car, so the total share of private cars as a mode of transport is 70%. Public transportation (buses) is used by 8% of adult residents of Reykjavík, and the share of active modes of transport is 22% [15]. At the same time, Reykjavík has already made reducing car travel a priority in the municipal plan in 2014 [16]. Combined with the existing modal split, the Reykjavík Capital Area provides an interesting and a globally valuable case study on the barriers hindering change.

Previous studies into barriers to modal shift in urban areas highlight different factors in shifting to active transport and to public transport. More studies have focused on barriers to shifting to active modes than on public transport. Common barriers for active transport include various infrastructural challenges such as poor connectivity of cycling paths [17–21], long travel distances and time (i.e., [18,21–23]), and road/traffic safety (i.e., [17,18,21,24]). Sociocultural norms such as pre-existing car-oriented lifestyles [19,23] or the lack of cycling culture [21,24,25] can be further deterrents to using active transport modes. Other barriers include weather [18,26] and necessity to run errands [22,26]. Older adults, people with disabilities, and ethnic minorities were more likely to report lack of skills and knowledge as a barrier to switching to active travel [20,24,25]. Marginalized groups [24], elderly [20] and parents [17,25] emphasized the lack of safety as a barrier for using active modes. Females were more likely to be positive about a shift to active modes [21,24] but could be faced with a lack of opportunity to choose active modes due to societal and cultural norms, which was more evident in studies from Middle Eastern countries [21,23].

Similarly to barriers for shifting to active modes, public transportation barriers found in previous research have included travel distance and time [22,27,28] and connectivity [27,29]. Also similarly, women and elderly people were more likely to have a positive outlook on public transport use and accessibility [27,30], while people with disabilities were more likely to experience inaccessibility to public transport due to infrastructure, lack of information, and negative societal experiences [31]. Several studies mention that public transport shifts need to focus on user needs, including aspects like improving accessibility, connectivity, ease of use [22,29,32,33], reliability [29,32,34], and service quality, including aspects such as travel time [22,27,28,34], convenience, efficiency [23,27,34,35], frequency [28,32,34], safety [32,34–36] and comfort [23,32,36]. One of the biggest challenges of shifting to public transport may be pre-existing negative perceptions of public transport [23,27–29,31,35]. In addition, existing urban infrastructure can pose a challenge to using public transport [28,30,31]. Cost is not a strong hindrance in some studies [30,34,35], as there are indications that users are willing to pay more for an efficient and functional public transport system [30,34,35]. However, one study in Iceland notes that high public transport ticket prices were a hindrance to some in using it [14].

Although there have not been specific studies done in Iceland focusing on barriers to travel mode shifts, several studies have analysed what background factors might influence mode choice. Studies have indicated that those who are more prone to using a car live further from the city centre [14,37,38], are more likely to have kids [14] and could exhibit less climate concern [13]. Public transport ticket prices have been noted as a potential deterrent, as well as its bad reputation, or reputation as a mode for young, poor and the elderly only, which might even put a stigma on a user [14]. There are also considerable indications that the public transportation network is not meeting the daily needs of Reykjavík Capital Area residents [38]. When asked to prioritize how they would most prefer to travel to work,

most, 41%, said they would prefer to travel by private car, followed by walking at 25%; 17% would prefer to travel by bicycle/electric bicycle, and only 7% by bus [15]. This indicates an overall disbelief in the public transportation system.

In this light, the aim of this study is to better understand the challenges the Reykjavík Capital Area faces in its transition to a more sustainable transportation system. Thus, the focus of this study is on what the barriers are to changing transport behaviour away from a private car and towards public or active transport. This study uses data gathered in 2025 from a softGIS survey, a survey combining traditional survey questions and map exercises [39], totalling at 1801 responses. This study contributes to the existing body of literature on travel mode choice by examining a lesser-studied sub-topic of barriers to change. Furthermore, the dataset is rich with background data, including, e.g., climate concern level questions, citizenship status, disability status, and other such aspects that typically are missing from datasets utilized in similar studies elsewhere, therefore providing valuable information about the importance of understanding these aspects. The Reykjavík Capital Area is also a very particular location in terms of its weather, which is challenging for spending time outdoors due to cold temperatures and high precipitation and wind rates. Learning from the barriers in such a location, and about how to potentially overcome them, can be valuable in other locations with overall less harsh conditions but with one or more similar outdoor conditions related hindrances to overcome. Moreover, the scarcity of studies related to the barriers to changing transport behaviour towards public and active transport means that more case studies are needed to understand which barriers might be more global in nature and which relate more to local conditions.

2. Materials and Methods

2.1. Study Area

The study focuses on the Reykjavík Capital Area in Iceland (hereon referred to as the Capital Area; in Icelandic: *Höfuðborgarsvæðið*), which is home to nearly 2/3 of the country's population (about 250,000 people) [40]. The city is sprawled and relatively low in both its population and built environment density. Reykjavík's geographical conditions form a setting with multiple challenges in transport. Reykjavík itself surrounds a central peninsula, with no tunnels or bridges to connect the outskirts to the centre. The city is heavily car-oriented, with the city bus being the only public transport option available [14,37,41]. The sub-polar country's oceanic climate is characterized by mild temperatures throughout the year but with large amounts of precipitation and strong winds due to its location in the Northern Atlantic Ocean, which may hinder the use of active modes [42]. Locally, it is a common saying that the car is like the jacket of an Icelandic.

2.2. Data Collection and Overview

The aim of the survey was to gain an understanding of the habits and barriers to change regarding transportation and recycling behaviour among adult residents of the Capital Area. The survey was conducted in February–March 2025 using a softGIS method, which included regular types of survey questions and map-based questions [39], totalling at 101 questions. The questions covered a variety of topics: transportation habits and barriers to change, recycling habits and barriers to change, climate concern, life satisfaction, socio-demographic background, and map-based questions on home location, work location, recycling stations and frequently visited locations within the Capital Area. The survey was distributed by the City of Reykjavík via multiple social media platforms and social media ad campaigns in Icelandic, English and Polish. It was also shared in Facebook groups for foreigners in order to reach the foreign population and shared to mailing lists for queer,

disabled and elderly communities in the Capital Area. Small posters in Icelandic and English were hung in some public places like libraries and pools around the Capital Area.

Informed consent for using the data for research was gathered from each survey respondent. Before starting the survey, respondents were made aware of the purposes of the survey, its data processing procedures, and its anonymity clauses. They were presented with a tick-box question showing agreement and understanding of the prior points. There was a small prize lottery for those who had completed the survey entirely, and it was optional to participate in that by voluntarily entering their email. Similarly, it was voluntary to agree to participating in future studies by entering their email. Before data analysis, the emails were removed from the sample and stored separately to ensure that the collected data could not be traced back to any individual. This was also stipulated specifically in a data processing agreement between the City of Reykjavík and the University of Iceland.

Overall, the survey collected 1801 responses from across the Capital Area, the majority of which were residents of the City of Reykjavík. The average respondent was 42.33 years old and was female, with a household size of 2.82 people, a university education, and a net personal income between 516,000 and 562,000 ISK (~3550 and 3880 €). Below we provide some basic information about the sample together with a comparison of the sample to national statistics (or to Capital Area statistics when available) (Table 1). The sample is about 1% of the population of the Capital Area. The sample was slightly more female-leaning than the national average and more highly educated, although there is a gap in higher education attainment between the Capital Area and the rest of the country [43]. The survey captured only a small portion of people with a basic education level. Other means were comparable to the national averages (Table 1).

Table 1. Overview of the key socio-demographic variables of the survey sample used in the study with a comparison to national (*) or Capital Area (**) statistics. Comparison data obtained from Statistics Iceland, each source referenced in the table in brackets. Income converted into Euros in brackets for comparison using the conversion rate 1 EUR = ~145 ISK, which is based on the average conversion rate over the past year [44].

	Survey Sample	National * or Capital Area Statistics **
Sample size/population	1801	383,726 (304,428 adult) * ([44]) 194,725 ** ([45])
Age	42.33	43 * (adult population) ([44])
Gender	Female 56.4% Male 42.9% Nonbinary/other 0.5%	Female 48.8% ([45]) Male 51.1% ([45]) Nonbinary/other 0.06% ([45])
Household size	2.82	2.73 ** ([46])
Education level	Basic 3.1% Secondary/vocational 23.8% University level 64.2%	Basic 24.1% ([47]) Secondary/vocational 35.3% ([47]) University level 40.6% ([47])
Net personal income	Between 516,001 and 562,000 ISK (~3550 and 3880 EUR)	617,131 ISK ** ([48]) (~4260 EUR) 568,250 ISK * ([48]) (~3920 EUR)
Icelandic vs. foreign citizens	Icelandic 81.4% Foreign 18.6%	Icelandic 82.6% ([49]) Foreign 18.2% ([49])

2.3. Statistical Analyses

The data was analysed using binomial and multinomial logistic regression models. The analysis was conducted in two parts. First, the main mode choice was examined, and second, the barriers to switching the main mode were examined. Each regression model

produced Odds Ratios, which explain the relative likelihood of choosing a given mode or, alternatively, barriers to switching modes. The analyses included various socio-demographic background variables, spatial variables such as distance to work, and attitudinal variables related to climate concern and barriers to changing transport modes. All models were checked for internal multicollinearity and amended as needed. All analyses were conducted with a combination of tools within R 4.4.3, IBM SPSS Statistics 31.0.0.0 and Jamovi 2.6.44.

2.3.1. Socio-Demographic Variables

A variety of socio-demographic background variables were included in the models: age, education level, weekly working hours, job type, household income level, gender, kids in household (binary), citizenship (Icelandic vs. non-Icelandic), and disability status (binary). Education level was split into low (basic and secondary), medium (bachelor's level and professional education), and high (master's degree and doctoral degree).

Income level was transformed into income level per consumption unit based on the number of consumption units in the household. Personal and household income were asked in the survey in income deciles. The household income deciles were then assigned numerical values based on middle points of the deciles (Table 2), and the values were then used to calculate household income per consumption unit. The consumption unit is based on OECD guidelines and assigns residents of a household different weights to better account for shared expenses [50,51]:

- First adult aged 18 and over = 1.0;
- Subsequent adults aged 18 and over = 0.7;
- Each person aged under 18 = 0.5.

Table 2. Monthly net personal and household income groups used in the survey and their respective monetary middle-points, which were used to calculate income per consumption unit [50,51]. Income converted into Euros in brackets for comparison, using the conversion rate 1 EUR = ~145 ISK, which is based on the average conversion rate over the past year [44].

Income Decile	Personal Income Decile	Personal Income for Calculating	Household Income Decile	Household Income for Calculating
1	Below 235,000 ISK	235,000 ISK (~1621 EUR)	Below 616,000 ISK	616,000 ISK (~4248 EUR)
2	235,001–379,000 ISK	307,000 ISK (~2117 EUR)	616,001–848,000 ISK	732,000 ISK (~5048 EUR)
3	379,001–429,000 ISK	404,000 ISK (~2786 EUR)	848,001–913,000 ISK	880,500 ISK (~6072 EUR)
4	429,001–476,000 ISK	452,500 ISK (~3117 EUR)	913,001–975,000 ISK	944,000 ISK (~6510 EUR)
5	476,001–516,000 ISK	496,000 (~3421 EUR)	975,001–1,175,000 ISK	1,075,000 ISK (~7414 EUR)
6	516,001–562,000 ISK	539,000 (~3717 EUR)	1,175,001–1,267,000 ISK	1,221,000 ISK (~8421 EUR)
7	562,001–606,000 ISK	584,000 ISK (~4028 EUR)	1,267,001–1,388,000 ISK	1,327,500 ISK (~9155 EUR)
8	606,001–672,000 ISK	639,000 ISK (~4407 EUR)	1,388,001–1,520,000 ISK	1,454,000 ISK (~10,028 EUR)
9	672,001–758,000 ISK	715,000 ISK (~4931 EUR)	1,520,001–1,708,000 ISK	1,614,000 ISK (~11,131 EUR)
10	758,001–979,000 ISK	868,500 ISK (~5990 EUR)	1,708,001–2,312,000 ISK	2,010,000 ISK (~13,862 EUR)
11	979,001–1,300,000 ISK	1,139,000 ISK (~7,855 EUR)	2,312,001–2,600,000 ISK	2,456,000 ISK (~17,241 EUR)
12	More than 1,300,000 ISK	Grouped together with previous	More than 2,600,000 ISK	Grouped together with previous

The household income was divided by the sum of how many people were in the household, using the abovementioned weights to get net household income per consumption unit (CU) based on the household composition reported in the survey. The resulting incomes per CU were then re-split into new income deciles, which were used in the analyses (Table 3).

Table 3. Income deciles with updated value ranges, which were used for analyses. The table shows net monthly household income per capita, calculated using consumption unit weights assigned to each household member [50,51]. Income converted into Euros in brackets for comparison, using the conversion rate 1 EUR = ~145 ISK, which is based on the average conversion rate over the past year [44].

Income Decile	Monthly Household Income per Capita (1 EUR = ~145 ISK)
1	<303,621 ISK (~2094 EUR)
2	303,622–362,353 ISK (~2095–2499 EUR)
3	362,354–410,667 ISK (~2500–2832 EUR)
4	410,668–448,333 ISK (~2833–3092 EUR)
5	448,334–517,941 ISK (~3093–3572 EUR)
6	517,942–603,409 ISK (~3573–4161 EUR)
7	603,410–616,000 ISK (~4162–4248 EUR)
8	616,001–648,387 ISK (~4249–4472 EUR)
9	648,388–780,882 ISK (~4473–5385 EUR)
10	780,883+ ISK (5386+ EUR)

2.3.2. Transport Variables

Transportation variables included main mode, various aspects related to work commutes, distance from home to work, other visited locations between home and work, reasons for car ownership, and barriers to changing main mode. The main mode of transport was determined based on the self-reported main mode of transport taken to work. Of those surveyed, 60% used a car, 32% used active modes, and 8% reported using public transport (bus) to go to work regularly.

Questions about modal shift were asked in the form of a multiple-choice question, with respondents allowed to choose as many options as they found applicable. The selection of answer options included in the study is listed in Table 4.

Table 4. Questions and answer options for barriers to using public transport (bus) or active transport modes (walking, cycling) as presented in the study. The respondents were able to choose more than one barrier or add their own using the answer “Other”.

What Is Currently a Barrier for You to Change Your Main Transport Mode to Bus? Choose All That Apply	What Is Currently a Barrier for You to Change Your Main Transport Mode to Active Transport (Walking, Cycling)? Choose All That Apply
☐ Already mainly using the bus ☐ Other people will think badly of me if I use the bus ☐ Difficult to pick-up children ☐ Sharing a car with my family and need to pick them up ☐ Takes too much time ☐ The price is too high ☐ No direct connection to my destinations ☐ Bus is not available where I live or at my key locations (no bus stops nearby or schedule is not frequent enough) ☐ Bus is not reliable (bus does not come according to schedule) ☐ Bus is not accessible to me ☐ Difficult to run errands (groceries, pharmacy, doctor appointments, etc.) ☐ Lack of a sense of safety ☐ Insufficient road maintenance during winter ☐ Weather ☐ Disability/health related reasons ☐ Other (please specify)	☐ Already mainly using active transport ☐ Other people will think badly of me if I use active transport ☐ Difficult to pick-up children ☐ Sharing a car with my family and need to pick them up ☐ Takes too much time ☐ My frequently visited locations are too far apart to walk or cycle ☐ Difficult to run errands (groceries, pharmacy, doctor appointments, etc.) ☐ Lack of bike paths ☐ Lack of a sense of safety ☐ Insufficient road maintenance during winter ☐ Weather ☐ Disability/health related reasons ☐ Other (please specify)

Distance from home to work (km) was calculated using PyQGIS 3.42, based on the respondent's self-reported home location and work location, finding the best route fit between the pinned locations. Distance from home to city centre (km) was found similarly, with a city centre location at coordinates 64.146329, −21.932815.

Satisfaction with current mode choice for work commutes and satisfaction with public transport on a city and neighbourhood scale were included where relevant. The questions were asked on a 5-point Likert scale, where 1 was “not at all satisfied” and 5 was “very satisfied”.

2.3.3. Climate Concern and Responsibility

In addition to socio-demographic background, people's climate concern was included in the study, as it has been noted in prior studies to be a significant factor in explaining travel behaviour (e.g., [13]). Climate concern was captured through nine questions, based in part on the Six Americas Short Survey [52] and with additional questions to capture collective and personal efficacy and knowledge about the climate impact of lifestyles (Table 5). Each question was answered on a five-step Likert like scale ranging from not at all to slightly, moderately, very, and extremely. The answers were then coded into numeric values from 1 to 5. The responses were processed using Exploratory Factor Analysis techniques in SPSS. Principal component analysis with Promax rotation with Kaiser Normalization was done to reveal which questions potentially factor together.

Table 5. Questions and statements from the survey regarding climate concern and climate action that were included in the factor analysis, along with their variable names. Sources of questions cited in brackets where relevant.

Variable Name	Question
cc_worry	How worried are you about climate change? [52]
cc_future	How much do you think climate change will harm future generations of people? [52]
cc_harmpersonally	How much do you think climate change will harm you personally? [52]
cc_importantpersonal	How important is the issue of climate change to you personally? [52]
cc_influence	How likely do you think it is that your actions will influence others to behave in ways that reduce greenhouse gas emissions resulting from their lifestyles? (similar to [53])
cc_voluntary	How likely do you think it is that large numbers of people will voluntarily change their lifestyles to try to mitigate climate change? (similar to [54])
cc_important	How important is it to mitigate climate change? [52]
cc_lifestyle	How climate sustainable would you think that your own lifestyle is?
cc_knowledge	Do you feel that you are knowledgeable about the climate impacts of your consumption choices?

The analysis revealed 3 components with Eigenvalues above 1, which in total explain about 68% of variance in the data:

- Variable 1 (named as “Climate concern”): cc_worry, cc_future, cc_harmpersonally, cc_importantpersonal, cc_important;
- Variable 2 (“Belief in individual impact in climate”): cc_influence, cc_voluntary;
- Variable 3 (“Lifestyle awareness”): cc_lifestyle, cc_knowledge.

Then, the reliability of the suggested factors was checked using Cronbach's Alpha using Reliability testing in SPSS.

For Variable 1 “Climate concern”, Cronbach's Alpha was 0.939. Removing any item from this group would not have increased the Alpha; therefore, this variable was deemed

viable for further analysis. Overall, the items included in this variable encompass a sense of climate worry that is out of individual control.

For Variable 2 “Belief in individual impact on climate”, Cronbach’s Alpha was 0.633. The variable confounds the sense of individual responsibility and the impact an individual feels they can have on climate change.

For Variable 3 “Lifestyle awareness”, Cronbach’s Alpha was 0.473, and this variable was therefore excluded from further analysis.

New variables were created based on the results, using the average of the total items in the variable, with descriptives provided below (Table 6).

Table 6. Descriptive statistical overview of two significant variables (“Climate concern” and “Belief in individual impact on climate”), which were formed in factor analysis.

	N	Mean	Variance	Skewness	Kurtosis
“Climate concern”	1473	3.717 (± 1.013)	1.027	−1.020 (± 0.064)	0.347 (± 0.127)
“Belief in individual impact on climate”	1583	2.819 (± 0.808)	0.653	−0.169 (± 0.062)	−0.253 (± 0.123)

2.3.4. Life Satisfaction Variables

Life satisfaction was included in two ways. In the models on modal choice, life satisfaction was calculated as a mean of all included life satisfaction questions. For the barriers, two independent life satisfaction variables—total life satisfaction and satisfaction with health—were used to capture the potential additional impact of health-related issues, which may explain why people cannot use a certain mode. The questions were, respectively, “How satisfied are you with your life overall these days?” and “How satisfied are you with your current state of health?”. Both were asked on a 11-point scale, with 0 being “not at all satisfied” and 10 being “completely satisfied”.

3. Results

Of our sample, 79% owned a car, and an additional 9% had a car available for them to use. Most respondents drove every day (60%), and a third used it a few times a week (33%). Cars were used for at least 50% of trips, even among those whose home-to-work distance was shorter (less than 4 km), while bikes were used for less than 10% of trips overall. Public transport use did not exceed 30% anywhere in the Capital Area. People living in the city centre used cars less than their suburban counterparts. Central dwellers also used active modes more, while the highest rate of public transport use was among residents of Hafnarfjörður, which is one of the more distant suburbs of the Capital Area.

Among car owners, the main reasons for having a car were convenience, reliability, enabling leisure activities, and usefulness in running household errands and transporting kids (Figure 1). Among non-car owners, the main reasons for not having a car were income or cost, having no need for errands by car, preference for active and public transportation modes, and climate concern.

When asked about home-to-work commuting, 60.4% used a car to get to work regularly. But when asked what mode of transportation they would like to use to get to work, only a total of 40% said they would still prefer a car. Therefore, about a third of people currently using a car to get to work would already be willing to make the shift to public or active transportation modes.

Mean satisfaction with public transport in the Capital Area was 2.55, and mean satisfaction with public transport at the neighbourhood level was 2.91, both on a 5-point Likert scale. Satisfaction levels were lower in both categories among those who regularly

drove to work compared to those not driving to work, particularly with public transport in the city overall (2.00 for those driving, 2.85 for those not driving).

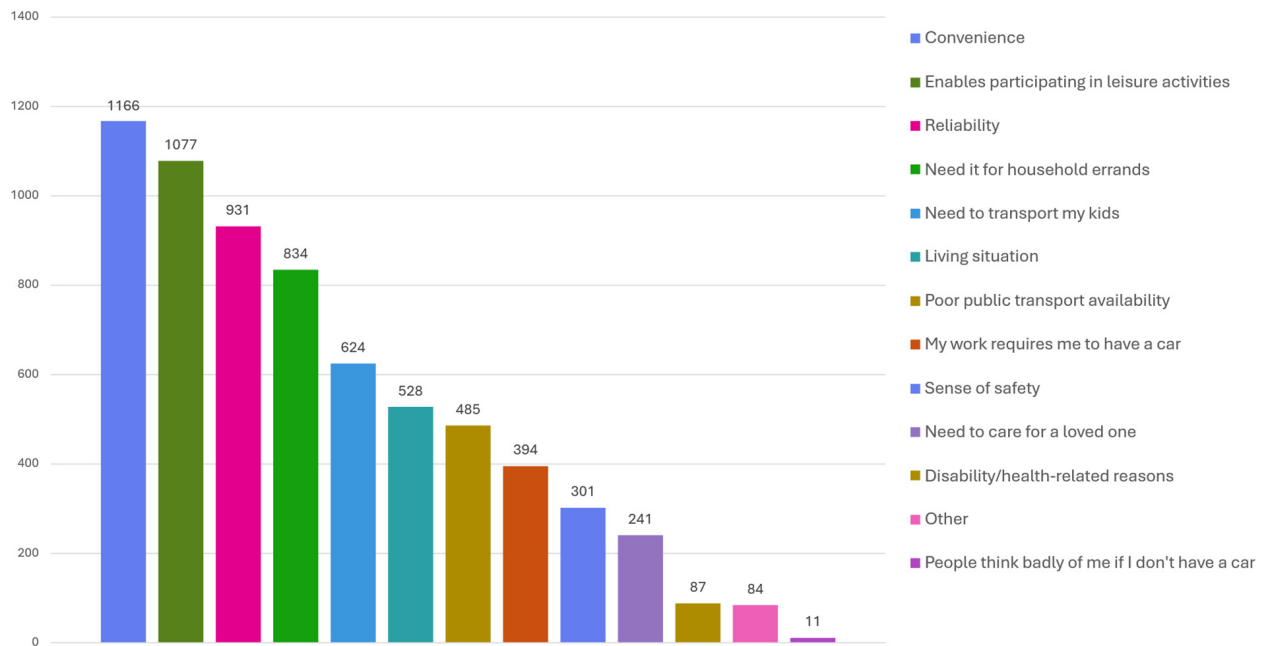


Figure 1. Main reasons for owning a car. In this question, respondents were allowed to choose as many options as they found applicable.

3.1. Explaining the Choice of the Main Mode of Transportation

From a demographic standpoint, living further away from work, having kids and older age were associated with a higher likelihood of mainly using a car. From an infrastructure perspective, having parking available at the work location increased the likelihood of mainly using a car (Table 7). Factors behind an increased likelihood of choosing a car as one's main mode of transport included finding that public transport takes too much time, being satisfied with the time it takes to commute to work currently, having a car because of its reliability, and not using active transport modes because it is difficult to run errands with them and because they are difficult to use in bad weather.

On the other hand, people who believe that their individual actions can reduce the climate impact were less likely to pick a car as their main mode. Interestingly, finding that public transport is unreliable, although a significant result, did not increase the odds of picking a car. This could be due to other factors being more dominant in the decision-making process. In addition, the factor might be somewhat cancelled out by the factor "having a car because it is more reliable", even though no multicollinearity issues were evident.

Being satisfied with the chosen transport mode seemed to go hand-in-hand with having active transport as the main mode. In addition, finding public transport to be unreliable indicated an increased likelihood of choosing active transport as the main mode. On the other hand, some of the same aspects that increased the likelihood of car use appeared to decrease the likelihood of active transport use. These aspects included having kids, living further away from work, and older age. Similarly, parking availability at the work location and owning a car because it is more reliable were linked to a lower likelihood of having active transport as the main mode. In addition, public transport not connecting to frequently visited destinations and being too expensive also appeared to reduce the likelihood of picking active transport as the main mode.

Table 7. Binomial logistic regression models for main mode choice, where the dependent variables is the main mode of transport of the respondents. AT—active transport; PT—public transport, OR—Odds Ratio (OR > 1 increased likelihood, OR < 1 reduced likelihood). *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

	Model 1: Car		Model 2: Public Transport		Model 3: Active Transport	
	OR	Sig.	OR	Sig.	OR	Sig.
(Intercept)	2.307	***	0.034	***	0.256	***
Times per week one commutes to work	1.074		1.237		0.834	
Other visited location during work commute—grocery store	1.191		0.897		0.902	
Other visited location during work commute—friends/family	1.177		1.047		0.795	*
Parking available at work location	2.181	***	0.985		0.491	***
Main mode to work matches dream mode to work	0.387	***	2.120	***	1.929	***
Works full time	0.887		1.162		1.052	
Has kids	1.309	*	1.153		0.727	**
Female	1.074		1.242		0.860	
Income deciles	0.840		1.173		1.092	
Distance from home to work (km)	2.861	***	1.357	*	0.228	***
Uses same mode in summer as in winter	0.839		1.054		1.118	
High qualification job	0.967		1.155		0.980	
I have a car because it is reliable	1.789	***	0.832		0.615	***
I have a car because PT is not reliable	0.969		1.012		1.061	
I have a car because of safety concerns	0.975		0.842		0.971	
PT barrier—unreliable	0.689	**	-		1.313	*
PT barrier—no direct connections	1.205		-		0.799	*
PT barrier—too expensive	0.974		-		0.797	*
AT barrier—safety concerns	1.136		1.002		-	
AT barrier—bad weather	1.476	**	0.553	**	-	
Satisfaction with the time it takes to get to work	1.285	*	1.293		0.710	**
Belief in individual impact on climate	0.774	*	1.261		1.150	
Age	1.233	*	1.073		0.765	*
Total life satisfaction	0.970		1.021		1.005	
I have a car to run errands	0.741	*	1.074		1.101	
PT barrier—takes too much time	1.654	***	-		0.668	***
AT barrier—difficult to run errands	2.147	***	0.588	*	-	
AIC	628		209		697	
BIC	760		506		816	
McFadden R ²	0.634		0.413		0.561	
McFadden Adjusted R ²	0.599		0.332		0.527	

The results about public transport as the main mode showed some interesting underlying factors, but since the sample of regular public transport users was considerably smaller than that of car or active-mode users, the results were less reliable. The models showed that living further away from work increased the likelihood of having public transport as the main mode. Also, those who have chosen public transport seemed satisfied with the choice. The factors reducing the likelihood of having public transport as the main mode appeared to relate mostly to disadvantages of active modes, such as bad weather or difficulty running errands.

A comparison model was conducted (Table 8), which compared active and public transport users, respectively, to car users. General observations from the results of the model indicated that active-mode users were less likely to find public transport reliable and their car ownership was less likely to be driven by the reliability aspect of the vehicle. Both active and public transport users were more likely to own a car for running errands, even if it was not their main transport mode, and both found it difficult to run errands with active modes. Interestingly, although the separate analysis on public transport users revealed that they were generally happy with their main mode choice, they did still find a car more reliable than those who mainly drove. In contrast, active transport users found a car to be less reliable than car users. People who have active or public transport as their main mode were less likely to find weather to be a barrier to using those modes compared to car users. Notably, both active and public transport users were more likely to believe in the impact of individual actions on the climate than car users.

Table 8. Multinomial logistic regression comparing active transport users and public transport users to car users. AT—active transport; PT—public transport, OR—Odds Ratio (OR > 1 increased likelihood, OR < 1 reduced likelihood). *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

	Active Transport vs. Car		Public Transport vs. Car	
	OR	Sig.	OR	Sig.
(Intercept)	224.927	***	0.001	**
Times per week one commutes to work	0.814		0.001	
Other visited location during work commute—grocery store	0.718		1.380	
Other visited location during work commute—friends/family	0.573		0.674	
Parking available at work location	0.173	***	0.821	**
Main mode to work matches dream mode to work	6.303	***	0.367	***
Works full time	1.236		13.940	
Has kids	0.472	**	1.499	
Female	0.740		0.928	
Income decile	1.045		1.292	
Distance from home to work (km)	1.000	***	1.118	
Uses same mode in summer as in winter	1.527		1.000	
High qualification job	1.007		1.296	
I have a car because it is reliable	0.313	***	1.429	**
I have a car because PT is not reliable	1.115		0.297	
I have a car because of safety concerns	1.234		1.123	
PT barrier—unreliable	2.162	**	0.616	
PT barrier—no direct connections	0.648		1.614	
PT barrier—too expensive	0.624		0.700	
AT barrier—safety concerns	0.525	*	0.744	**
AT barrier—bad weather	0.799		0.211	*
Satisfaction with the time it takes to get to work	0.663	**	2.229	
Belief in individual impact on climate	1.310		1.206	*
Age	0.981	*	1.665	
Total life satisfaction	1.002		0.993	
I have a car to run errands	2.010	**	1.006	
PT barrier—takes too much time	0.319	***	1.659	*
AT barrier—difficult to run errands	0.210	***	0.372	***
Log-likelihood	−402.67			
McFadden R ²	0.444			
Chi-squared	344.38	***		

3.2. Barriers to Switching One's Main Mode of Transport

Some of the biggest barriers to switching the main mode to public transport included it taking too much time, a lack of direct connections to destinations, difficulty picking up children and running errands, the public transport system being too expensive, and the weather (Figure 2a). Similarly, some of the main barriers to switching to active transport as the main mode of travel included difficulty running errands, weather, frequently visited destinations being too far apart, and taking too much time to go between places (Figure 2b). The reluctance to switch to public transport was also reflected in the low satisfaction level with the public transport system.

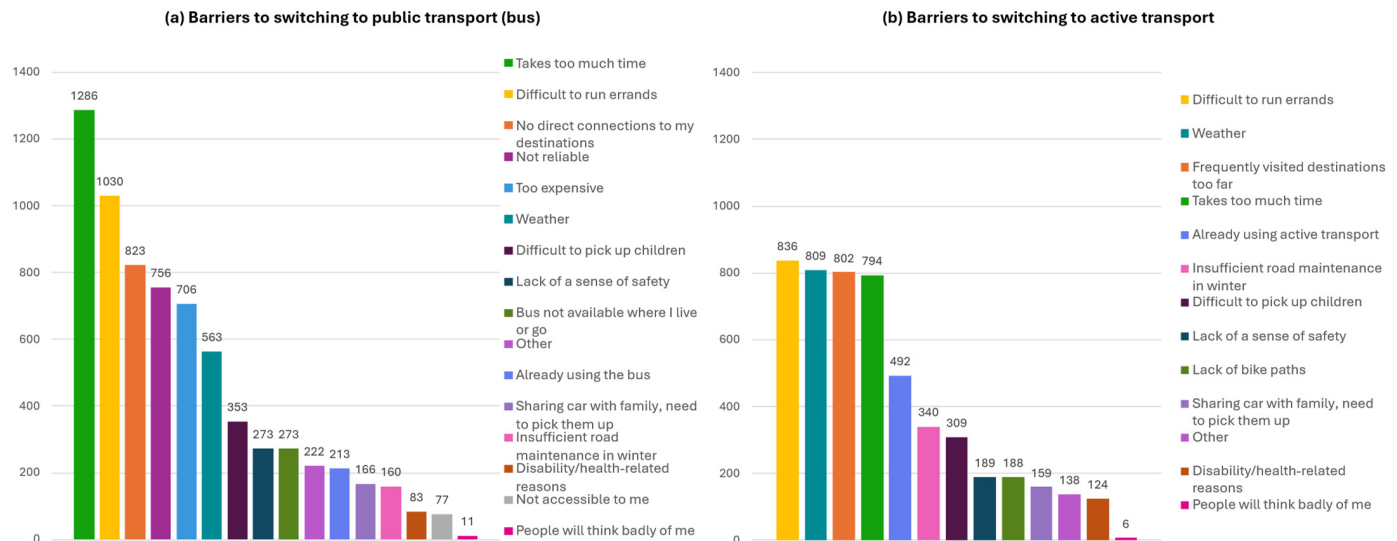


Figure 2. Main barriers to switching to public transport (a) and active transport (b) modes. In both questions, respondents were allowed to choose however many options they found applicable.

In a binomial logistic regression setting, the focus was on the top five barriers for each mode group and trying to understand which background factors increased the odds of choosing these barriers in the survey. Model results for public transport barriers will be given first, followed by results of active transport barriers.

3.2.1. Public Transport Barriers

As depicted in Table 9, owning a car ($p < 0.001$; OR = 3.17) and living further from the city centre ($p = 0.007$; OR = 1.05) increased the odds of finding that public transport takes too much time. On the other hand, high levels of satisfaction with the public transport system overall ($p < 0.005$; OR < 1) and with public transport in the neighbourhood ($p = 0.015$; OR = 0.458) decreased the odds of finding long travel times to be a barrier. Overall, the model explained 16.7% of variance.

Being more than 45 years old ($p < 0.05$; OR < 1), being Icelandic ($p = 0.021$; OR = 0.631), and having a medium–high income level ($p = 0.025$; OR = 0.609) were associated with a lower likelihood of finding public transport to be too expensive. Furthermore, the more satisfied one was with the public transport system, the less likely they were to find it too expensive ($p < 0.05$; OR < 1). The model explained 11.3% of variance.

Being female ($p = 0.005$; OR = 1.647) and owning a car ($p < 0.001$; OR = 3.193) increased the odds of choosing the barrier of having no direct connections to one's destinations. On the other hand, Icelandic people ($p < 0.001$; OR = 0.360), people more concerned about climate ($p = 0.006$; OR = 0.784), and respondents who were more satisfied with public transport overall ($p < 0.05$; OR < 1) or with their neighbourhood ($p < 0.05$; OR < 1) were

less likely to choose lack of direct connections as a barrier for switching to public transport. The model explained 16.9% of variance.

Table 9. Binomial logistic regression results for barriers to choosing public transport as one’s main transport mode. The models examine which background variables explain choosing one barrier or another. AT—active transport; PT—public transport, OR—Odds Ratio (OR > 1 increased likelihood, OR < 1 reduced likelihood). Reference categories for categorical variables marked with “ref”. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

		Already Using		Takes Too Much Time		Too Expensive		No Direct Connections		Not Reliable		Difficult to Run Errands	
Variables		OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Intercept		0.839		1.516		32.999	***	4.497	***	5.140	***	2.045	
Age, grouped	<25	ref											
	26–35	0.827		1.245		0.844		0.655		0.578	*	1.294	
	36–45	0.799		0.976		0.852		1.127		0.574	*	1.528	
	46–55	0.460		0.886		0.401	**	0.600		0.418	***	1.995	*
	56–65	0.638		0.982		0.407	*	0.700		0.275	***	0.994	
	>65	1.358		0.638		0.198	***	0.660		0.329	**	1.066	
Education level	low	ref											
	medium	1.018		0.967		0.769		0.685		0.959		1.142	
	high	0.853		0.991		0.904		0.820		1.152		1.374	
Income level (CU)	low	ref											
	medium	1.669		0.965		0.784		1.344		0.918		0.844	
	medium high	1.644		1.160		0.588	*	1.463		0.879		0.505	***
	high	1.562		0.900		0.608		1.595		0.801		0.601	
	Male + other	ref											
Gender	Female	0.588		1.061		0.959		1.649	**	0.969		1.552	**
Weekly working hours	None	ref											
	Part-time	1.636				0.771							
	Full-time	0.796				0.739							
	Overtime	0.968				0.487							
Kids in household	No	ref											
	Yes	0.638		1.279		0.640	*	0.806					
Disability	No	ref											
	Yes	0.411	*							1.366			
Being Icelandic	No	ref											
	Yes					0.635	*	0.357	***				
Car ownership	No	ref											
	Yes	0.103	***	3.170	***			3.223	***			2.621	***
Climate concern		1.666	**	0.932		0.992		0.783	**	1.299	**		
						0.775	*			0.797	*	0.634	***
Belief in individual climate impact													
Satisfaction with one’s health													
	Low	ref											
	Medium	0.526								1.011			
	High	0.720											

Table 9. Cont.

		Already Using		Takes Too Much Time		Too Expensive		No Direct Connections		Not Reliable		Difficult to Run Errands	
Variables		OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Satisfaction with life overall	Low									0.775			
	Medium			1.150								0.812	
	High			0.955						0.774		0.978	
Distance from home to work (km)		0.923	*			1.021		1.005		0.895		1.019	
Distance from home to city centre (km)				1.050	**	0.956	*	1.039	*	0.960	**	0.975	
Satisfaction with PT in the neighbourhood	Low	ref											
	Medium	1.679		0.662				0.662					
	High	1.205		0.856				0.554	*				
	Very High	5.047	**	0.458	*			0.293	***				
Satisfaction with the PT system overall	Low	ref											
	Medium			1.133		0.653		0.640		0.520	***	1.044	
	High			0.537	*	0.289	***	0.411	**	0.213	***	0.955	
	Very high			0.223	***	0.232	***	0.234	***	0.096	***	0.489	**
Satisfaction with the time it takes to get to work	Very low	ref											
	Low	0.366	*									1.075	
	Medium	0.185	***									0.645	
	High	0.070	***									0.821	
How long have you lived in your current home?	Less than 1 year	ref											
	1–3 years			1.206								0.722	
	4–6 years			1.365								1.172	
	7–10 years			1.598								1.467	
	10+ years			1.525								1.225	
	Entire life			7.463								4.571	*
Home type	Other	ref											
	Apartment					0.602	**	1.176					
AIC		459		1289		1063		1068		1403		1100	
McFadden R ²		0.332		0.167		0.12		0.17		0.144		0.105	

The model for finding public transport to be unreliable explained 14.4% of variance. The likelihood of finding public transport unreliable seemed to decrease with age ($p < 0.05$; OR < 1). Similarly, the more satisfied one was with the system overall, the less likely they were to find it unreliable ($p < 0.001$; OR < 1). The likelihood also de-

creased by 4% for every 1 km a person lived further away from the city centre ($p = 0.008$; OR = 0.96). People who believe more in their individual impact on the climate were less likely to find public transport unreliable ($p = 0.028$; OR = 0.7974), while people who were more concerned about the climate were more likely to find it unreliable ($p = 0.003$; OR = 1.2993).

Lastly, difficulty running errands was one of the top five barriers for not switching to public transport as one's main mode. The model explained 10.5% of variance. People who were female ($p = 0.008$; OR = 1.552), owned a car ($p < 0.001$; OR = 2.621), or who were between the ages of 46 and 55 ($p = 0.027$; OR = 1.995) were more likely to find it difficult to run errands with public transport. Conversely, respondents with a medium–high income ($p < 0.001$; OR = 0.505) were less likely to find this to be a barrier compared to low-income respondents. In addition, believing more in one's individual impact on the climate ($p < 0.001$; OR = 0.643) and being more satisfied with the public transport system overall ($p = 0.005$; OR = 0.489) were indicative of a lower likelihood of finding it difficult to run errands with public transport.

3.2.2. Active Transport Barriers

For active transport, four main barriers emerged: difficulty running errands, weather, frequently visited locations being too far apart, and the time it takes to travel to destinations (Table 10). The model for the barrier “weather” had an explanatory power of less than 10% and will therefore not be included in the discussion here.

Table 10. Binomial logistic models for main barriers for choosing active transport as the main mode. The models examine which background variables explain choosing one barrier or another. AT—active transport; PT—public transport, OR—Odds Ratio (>1 increased likelihood, <1 reduced likelihood). Reference categories for categorical variables marked with “ref”. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

		Already Using as Main Mode		Difficult to Run Errands		Bad Weather		Distance Too Long Between Visited Locations		Takes Too Much Time	
Variables		OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Intercept		0.091	**	3.021	*	2.426		1.225		2.381	
Age, grouped	<25	ref									
	26–35	0.959		0.725		1.262		0.792		0.943	
	36–45	0.855		0.968		1.409		1.009		1.055	
	46–55	1.280		0.807		1.087		0.768		0.891	
	56–65	1.684		0.960		0.731		0.942		0.730	
	>65	0.639		3.350	*	2.785		2.108		0.824	
Education level	low	ref									
	medium	1.136		0.849		0.857		0.767		1.135	
	high	1.044		0.776		0.721		0.674		0.996	
Income level (CU)	low	ref									
	medium	1.130		0.869		1.089		1.165		0.926	
	medium	1.517		1.015		0.930		1.242		1.001	
	high	1.306		1.493		0.857		1.386		1.630	
Gender	Male + other	ref									
	Female	0.820		1.589	**	1.015		1.270		1.426	*

Table 10. Cont.

		Already Using as Main Mode		Difficult to Run Errands		Bad Weather		Distance Too Long Between Visited Locations		Takes Too Much Time	
Variables		OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Car ownership	No	ref									
	Yes	0.177	***	3.404	***	2.745	***	4.128	***	3.430	***
Satisfaction with the time it takes to get to work	Very low	ref									
	Low	1.659		0.433	**	0.640		0.367	**	0.724	
	Medium	1.293		0.324	***	0.631		0.341	***	0.499	*
	High	2.601	**	0.367	***	0.500	*	0.238	***	0.334	***
Distance from home to city centre (km)		0.885	***	1.069	***	1.018		1.104	***	1.072	***
Distance from home to work (km)		0.982				0.997					
Climate concern		1.581	***	0.746	**	0.759	**	0.879		0.769	**
Belief in individual climate impact				0.733	**			0.717	**	0.694	***
Home size (m ²)		1.003									
Satisfaction with one's health	Low	ref									
	Medium	1.993	**	0.684	*	0.628	*				
	High	1.862	*	0.424	***	0.581	*				
Being Icelandic	No	ref									
	Yes	0.696				0.689					
Kids in household	No	ref									
	Yes	1.675	*	1.168		0.600	*	1.040			
Weekly working hours	None	ref									
	Part-time	0.793				1.919		1.853		1.298	
	Full-time	1.353				1.216		1.123		0.799	
	Overtime	1.071				1.307		2.043		1.118	
Home type	Other	ref									
	Apartment	1.331						1.376			
Disability	No	ref									
	Yes			1.388		0.795		1.766	**		

Table 10. Cont.

		Already Using as Main Mode		Difficult to Run Errands		Bad Weather		Distance Too Long Between Visited Locations		Takes Too Much Time	
Variables		OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Total life satisfaction	Low	ref									
	Medium			1.596	*	1.705	*	1.104			
	High			1.778	*	1.424		0.884			
Satisfaction with the PT system overall	Low	ref									
	Medium					0.888					
	High					0.615	*				
	Very high					0.539	*				
How long have you lived in your current home?	Less than 1 year	ref									
	1–3 years							0.734			
	4–6 years							0.563	*		
	7–10 years							0.731			
	10+ years							0.922			
	Entire life							1.414			
Satisfaction with PT in the neighbourhood	Low	ref									
	Medium									1.323	
	High									1.082	
	Very High									0.741	
AIC		861		1296		1040		1272		1275	
McFadden R ²		0.177		0.121		0.086		0.147		0.136	

The binomial logistic model for the barrier “difficult to run errands with active transport” explained 12.1% of variance in responses. Respondents over the age of 66 ($p = 0.019$; OR = 3.35), those who were female ($p = 0.003$; OR = 1.589), those owning a car ($p < 0.001$; OR = 3.404) and those living farther away from the city centre ($p < 0.001$; OR = 1.069) were more likely to find it difficult to run errands as a barrier for switching to active modes. In contrast, believing in the climate impact of individual actions ($p = 0.004$; OR = 0.595), being more concerned about the climate ($p = 0.001$; OR = 0.746), being more satisfied with one’s health ($p < 0.05$; OR < 1), and being more satisfied with the time it takes to commute to their work location ($p < 0.05$; OR < 1) were all indicative of a lower likelihood of choosing this barrier.

Next was the long distance between destinations, which was more likely to be chosen as a barrier by people owning a car ($p < 0.001$; OR = 4.218), people with their home further away from the city centre ($p < 0.001$; OR = 1.104), and people who have a disability ($p = 0.005$; OR = 1.766). However, the barrier was less likely to be chosen by people who

were more satisfied with the time it takes them to get to work ($p < 0.001$; OR < 1), by people with a stronger belief in the climate impact of individual actions ($p = 0.003$; OR = 0.717), and by people who have lived in their current home for 4–6 years ($p = 0.022$; OR = 0.563).

Lastly, being female ($p = 0.025$; OR = 1.426), owning a car ($p < 0.001$; OR = 3.43) and living further from the city centre ($p < 0.001$; OR = 1.072) increased the likelihood of picking “takes too much time” as a barrier for switching to active transport. Conversely, being more satisfied with the time it takes to travel to work ($p < 0.05$; OR < 1), being more concerned about the climate ($p = 0.004$; OR = 0.769), and believing that individual actions have an impact on the climate ($p < 0.001$; OR = 0.694) were all linked to a lower likelihood of choosing this barrier.

4. Discussion

In this article, a case study of transportation habits and barriers to change was carried out in the Reykjavík Capital Area in Iceland. While transport, which is a pain point for this Arctic capital, has been studied before, little progress has been made to reduce its car-centricity. Moreover, the barriers for switching away from private cars to active and public transport have not been studied before in this location.

Generally, studies on the barriers of switching away from private cars are less numerous than studies on the travel mode choice (e.g., [55]), and less is therefore known about specific hindrances related to mode choice, although the nature of mode choice and barriers are interconnected (e.g., [56]). Further case studies are thus important for getting a better understanding of what is hindering people from shifting from private cars to more environmentally friendly modes of transport. The learnings from these barriers in one location, and about how to potentially overcome them, can be valuable in other locations battling similar problems. Furthermore, along with more case studies a better general understanding about the local or global nature of the different barriers, and about the solutions, can be generated. In addition, while previous studies have mostly focused on barriers to shifting to active modes (e.g., [57]), and also on specific challenges of marginalized groups in modal shift (e.g., [31]), this study examines the residents of the Capital Area in general from a perspective of moving towards more sustainable transportation systems in general, including public and active transport modes. Due to the specificity of the city in terms of climate and the current very high reliance on private cars, and due to the inclusion of some less commonly available variables such as those related to climate concern, the results of this study can also provide important insights to global cities widely, as well as inform future research on the topic.

Firstly, a baseline was established to understand the state of transportation habits. Cars were still the predominant mode of transport and were used for more than half of the trips, even among those whose home-to-work distance was short. Over 60% of respondents used a car for work commutes on a regular basis, but if they could choose their mode, only 40% of respondents said they would still prefer a car, indicating a considerable willingness to switch to other modes, particularly to active modes. The results were similar to those of recent prior studies in the same case area [13–15], which all indicated that the car is the main mode of transport and that there is limited willingness to change modes, indicating that despite efforts to shift away from the use of private cars, this shift has yet to occur in recent years. Car owners cited convenience, reliability, leisure activities, household errands, and transporting their kids as the main reasons for owning a car, which were in line with prior studies wherein life without a car was seen as nearly impossible [14].

Living further away from work, having kids, older age, and having parking available at one's work were all associated with a higher likelihood of using a car as the main mode and a lower likelihood of choosing active transport modes. Similarly, it has been suggested

that a lack of parking could influence people to use their car less for work commutes [30]. Interestingly, gender was not a significant predictor in transport mode choice, which likely has to do with the high affluence and very high car ownership rate, with families often possessing more than one car. Current active transport users were less likely to find public transport reliable and less likely to own a car because of reliability when compared to car users. Both active and public transport users were likely to own a car for running errands, even if a car was not their main mode. They were also less likely to find weather to be a barrier for using active or public transport. The challenges of modal shift in the Capital Area were further underlined by the relatively low satisfaction with the existing public transport system. Stronger belief in individual actions having an impact on the climate went hand-in-hand with choosing active or public transport as the main mode of transport.

The main barriers to choosing public transport were similar to previous research, such as public transport taking too much time [22,27,28], lack of direct connections [27,29], difficulty picking up kids and running errands, and the weather. Gender was also found as a significant predictor for experiencing lack of direct connections and the difficulty of running errands as barriers to change. Cost was also noted as a top barrier in our study, similar to a prior study in the same case area [14], whereas in other studies cost of the public transport system was not a strong hindrance to using it, with people showing willingness to pay more for a well-functioning system [30,34,35]. Similarly to a study in Sweden [27], safety was not among the main barriers to using public transport in the Capital Area. A major difference in our results compared to previous research in the same area was that the respondents did not report “other people thinking badly about them” as a barrier for choosing public transport, whereas Heinonen et al. [14] found evidence of this kind of “stigma” hindering people from using buses.

Top barriers for choosing active modes were difficulty running errands, weather, destinations being too far apart, and active modes taking too much time. Prior studies have mostly mentioned infrastructure-related barriers, which were less evident among active transport barriers in the Capital Area but did include aspects like poor connectivity [19,20,24], long travel distances and time [17,19,21], weather [18,26], and needing to run errands [22,26], which are all aspects attributable to infrastructure. Of the socio-economic variables, interestingly, only gender was found to play a role in perceiving the barriers differently, with women (similarly to public transport) more likely perceiving the difficulty of running errands and the time needed as barriers. Age, education and income were not found as statistically significant predictors.

People who lived further away from work were more likely to find the time and distance aspects to be barriers and were more likely to own a car to mitigate this. The price barrier appeared to be associated with income and citizenship. Older, medium-high income earners with an Icelandic nationality background were less likely to find the cost of public transport to be a barrier. These findings potentially indicate differences in transport accessibility for local residents and non-native residents. Other studies have found similar barriers among ethnic minorities and people with disabilities in using active transport [25] and public transport [31].

Furthermore, female respondents were more likely to find the lack of direct connections and difficulties running errands to be barriers for switching to public transport. Similarly, female respondents were more likely to find errands and time as a barrier for choosing active modes. This may indicate the impact of household labour division and the responsibility of the “third shift” falling upon females more than males. Although gender equality in Iceland, and in the Nordics in general, is highly praised, it seems that female respondents still, in the very least, sense the division in household labour, such as picking up kids or

running errands, which affects their mode choice. Interestingly, in other studies, it was women who were more positively inclined to choose active modes (e.g., [27,30]).

4.1. Policy Implications

The potential policy implications can be divided into local aspects that directly arise from the results and to global perspectives, which arise through comparisons with other studies. Starting from the local perspectives, one clear observation was that across several barriers to switching to public or active transport as the main mode, it was evident that climate concern, and more importantly belief in individual impact on climate, shaped the way people viewed barriers in modal shifts. This is an aspect that has not come forward in previous literature on transport barriers, although we have seen connections in prior studies in the Nordics in relation to reduced transport emissions among the climate concerned (e.g., [13]). The results indicated that an increased understanding of the impact of individual actions, such as the mode of transport we choose, could help curb some of the barriers in modal shift in the Capital Area, and hinted at the underutilized potential of climate awareness and equipping citizens with practical information about the climate impact of various actions [13,58,59].

Second, due to its long-term car-oriented nature, it is likely that citizens in the Capital Area have prejudices against the local public transport system and struggle to picture life without a car [14]. Deeply rooted car culture [14,19,23] and existing negative perceptions and social norms connected to active modes [19,21,23,24] and public transport (i.e., [26,28,29,35]) have been described as notable barriers to modal shifts in many studies. Policies could be more directly aimed at raising awareness on health benefits [20,25] and educating about usage and safety [21,25,31] connected to both cycling and public transport.

However, raising awareness alone will not be enough to push modal shift in the Reykjavík Capital Area. The local public transport system needs to be upgraded to provide functional alternatives, especially since active modes are not usable for everyone all year round due to the city's climate and long average travel distances. The results of the study further highlighted some pitfalls of the built urban environment in the Capital Area—people are not able to run errands efficiently, with grocery stores being located in car-dominated areas further from residential zones, and that kids are not able to commute independently, quickly and securely enough for parents to feel like they do not have to transport them during the day. Infrastructural barriers have been noted by most studies on barriers to modal shift, ranging from issues like connectivity (i.e., [18,22,29,32]) to traffic safety concerns (i.e., [20,24,26,36]). Special attention should be paid to transport safety for children of all ages. Although safety did not emerge as a dominant barrier, studies have indicated that it is an aspect parents are generally concerned about (e.g., [17,19,26]).

Overall, Iceland has been focused on the electrification of the transport fleet. A large-scale sole focus on electric vehicles may divert resources away from other sustainable mobility measures like promoting public transportation and non-motorized transport, raising questions about whether the push for electric vehicles will align with or conflict with other sustainable mobility goals such as compact cities, restrictions on automobiles, and promotion of walking and bicycling [60]. While a shift to electric mobility would indeed reduce direct emissions in the Capital Area, it alone is not enough, but should be combined with changes in mobility behaviour and urban form to yield reduced private car ownership and use, regardless if electric or combustion engine cars, to achieve true global reductions in greenhouse gas emissions [61]. Stronger political initiative and legislative support could facilitate a more effective shift towards a more climate-friendly urban transportation system [19].

Although specific global policy recommendations cannot be made, as urban transport and sustainability policies need to consider the local context (e.g., [13,62]), some learnings can be drawn for cities with facing similar challenges in their transport systems. It was evident that despite differing climate conditions and culture, there are a lot of similarities between countries and regions in the way people choose to move around and what barriers they face (see also the following section). Furthermore, only through more case studies in different locations with varying local conditions and current challenges is it possible to learn about the similarities and differences in the experienced barriers and about the ways to overcome them. Overall, for transport policy and planning to be successful, it should consider people's needs beyond work commutes and ensure accessibility to all groups of society.

4.2. Limitations

This article focused on a case study setting, as local context is important to transportation and mobility planning and policy, and as it helps to approach a complex topic from multiple angles [62,63], as was done in this study. Single-country approaches in planning and policy to reduce emissions from transport have been criticized [64,65], although differences in local energy [65,66] and mobility [13] contexts are visible even among countries with a similar socio-economic, cultural and geographical context. The results of this study were compared with the literature from various contexts varying in affluence, climate, geography, and culture. While in each of the referred studies, local cultural and societal influences were a part of the barriers to modal switch, the studies also showed a lot of commonalities with one another and with the results of the current study at hand.

The data was collected using an online softGIS survey, which is a useful option for researchers, as it combines regular survey questions with map-based questions [39]. Despite a good survey sample size ($N = 1801$), the study relied on people's self-reported behaviours in transport, which may over- or underestimate their actual day-to-day modal split. The sample had a comparable socio-demographic split to local statistics, except in education level—the survey reached more highly educated people. However, in 2024 tertiary education level attainment among residents aged 25–64 living in the Reykjavik Capital Area was 55.7%, compared to 36.4% for the same age group in the rest of the country [43]. There appears to be a considerable urban–rural divide in higher education. Therefore, the sample can be said to be comparable to the Capital Area statistics on educational attainment. The survey was distributed organically through advertising in the local area but may have benefited from targeted marketing techniques for a more balanced sample. Furthermore, the quantitative nature of the barrier data enabled statistical analysis, but it does not capture potential underlying cultural or social barriers as well as in some qualitative studies. Socio-cultural barriers may often be hidden and not at the forefront of the respondent's mind when answering a survey. Thanks to a prior mixed-methods study in the same case area, we were able to provide the context of the Reykjavik Capital Area being strongly car-oriented.

4.3. Future Research Directions

Further studies on barriers are needed in various contexts, as studies on understanding barriers are limited, particularly barriers to switching to public transport. Quantitative studies could benefit from more accurate data on mobility, such as from GPS or mobile positioning. Moreover, in the future, even studies using quantitative methods could try to capture mindset and attitudinal issues beyond those covered in this study to better understand their roles compared to the importance of infrastructure- and transport-systems-related issues. In addition, qualitative studies and mixed-methods studies are needed in

this field, as they provide valuable clues to hidden perceptions and social barriers to modal shifts and can inform which attitudinal aspects should be covered in quantitative studies. Longitudinal studies focused on changes to transport modes over time and the triggers behind the modal switch (e.g., [67]) could provide an interesting perspective for understanding modal change and the effectiveness of ongoing planning and policy strategies. Lastly, studies focused on local transport policy and urban planning strategies, combined with insights into barriers to change, could yield important implications for policy adjustments within the local context in question.

5. Conclusions

All in all, this article aimed to study the barriers for changing from private cars to active and public transportation, which can be a major challenge in urban areas designed to accommodate cars. Yet it is a challenge that needs to be tackled to move towards sustainable urban mobility. Limited prior studies exist on this topic, and the topic has not been studied before in Iceland. This study analysed the results of 1801 residents of the Capital Area of Reykjavik, gathered in a softGIS survey. The study provides a two-sided perspective by examining mode choice and barriers to modal change.

The results of the study highlight that despite recent efforts, Reykjavik remains car-centric. The main barriers for switching modes include challenges running errands, long travel distances and time, and inconvenience and reliability of the public transport system specifically. The study also noted that climate concern and belief in our individual impact on the climate could be important factors in the decision to switch to active or public transport. However, raising awareness on the climate impact of transport is likely not sufficient to reduce car use. The local public transport system needs to be upgraded to meet the needs of the residents. This implies focusing on transportation infrastructure, connectivity, and safety, and especially safety for children.

As the study is based on self-reported behaviour in transport, the actual day-to-day modal split may be skewed based on people's own estimations. The sample had a higher representation of highly educated people compared to local statistics, which can be explained by the urban–rural divide in higher education attainment. Due to its quantitative nature, the study does not provide information on underlying cultural and social barriers, which can be aspects to analyse in future studies. More accurate data on mobility and qualitative and mixed-method studies are needed to pass beyond the limitations of this study on understanding barriers. Although the study presents just one geographical case, the learnings about these barriers can be used as an example to other countries with similar problems, as problems in modal switch tend to be similar across geographies.

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