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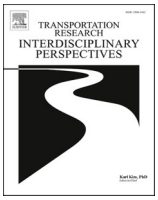

Differences in walking and cycling between professional immigrants and comparable ethnic Dutch: A quantitative analysis from the Netherlands

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ABSTRACT

Active travel (e.g. walking and cycling) is encouraged in the Netherlands for the many environmental and health benefits it offers, and, as a result, the country has among the highest rates of cycling in the world. This is at least partially attributed to investments in cycle infrastructure. Yet few other countries have followed the Netherlands lead and invested similarly, and arguments are made that the Dutch life experience and culture are also important in encouraging walking and cycling. To examine the influence mobility culture on active travel behaviour, this study assesses similarities and differences in walking and cycling between a sample of professional immigrants living in the Netherlands' Randstad region and a socio-demographically comparable sample born and raised in the Netherlands. The study found both similarities and differences in walking and cycling between professional immigrants and ethnic Dutch, with the immigrants actually walking and cycling more than the ethnic Dutch. In order to identify factors that influenced preferences to and levels of walking and cycling, a multiple linear regression analysis of dichotomous and ordinal variables based on their polychoric correlations was applied. Findings show that socio-demographic characteristics, car and bicycle access and trip purpose have a significant effect on the active travel behaviour of the two population groups. In addition, findings demonstrate that car access and use is associated with reduced active travel mode use. However, the reasons and causes of the differences in walking and cycling behaviour between immigrants and ethnic Dutch need further research.

Introduction

Background and research objectives

Active travel (e.g. walking and cycling) is encouraged in the Netherlands for the many environmental and health benefits it offers, such as contributing to a decrease in air and noise pollution in urban areas as it consists of non-polluting travel modes, and reducing potential health risks by increased physical activity (De Nazelle et al., 2011; Oakil et al., 2016; Sallis et al., 2016; Scheiner and Holz-Rau, 2013). In recent years, Dutch policymakers and practitioners have put much effort into creating better walking conditions by investing in walking infrastructure and providing safe street crossings (CROW, 2014; Pucher and Dijkstra, 2003), and promoting cycling by designing highly-developed, safe and specialised cycling infrastructure and providing financial aid, such as tax-exemptions offered by employers to buy bicycles (Heinen et al., 2010; Oakil et al., 2016; Pucher and Buehler, 2008). The effectiveness of these investments is reflected in the country's mode share, with around 37% of the total trips in 2018 taken using active travel and more than half of these were bicycle trips (CBS, 2018), making the Netherlands the leading cycling country in Europe (European Commission, 2017). Many cities and regions have tried to follow the Netherlands lead by dedicating a growing number of resources to active travel planning practices to increase walking and cycling among residents (Barajas, 2020; Panter et al., 2016; Pucher et al., 2010). However, active travel mode use levels remain low compared to the Netherlands (Bassett et al., 2008; European Commission, 2017), and arguments are made that life experiences with walking and cycling (Chatterjee and Scheiner, 2015; Lanzendorf, 2003; Salomon and Ben-Akiva, 1983), as well as subjective norms with regard to active travel mode use in the respective mobility culture (Baslington, 2008; Haustein et al., 2020; Nello-Deakin and Nikolaeva, 2021), are also important in encouraging (and/or discouraging) walking and cycling.

In the past 20 years, a number of transport researchers have adopted a life course approach to study travel behaviour (Chatterjee and

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Scheiner, 2015). These studies found that changes in active travel behaviour are often related to a life event, such as residential relocation, changing jobs, having children or retirement (Bonham and Wilson, 2011; Chatterjee et al., 2013; Jones et al., 2015). Although, the life course perspective demonstrates the long-term influence of a set of life events on transport behaviour, other factors of change can also mediate this effect (Chatterjee et al., 2013; Clark et al., 2016a). Baslington (2008) proposes the role of 'travel socialisation' in studying the development of transport behaviour. The theory of travel socialisation posits that travel behaviour is influenced by social norms regarding particular behaviour transferred through agents of socialisation, such as media, peers and family (Baslington, 2008; Haustein et al., 2009). Other travel socialisation related studies also found that the effect of specific events related to personal mobility, such as moving to another mobility culture, may also change attitudes about particular transport modes and, as a result, induce behavioural change (De Haas et al., 2018; Klinger and Lanzendorf, 2016). Depending on the local infrastructure, available mobility options, their individual capabilities and social norms associated with using particular transport modes in a particular context, immigrants might change their travel behaviour after moving to a new mobility culture (Chatterjee and Scheiner, 2015; Welsch et al., 2018).

Such findings led to a growing interest in examining immigrants' walking and bicycle behaviour following moves to places with distinct mobility cultures and behaviours in order to investigate the role of socialisation in travel behaviour (Doescher et al., 2017; Kaplan et al., 2018; Smart, 2010). The focus on immigrants, individuals who came into a foreign country in order to live there (Cambridge University Press, 2022), allows researchers to study the impact of cultural norms on current travel behaviour, as immigrants live in the same mobility culture as the native population, but they have been exposed to other cultural influences from their country of origin or other countries in which they previously lived (Haustein et al., 2020). In addition, unlike the native population, immigrants might not have a 'built-in' propensity to use particular transport modes common in the new mobility culture, allowing researchers to focus more on place-specific factors and on how immigrants become socialised into a distinct mobility culture (Nello-Deakin and Nikolaeva, 2021). Previous empirical studies reveal great differences between travel behaviour of immigrants and that of the native population (Haustein et al., 2020; Smart, 2010; Welsch et al., 2018). However, current literature generally considers one type of immigrant, that of less affluent, low-status individuals, thereby neglecting the rich heterogeneity that exists among immigrants in general (Smart, 2010). As a result, other types of immigrants, including expats, are generally not included in transport equity and travel behaviour related research. Currently, there is limited knowledge of the differences in walking and cycling activity among particular immigrant population groups with distinctive personal characteristics, in comparison with various native populations; which, in turn, also host a wide variety of personal characteristics. Research on this topic is needed in order to promote walking and cycling among immigrants, which, in turn, might contribute to improved cultural adaptation (Haustein et al., 2020; Nello-Deakin and Nikolaeva, 2021) and, hence, increased social integration in society (Kaplan et al., 2018; van der Kloof, 2015). In addition, understanding the behaviour of immigrants moving to countries with a strong cycling culture can help us understand the role of life experiences with active travel modes compared to culture and infrastructure.

The aim of this study is to identify the impact of a distinct mobility culture on walking and cycling behaviour by assessing the influence of various socio-demographic and transport related factors on active travel mode choice and use. This will be done by investigating differences in active travel behaviour among young, highly-educated people living in the Netherlands between those born and raised in the Netherlands (ethnic Dutch) without having spent a significant time abroad and those born elsewhere and who spent a significant amount of time in less active travel mode friendly places (immigrants) by means of assessing two different kinds of data sources. This study focuses specifically on professional immigrants, young and highly-educated immigrants with a relatively high income, as they are more likely to have modal choice because they can afford a car than other relatively lower income immigrant groups or refugees seeking to immigrate. In turn, this allows us to assess the active travel behaviour between varying populations groups living in the same mobility culture. Even though the data sets have a different origin, the mode choice of both samples is likely not restricted by costs; meaning that they have a range of transport options available to them and are able to make a deliberate choice to use active travel modes. Accordingly, a multiple linear regression analysis of dichotomous and ordinal variables is used to identify similarities and differences in walking and cycling behaviours between two samples, namely a survey sample and a sub-sample of ethnic Dutch drawn from the 2018 Dutch national travel survey (MPN) with similar socio-demographic characteristics.

The remainder of this paper is structured as follows. The introductory section proceeds by discussing the main determinants of the preference to walk and cycle by means of a brief literature review, and setting out the context of the study. In section 2 we discuss the methods applied to collect data, the data preparation and the data analysis methods that have been utilised. The results from a descriptive analysis and the multiple linear regression analysis with regard to active travel behaviour are presented in section 3. Finally, in section 4, based on the results, conclusions are drawn and the implications of the study findings for policy and future research are discussed.

Literature review

In order to study the differences in the walking and cycling behaviours of professional immigrants and comparable ethnic Dutch, it is important to identify which factors have a significant influence on active travel mode choice. Previous transport research suggests that levels of walking and cycling differ between population sub-groups in various contexts (Adams, 2010; Heesch et al., 2014; Kwaśniewska et al., 2010; Scheepers et al., 2013; Ton et al., 2019). With regard to gender, previous literature often reports that men cycle and walk more than women (Fraser and Lock, 2010; Muñoz et al., 2016; Olabarria et al., 2012). However, this mainly holds true for countries with low cycling penetration (Heinen et al., 2010), as studies conducted in well-established active travel cultures, such as the Netherlands or Denmark, report the opposite (Böcker et al., 2017; Heinen et al., 2010), while other studies found no gender differences at all across various contexts (Edwards and Mason, 2014; Ton et al., 2019). In terms of age, younger people are often found to cycle more than relatively older people (Adams, 2010; Heinen et al., 2010; Muñoz et al., 2016), although mixed results have been reported (Ton et al., 2020; Ton et al., 2019). With regard to education, Adams (2010), for instance, found that participation in active travel among UK citizens is greater among higher educated people than population groups with lower levels of education. Similarly, Scheepers et al. (2013) and Ton et al. (2019) found that Dutch people who completed a high-level of education, walk or and/or cycle more than groups who have a lower level of education. However, these results are inconclusive as mixed findings on the effects of education on walking and cycling levels have been reported in the literature (Beenackers et al., 2012; Heinen et al., 2010). In terms of income, lower income groups often have less access to well-developed walking and cycling infrastructure (Goodman et al., 2013), and have overall lower levels of walking and cycling (Gao et al., 2019; Kamphuis et al., 2009), compared to higher income groups. However, the direction of causality in the relationship is often mixed (Handy et al., 2014; Heinen et al., 2010; Muñoz et al., 2016). Additionally, in countries with a high share of cycling trips, native populations are often found to cycle more than immigrants (Bere et al., 2008; Haustein et al., 2020; Pucher and Buehler, 2008), although other studies did not find a significant differentiation between native populations' and immigrants' active travel mode choice (Ton et al.,

2019).

Furthermore, multiple built environment related characteristics are positively associated with walking and/or cycling levels, including: high population and urban density, mixed land-use areas, the presence of a safe, well-connected and dedicated walking and cycling infrastructure and the provision of bicycle storage facilities (Fraser and Lock, 2010; Heinen et al., 2010; Saelens and Handy, 2008; Saelens et al., 2003; Yang et al., 2019). Additionally, the presence of parks, playgrounds, street vegetation, street furniture (e.g. benches and bins), are associated with increased walking and bicycle use (Wang et al., 2016). Life course related research argues that when a contextual change triggers deliberation of active travel behaviour, this process is often mediated by various built environment characteristics. Previous research shows that moving to a mobility culture that boasts many of the above-mentioned built environment characteristics, together with reduced travel distances and times, and perceived increases in neighbourhood attractiveness, safety and sociability, improves attitudes towards active travel modes and overall levels of walking and cycling (Aditjandra et al., 2016; Clark et al., 2016b; Giles-Corti et al., 2013; Oakil et al., 2016). For instance, Oakil et al. (2016) and Clark et al. (2016b) found that a decrease in commute time increases the likelihood to switch to active commuting. In addition, moving to an area with more cycle routes and secure parking in public locations is positively associated with increased cycling (Chatterjee et al., 2013).

With regard to mobility and transport related variables, previous literature found that car ownership/access is often negatively associated with levels of walking and cycling (Heinen et al., 2010; Mitra, 2013), whereas bicycle and e-bike availability leads to increased levels of cycling (Fraser and Lock, 2010; Fyhri and Fearnley, 2015; Handy et al., 2014). In contrast to these findings, Ton et al. (2019) found in their study on the effects of various factors on active travel mode choice no significant relationship between car ownership and active travel mode use. Pucher and Buehler (2008) found this is likely due to the fact that despite the significant increases in car ownership in well-established active travel cultures, such as the Netherlands, cycling remained a common mode of transport; suggesting that bicycle use might be effectively promoted in car-dominated countries. Furthermore, travel distance is negatively associated with active travel mode use (Heinen et al., 2010). Finally, previous research found a significant relationship between trip purpose and active travel mode choice (Fraser and Lock, 2010; Gao et al., 2019; Ton et al., 2019), suggesting that active travel modes are used for various trip purposes. However, the direction of causality remains unknown (St-Louis et al., 2014).

Study context

The Netherlands has a well-established active travel culture (Carstensen & Ebert, 2012; Haustein and Nielsen, 2016). Longstanding and significant investment in walking and cycle infrastructure, together with its historical disposition to use active travel for transport purposes, temperate climate and relatively flat terrain are the primary reasons suggested for the resultant high use of active travel modes among residents (Carstensen and Ebert, 2012; Fishman, 2016; Haustein and Nielsen, 2016; Pucher and Buehler, 2008). This is further reflected in the country's mode share; approximately 37 per cent of the total trips in 2018 were accounted for by active travel and more than half of these consisted of bicycle trips (CBS, 2018), making the Netherlands the leading cycling country in Europe (European Commission, 2017). The use of active travel modes in the Netherlands, however, differs significantly between urban centres and less urbanised areas (Gao et al., 2018; Gao et al., 2019). In contrast to many other Western countries, active travel mode use in the Netherlands is high across various gender and age groups (Aldred et al., 2016; Gao et al., 2017). This is predominately explained by the suitable climate and topography of the country (Pucher and Buehler, 2008), lower safety concerns associated with using these modes (Barajas, 2020; Furian et al., 2016), and commonly held views that using active travel modes for transport purposes is common (Haustein et al., 2020; Pucher and Buehler, 2008). However, previous research suggests that governmental policies are at least as important in promoting active travel (Pucher and Buehler, 2008). Even with the arrival of the private car after the Second World War, walking and cycling have been given a central role in transport policies and helped shape the national identity of the Netherlands (Carstensen and Ebert, 2012; Pucher and Buehler, 2008; Schwanen et al., 2004).

Despite the Netherlands' position as a premier active travel culture, there is limited knowledge of spatial and social variations in active travel (Harms et al., 2014). In order to address this research gap and meet the research objectives of this study; that is, to gain better understanding in the differences in active travel behaviours between immigrants and the native Dutch population and the factors that influence their behaviour; we conducted an empirical study among professional immigrants in the Randstad region and compared this with data drawn from the 2018 MPN dataset. The Randstad region is a conurbation of large and mid-sized cities, including Amsterdam, Rotterdam and The Hague with approximately 8.3 million inhabitants (CBS, 2020a). Due to its wide spectrum of economic activities and excellent international accessibility, the region is currently the fourth-largest metropolitan area in Europe, making it an attractive place for international businesses, conferences and visitors. In addition, the Randstad hosts many higher education institutions, including leading universities in the Netherlands. As a result, the region is the main driver of knowledge and innovation in the country (Regio Randstad, 2019). Thanks to its social, cultural and economic capital, the Randstad attracts most immigrants, as approximately 73 per cent of high-income foreign workers in the Netherlands reside there (CBS, 2011).[1]

In our study we refer to professional immigrants, instead of high-income and/or highly educated foreign workers and expats, to reduce any stigmatisation associated with these definitions in terms of income, education and social status (van Bochove and Burgers, 2019), and, thereby, include more potential participants. Professional immigrants (sometimes referred to as expats) are defined in our study as highly-educated immigrants who have sufficient financial resources to be able to afford a range of transport options, including the ability to purchase a car. Accordingly, due to having multiple transport options available to them, this immigrant population group can be regarded as either 'captive-by-choice' and 'choice users', as they choose to be dependent on public or active travel modes while they could own a car or already have a car available to them (van Lierop and El-Geneidy, 2016).

Methodology

Data collection

In order to obtain socio-demographic and travel behaviour information on immigrants living in the Randstad, we conducted an online survey via Qualtrics. This approach was found suitable for the aims of this study, due to the limited amount of socio-demographic information, especially income, in the MPN dataset which impeded us from drawing professional immigrants from this dataset, Furthermore, there is no central registration of professional immigrants in the Netherlands from which a sample could be drawn from. Thus, an exploratory recruitment strategy is the only possible method to collect data for this particular population group. As such, the findings of this study cannot be generalised to the wider professional immigrant population, and only apply to this particular drawn sample. Potential participants were recruited via expat and international community groups in the Randstad region using Facebook. Previous research has shown that Facebook could act as a

[1] More recent data with regard to the number of high-income foreigners in the Netherlands is not available.

Table 1
Proportional distribution in socio-demographic factors between the survey sample, MPN sample and the sub-sample. Source: Authors.

	MPN sample[3] (**n = 8561**)		Survey sample (professional immigrants) (**n = 160**)		MPN Sub-sample (native Dutch) (**n = 276**)		Differences in proportion
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*	*Z-value*
Highest education achieved by the respondent							
Left school at 18	679	18.7	4	2.5	9	3.3	−0.471
Trade/vocational degree	935	25.7	7	4.4	19	6.9	−1.042
Bachelor's degree	1444	39.7	51	31.9	70	25.4	1.444
Master's degree or higher	576	15.9	98	61.3	178	64.5	−0.667
Valid cases	3634	42.4	160	100.0	276	100.0	
Age of respondent (years)							
≤ 20	855	12.7	3	1.9	7	2.5	−0.400
21–28	559	8.3	46	28.7	104	37.7	−1,875*
29–34	1427	21.1	53	33.1	100	36.2	−0.646
35–44	1241	18.4	47	29.4	50	18.1	2.690**
45–54	1418	21.0	8	5.0	11	4.0	0.476
55–64	1249	18.5	3	1.9	4	1.4	0.417
Valid cases	6749	78.8	160	100.0	276	100.0	
Gender							
Male	4037	47.2	37	23.1	64	23.2	−0.024
Female	4524	52.8	123	76.9	212	76.8	0.024
Valid cases	8561	100.0	160	100.0	276	100.0	

*Significantly different at $p < 0.10$.
**Significantly different at $p < 0.05$.
[3]Percentages in the column of the MPN sample are based on the number of valid cases.

useful recruitment tool for a range of fields of study (Whitaker et al., 2017; Zhang et al., 2020). For example, when compared with traditional recruitment methods (print, radio, television, and email), benefits include reduced costs, shorter recruitment periods, better representation, and improved participant selection in young and hard to reach demographics (Whitaker et al., 2017). However, several limitations should be considered, which are discussed in the discussion section of the paper.

Invitations to participate were distributed through online social media posts, which included information about the purpose of the study, alongside a link to the online survey in Qualtrics. Participants were encouraged to share the link among peers and family in order to include more potential participants. To generate interest among professional immigrants to participate in the research, three gift cards (worth of 25 euros) were randomly allotted among the research participants in a prize draw.

The survey focused on obtaining information regarding immigrants' personal characteristics; including gender, age, educational attainment and personal income; and, current travel practices, including travel mode access, driver's license possession, mode preference, actual mode use, trip purpose. Furthermore, information about how the Dutch mobility culture has affected their walking and cycling behaviour was gathered. In addition, participants were asked about their migration history, including information about the places they lived throughout their life, in what year they did come to live in the Netherlands, their main reasons to live in the Netherlands, whether they are registered at a Dutch address, and how much longer they intend to stay in the Netherlands. The questions of the survey are in accordance with the questionnaire used in the 2018 Dutch national travel survey, the Netherlands Mobility Panel (MPN), to allow for comparison of the results between both samples. The MPN is a multi-wave cross-sectional survey that collects data on the travel behaviour of a fixed groups of individuals and households over multiple years, with the aim to determine how changes in personal or household characteristics and other travel-related issues are related to changes in travel behaviour (Hoogendoorn-Lanser et al., 2015).

In order to select participants relevant to this study, we assessed whether participants could be defined as professional immigrants. Professional immigrants are sometimes referred to as expats and encompass immigrants who have sufficient financial resources to be able to afford a range of transport options, specifically car. Although the term 'expat' is widely-known, no universal definition currently exists. As we seek to investigate professional immigrants in the Dutch context (CBS, 2015), this study makes use of the definition provided by Statistics Netherlands (*Centraal Bureau voor de Statistiek*). Statistics Netherlands defines expats as individuals who are between 18 and 75 years old; have a foreign nationality; are registered in the Dutch population register (BRP); have a different migration motive than asylum seekers, au-pairs and interns; and have a fiscal income that falls within 15 to 35 percent of the highest income levels of their respective sector (CBS, 2015).

Data preparation

In total, 160 surveys were completed. Respondents were generally female (76.9%), between 29 and 34 years old (33.1%) and held at least a Master's degree (61.3%); which is not surprising given the target population of this study. In comparison, respondents to the MPN dataset (n = 8561) were also predominantly female (52.8%), between 29 and 34 years old (21.1%) and held a Bachelor's degree (39.7%) (Table 1). In order to compare travel behaviour and travel mode use and their determinants with the survey sample, a sub-sample of the MPN 2018 dataset with similar key socio-demographic characteristics, including gender, age and level of education was created. This was done in three steps. We started by matching the proportions by level of education resulting in 945 cases drawn from the original MPN 2018 dataset. This was followed by matching the proportions of the various categories of age in the sub-sample reducing these 945 cases to 362. In the third step, we matched the proportions in gender, resulting in a total of 276 relevant cases for the sub-sample.

In order to show that the sub-sample of 276 cases, drawn from the MPN 2018 dataset, has the same distributional characteristics as the survey sample, differences in proportion tests have been conducted (Schumacker, 2015) (Table 1). Differences in proportions between the survey sample and the ultimate sub-sample may be due to the stepwise procedure applied. More than 83 per cent of the differences in proportions are statistically not different from zero ($Z < 1.64$ or 1.96; $p > 0.10$ or 0.05). However, the representation of the age group 21–28 is slightly overrepresented ($Z > 1.64$, $p < 0.10$) and the age group 35–44 is underrepresented ($Z > 1.96$, $p < 0.05$) compared to the survey sample. Furthermore, to ensure that the MPN sub-sample represents a sample solely comprised of ethnic Dutch, only individuals within the category 'Native Dutch ethnic origin' were selected. This includes people born in

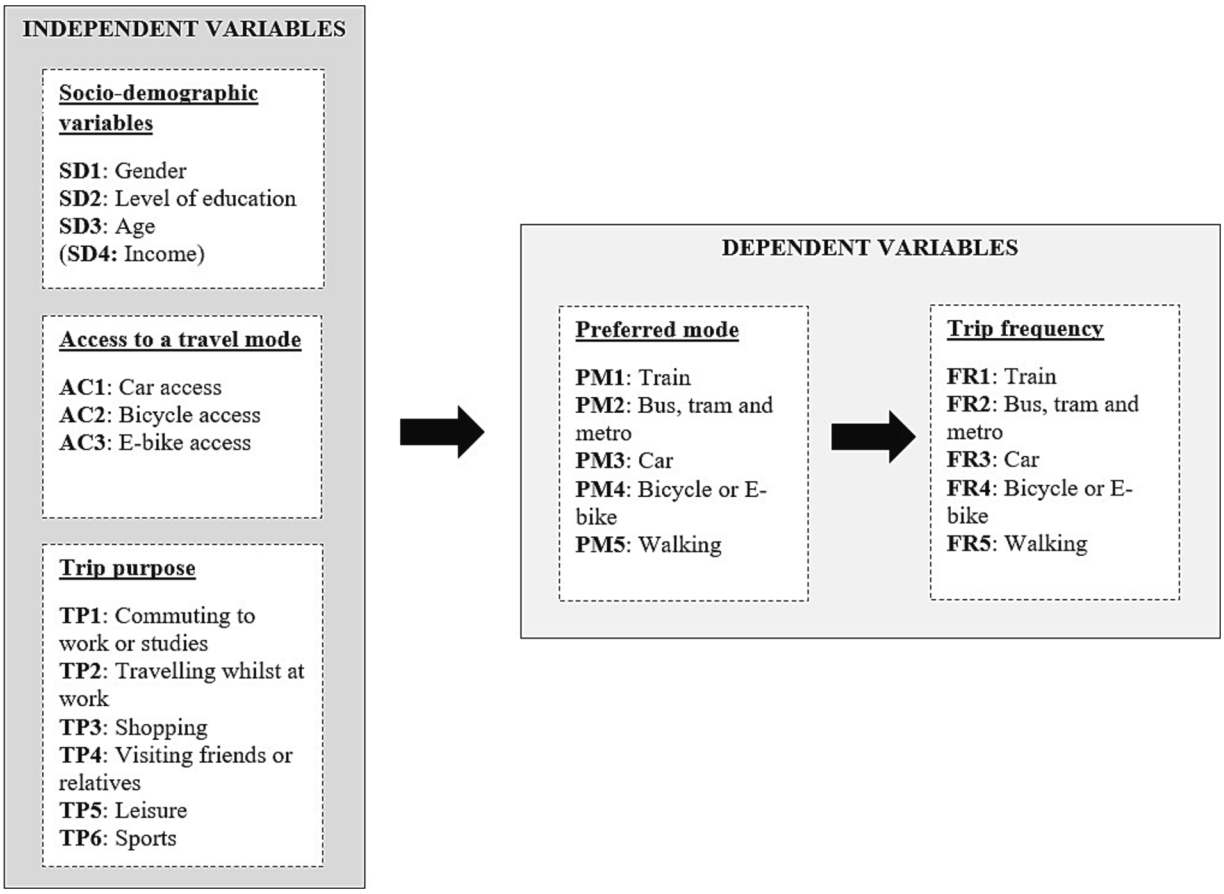

Fig. 1. Conceptual model for explaining the effects of socio-demographic and transport related variables on active travel mode choice and use. Source: Authors.

the Netherlands and whose both their parents are also born in the Netherlands. Therefore, all other categories were excluded, including professional immigrants.[2]

Data analysis

Descriptive analysis allowed us to identify differences in travel behaviour between the two samples and determine which population group is more prone to use active travel modes on a regular basis. Furthermore, based on previous findings on active travel mode choice and use (see **Section 1.2**) we specified a conceptual model containing various mutually related travel behaviour variables, controlling for the effects of the socio-demographic characteristics of the respondents (see Fig. 1). Unfortunately, information about the gross personal income and residential location of ethnic Dutch, together with data on travel distance, is not available in the MPN 2018 dataset due to privacy restrictions. As a result, we were unable to compare both samples based on these variables. However, as the average distances to basic amenities in the Randstad and the Netherlands as a whole do not significantly differ on a regional scale (CBS, 2020b), there are indications that both samples share a similar distribution in residential and/or work locations, although previous research has shown that access and other opportunities differ across postal code areas (Geurs and van Eck, 2003; Lucas et al., 2016; Scheepers et al., 2013). A list of the variables specified in the conceptual model and how they have been measured can be found in Appendix **A**.

In order to test for the relationships between the variables specified in the conceptual model, two estimation approaches are suited, namely a multi-nominal logit model (MNL) in combination with an ordinal regression (OR) (Bhat, 1997), or by treating all variables as ordinal variables with two or more categories and estimating the underlying Pearson's correlation and feeding them into a multiple linear regression model (Olsson, 1979). The later model is preferred, because it additionally accounts for the strength of preferences and the relationships among those preferences, thereby containing a higher informational output. Accordingly, we conducted a multiple linear regression analysis of the dichotomous and ordinal variables in the conceptual model based on their polychoric correlations. Polychoric correlations are the Pearson correlations of the standardised normally distributed latent variables underlying the measured ordinal variables (Olsson, 1979). This method allows us not only to test for the direct effects of independent variables and preferences on actual travel mode use, but also for simultaneous feedback effects of actual travel mode use on mode preferences. Furthermore, correlations between regression errors are estimated in order to control for relations induced by variables not specified in the model. For this purpose, we used the software package LISREL 8.80 (Jöreskog and Sörbom, 1996). In order to estimate the models, we first specified the independent variables individually and removed high-correlating variables ($R > 0.9$) using a step-wise procedure. This procedure is based on the modification indices indicating significant effects of non-specified parameters provided by the LISREL program and is used to improve the fit of the model. Subsequently, we specified the dependent variables of the conceptual mode using the same approach. Furthermore, in order to test for moderation effects between the dependent and independent variables specified in the conceptual model (see Fig. 1) a simple moderation analysis was performed. Findings show that these effects are similar to the direct effects of access to transport

[2] A full description of the ethnicity categories used in the 2018 MPN dataset can be found in question 11, 13 and 14 in the following control construct scheme: https://www.mpndata.nl/control_construct_schemes/view/29.

Table 2
Results from the descriptive analysis with regard to travel mode access. Source: Authors.[4.]

	Survey sample (professional immigrants) (**n = 160**)			MPN Sub-sample (native Dutch) (**n = 276**)		
	Frequency	*%*	*Missing data (%)*	*Frequency*	*%*	*Missing data (%)*
Access to travel modes						
Passenger car (diesel or gasoline)	47	29.4	–	196	71.0	–
Passenger car (electric, hydrogen or hybrid)	10	6.3	–	8	2.9	–
Van	3	1.9	–	1	0.4	–
Motorcycle	5	3.1	–	11	4.0	–
Moped, scooter (max. 45 km/h)	1	0.6	–	7	2.5	–
Moped, scooter (max. 25 km/h)	3	1.9	–	1	0.4	–
Speed pedelec	0	0.0	–	1	0.4	–
Bicycle	148	92.5	–	211	76.4	–
Electric bicycle (e-bike)	9	5.6	–	21	7.6	–
Folding bicycle	8	5.0	–	10	3.6	–
Mobility scooter, Canta or wheelchair	0	0.0	–	2	0.7	–
Other	7	4.4	–	3	1.1	–
Not applicable	4	2.5	–	4	1.4	–

[4] Percentages in the columns of both datasets are based on the number of respondents owning or having access to a particular transport mode compared to the total sample size. Owning or having access to multiple transport modes per individual is possible.

Table 3
Results from the descriptive analysis with regard to trip frequency in days per month. Source: Authors.

	Survey sample (professional immigrants) (**n = 160**)			MPN Sub-sample (native Dutch) (**n = 276**)		
	$\bar{x}$	*S*	*Missing data (%)*	$\bar{x}$	*S*	*Missing data (%)*
Average travel mode use on a monthly base in days						
Passenger car	4.372	6.315	4.4	10.534	6.163	–
Shared car (e.g. Greenwheels)	0.163	0.418	6.3	–	–	–
Car sharing services (e.g. Uber)	0.554	1.628	5.6	–	–	–
Train	4.802	5.625	0.6	3.237	5.494	–
Bus, tram and metro	5.808	6.130	5.0	2.601	4.772	–
Bicycle and e-bike	12.691	6.787	1.3	10.042	6.940	–
Shared bicycle or e-bike	0.279	1.442	5.6	–	–	–
Walking	13.959	5.361	2.5	12.035	6.102	–
Shared moped (e.g. GoSharing)	0.040	0.235	6.3	–	–	–
Shared scooter (e.g. Bird, Felyx)	0.092	0.388	5.0	–	–	–

modes; as indicated by very high correlations (>0.90) between the variables constituting the moderating effects and the variables representing modal access. Therefore, we left out the moderating effects of the model and estimated the direct effects between modal access and other variables only.

Results

Descriptive analysis

Results of the descriptive analysis reveal that immigrants in the Randstad mostly own or have access to a bicycle (either a racing or a Dutch style bicycle) compared to other modes of transport (92.5%) (see Table 2). This is furthermore reflected in travel mode use, as most of our respondents walk and use a bicycle or e-bike more days per month on average than other modes of transport such as trains, other public transportation and private cars (see Table 3). Furthermore, results from the sub-sample reveal that the comparable native Dutch population mostly has access to a bicycle (76.4%) compared to other modes of transport, followed by access to a conventional car (71.0%) (see Table 2). Taking a look at transport mode use, most natives either walk, drive a private car or cycle on a frequent basis per month (see Table 3).

Comparing the results between the two samples, the native Dutch population has less access to a bicycle (76.4%) compared to immigrants (92.5%) (see Table 2). In addition, professional immigrants have relatively less access to a conventional car (29.4%), than the native Dutch population (71.0%). Moreover, professional immigrants in the Randstad, on average, walk (13.96 days) and cycle (12.69 days) more days per month than the native Dutch population; 12.04 days and 10.04 days per month respectively (see Table 3). These findings suggest that highly-educated immigrants in the Randstad who have sufficient means to purchase a range of transport options, including the car (i.e. professional newcomers), are more prone to use active travel modes on a frequent basis than the native Dutch population. Interestingly, the findings show significant differences in private car and public transport use between the two samples. This could be partly due to locational differences in residence between immigrants and the native population at a neighbourhood level (Chatman, 2014; Nello-Deakin and Harms, 2019), in which professional immigrants might prefer to move to more densely populated urban centres. Previous research found that the relative large urban density and presence of cyclists in Dutch urban centres stimulates bicycle use among professional immigrants (Nello-Deakin and Nikolaeva, 2021).

Multiple linear regression analysis

The previous section discussed the descriptive results of both data sets. This section presents the results of the multiple linear regression analysis and identifies the factors that influence walking and cycling behaviour among immigrants and the comparable native Dutch population. In total, three models were estimated to identify variations between these samples. The first model estimated the effects of the variables specified in the conceptual model (see Fig. 1) based on the survey sample, while the second model additionally controlled for income level to identify its underlying effects. The third model estimated the effects of the specified variables based on the MPN sub-sample dataset. Due to privacy restrictions, data on personal annual gross income cannot be included. As a result, we could not compare both datasets with respect to income. In this context, two models have been estimated with respect to the survey sample; allowing us to directly compare findings of the survey sample with that of the MPN sub-sample. In order to obtain significant results, we optimised the fit of the operationalised conceptual model to the data, that is, no more significant parameters could be added to the statistical model. This resulted in the following estimates of the various relations (e.g. standardised beta coefficients) between the variables in the conceptual model (see Tables 4,

Table 4
Estimated direct effects of the (in)dependent variables on each other for the survey sample without income control (n = 160). Source: Authors.[5.]

	To									
From	**PM1: Train preference**	**PM2: Bus, tram and metro preference**	**PM3: Car preference**	**PM4: Bicycle or e-bike preference**	**PM5: Walking preference**	**FR1: Train frequency**	**FR2: Bus, tram and metro frequency**	**FR3: Car frequency**	**FR4: Bicycle or e-bike frequency**	**FR5: Walking frequency**
PM1	–	–	–	–	–	–	–	−0.267***	–	–
PM2	–	–	–		–	–	–	–	–	–
PM3	–	–	–	–	–	–	–	–	–	–
PM4	–	−0.516***	–	–	–	–	–	–	–	–
PM5	–	–	–	–	–	–	–	–	–	–
FR1	–	–	–	–	–	–	–	–	–	–
FR2	–	–	–	–	–	–	–	–	–	–
FR3	–	–	0.302***	–	–	–	–	–	–	–
FR4	–	–	–	–	–	0.265***	–	−0.341***	–	–
FR5	–	–	–	–	–	–	–	–	–	–
AC1	–	–	0.769***	–	–	−0.208***	−0.251***	0.516***	–	−0.225***
AC2	–	–	−0.753***	0.620***	–	–	–	−0.166**	0.922***	–
AC3	–	–	–	–	−0.914***	–	−0.302***	–	–	−0.176***
TP1	−0.328***	−0.138***	–	−0.441***	0.450***	–	–	–	–	0.804***
TP2	–	0.626***	0.816***	–	−0.335***	0.140**	0.146**	–	−0.436***	–
TP3	–	–	−0.248***	0.294***	0.493***	–	–	–	–	0.164**
TP4	0.459***	0.247***	0.323***	–	–	–	–	–	–	–
TP5	–	–	–	–	0.314***	–	–	–	–	–
TP6	0.159***	–	–	–	−0.663***	–	–	–	–	–
SD1	–	–	−0.184**	0.441***	0.402***	–	0.266***	−0.206***	0.199**	−0.137**
SD2	–	–	–	–	0.211**	–	−0.270***	–	–	–
SD3	–	–	0.460***	–	–	–	–	–	–	–
R^2	0.366	0.483	0.843	0.602	0.838	0.078	0.300	0.592	0.744	0.935

*Significantly different at $p < 0.10$; ** Significantly different at $p < 0.05$; *** Significantly different at $p < 0.01$.

[5] In addition to the results presented in the table, also significant correlations between the regression errors were found, namely between preferences to use the car and the preference to walk (-0.190**) and levels of cycling (0.345***). Furthermore, significant correlations between the regression errors were found for actual use of the train and the use of the bus, tram or metro (0.229***).

Table 5
Estimated direct effects of the (in)dependent variables on each other for the survey sample with income control (n = 160). Source: Authors.[6.]

	To									
From	**PM1: Train preference**	**PM2: Bus, tram and metro preference**	**PM3: Car preference**	**PM4: Bicycle or e-bike preference**	**PM5: Walking preference**	**FR1: Train frequency**	**FR2: Bus, tram and metro frequency**	**FR3: Car frequency**	**FR4: Bicycle or e-bike frequency**	**FR5: Walking frequency**
PM1	–	–	–	–	–	–	–	−0.276***	–	–
PM2	–	–	–		–	–	–	–	–	–
PM3	–	–	–	–	–	–	–	0.353***	–	–
PM4	–	−0.512***	–	–	–	–	–	–	–	–
PM5	–	–	–	–	–	–	–	0.335*	–	–
FR1	–	–	–	–	–	–	–	–	–	–
FR2	–	–	–	–	–	–	–	–	–	–
FR3		–	–	–	–	–	–	–	–	–
FR4	–	–	–	–	–	0.263***	–	−0.368***	–	–
FR5	–	–	–	–	–	–	–	–	–	–
AC1	–	–	0.910***	–	−0.496**	−0.194***	−0.260***	0.393***	–	−0.231***
AC2	–	–	−0.843***	0.611***	–	–	–	−0.219***	0.935***	–
AC3	–	–	–	–	−0.955***	–	−0.288***	–	–	−0.177***
TP1	−0.335***	−0.139***	–	−0.442***	0.476***	–	–	–	–	0.792***
TP2	–	0.624***	0.906***	–	−0.318***	0.147**	0.140**	–	−0.456***	–
TP3	–	–	−0.243***	0.299***	0.606***	–	–	–	–	0.165**
TP4	0.456***	0.250***	0.355***	–	–	–	–	–	–	–
TP5	–	–	–	–	0.428***	–	–	–	–	–
TP6	0.149**	–	–	–	−0.485***	–	–	–	–	–
SD1	–	–	−0.197**	0.438***	0.485***	–	0.244***	−0.220***	0.201**	−0.139**
SD2	–	–	–	–	–	–	−0.254***	–	–	–
SD3	–	–	0.453***	–	0.278**	–	–	0.162*	–	–
SD4	–	–	−0.335***	–	–	–	–	–	–	–
R^2	0.364	0.482	0.905	0.598	0.999	0.074	0.281	0.590	0.757	0.920

*Significantly different at $p < 0.10$; ** Significantly different at $p < 0.05$; *** Significantly different at $p < 0.01$.

[6] In addition to the results presented in the table, also significant correlations between the regression errors were found, namely between preferences to use the car and the preference to walk (-0.272**) and levels of cycling (0.359***). Furthermore, significant correlations between the regression errors were found for actual use of the train and the use of the bus, tram or metro (0.229***).

Table 6
Estimated direct effects of the (in)dependent variables on each other for the sub-sample drawn from the MPN 2018 dataset (n = 276). Source: Authors.[7]

From	To									
	PM1: Train preference	**PM2: Bus, tram and metro preference**	**PM3: Car preference**	**PM4: Bicycle or e-bike preference**	**PM5: Walking preference**	**FR1: Train frequency**	**FR2: Bus, tram and metro frequency**	**FR3: Car frequency**	**FR4: Bicycle or e-bike frequency**	**FR5: Walking frequency**
PM1	–	–	–	–	–	–	–	–	–	–
PM2	–	–	–	–	–	–	–	–	–	0.285***
PM3	–	–	–	−0.331***	–	–	–	–	–	–
PM4	–	–	–	–	−0.503***	–	–	–	–	–
PM5	−0.183***	–	–	–	–	–	–	–	–	–
FR1	–	–	–	–	–	–	–	–	–	–
FR2	0.566***	–	–	–	–	–	–	–	–	–
FR3	0.283***	0.209***	−0.162***	–	–	–	–	–	–	–
FR4	–	0.146**	–	0.574***	–	–	–	–	–	–
FR5	–	–	–	0.094*	–	0.131**	–	−0.189***	–	–
AC1	−0.545***	–	0.347***	−0.501***	–	–	−0.251***	–	–	–
AC2	0.427***	−0.431***	–	–	–	0.267***	–	–	0.388***	–
AC3	0.286***	−0.656***	−0.316***	0.457***	–	−0.322***	–	–	−0.208***	–
TP1	–	–	–	0.345***	–	–	–	–	–	–
TP2	0.363***	–	–	–	–	–	–	–	–	0.263***
TP3	–	−0.314***	−0.310***	–	0.218***	–	–	–	–	–
TP4	−0.623***	–	–	–	–	–	–	–	0.334***	0.111**
TP5	–	–	−0.577***	–	0.853***	–	0.184***	–	–	–
TP6	0.202***	0.194***	–	0.197**	–	–	–	–	–	–
SD1	–	–	–	–	–	–	–	−0.140**	–	0.346***
SD2	0.106*	0.616***	–	–	–	–	0.230***	0.301***	–	–
SD3	–	−0.169***	–	0.258***	–	–	–	–	–	–
R^2	0.568	0.920	1.0[4]	0.511	0.956	0.175	0.726	0.501	0.709	0.282

*Significantly different at $p < 0.10$; ** Significantly different at $p < 0.05$; *** Significantly different at $p < 0.01$.
[4]The original R^2 value may be attributed to rounding errors in the estimation procedures applied; $R^2 = 1.042$. Nevertheless, the estimate of the Weighted Least Squares Chi-Square indicates a nearly perfect fit of the model to the input correlation matrix, with X^2 (df = 108, N = 276) = 70.024, $p = 0.998$.
[7] In addition to the results presented in the table, also significant correlations between regression errors were found, namely between the preferences to use the bus, tram or metro and the preference to use a car (−0.414***); actual train use (−0.273***); and, actual car use (0.258***). Furthermore, significant correlations between regression errors were found for the preference to cycle and train use (0.108*), between train use and the actual use of the bus, tram and metro (−0.116*), and between the actual use of the bus, tram or metro and levels of walking (−0.144**), and actual car use (0.238***).

5 and 6). The Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit index (AGFI) of the model on the survey sample with (GFI = 0.974; AFGI = 0.941) and without controlling for income (GFI = 0.976; AFGI = 0.944) are >90 per cent, with a RMSEA close to zero (RMSEA = 0.0001), indicating well-fit models. Furthermore, the optimisation of the conceptual model on the sub-sample results in a GFI and AFGI >90 per cent (GFI = 0.992; AGFI = 0.980) and a RMSEA with a value close to zero (RMSEA = 0.001).

Results of the survey sample without income control

The findings from the multiple linear regression analysis of the survey sample without controlling for income show that socio-demographic factors have significant impacts on mode preference and levels of use (see Table 4). Women tend to cycle or use the bus, tram or metro frequently and prefer cycling to get around, though more highly educated women walk more. Men, in general, walk or use the car more, while men in their 30′s and 40′s travel more by car. As this study focuses on professional immigrants, modal use is based on choice and not on affordability. In terms of modal access, bicycle and e-bike access unsurprisingly increased the likelihood of cycling and reducing other modes, including walking, public transportation and car use. In contrast, access to a car reduced levels of cycling and walking. Trip purpose had a number of impacts on modal use and preference. People have a preference for walking for commuting, shopping and leisure trips but less so for business or sport trips. Business trips, along with commuting to work or study, were also less likely to be done by bicycle; shopping trips were more likely to be done by bicycle.

Results from the reciprocal relations between dependent variables show some limited effects on active travel behaviour. Having a preference for the bus, tram, metro or levels of car use has a negative effect on the preference to cycle, but frequent train use positively influences levels of cycling. This finding might be explained by complementary effects between the train and the bicycle in meeting the transport demands of professional immigrants, whereas the preference to use public transportation modes other than the train and the preference to cycle substitute each other. However, whether these negative and positive effects represent substitution and complementary effects cannot be concluded yet; showing that further research into the nature of the found effects is needed.

Results of the survey sample controlling for income

In our second model, we performed a multiple linear regression analysis of the survey sample data that additionally controls for income (see Table 5). When comparing both models, gender effects on mode preference and actual mode use remain the same, as women generally tend to cycle and men walk more often to meet their transport needs. Interestingly, when controlling for income, the relationship between education and the preference for walking disappears and a significant relationship between age and walking preference emerges. The findings show that women in their 20′s prefer to cycle, while women in their 30′s and 40′s prefer to walk. Furthermore, the effect and direction of access and trip purpose remain the same.

When comparing the effects of the dependent variables on each other between both models, the effects of having a preference to cycle on the preference to use public transportation remains the same. Similarly, immigrants who frequently use a car tend to cycle less often and immigrants who frequently travel by train often cycle. Furthermore, in accordance with the previous model, the preference to cycle is negatively related to using the bus, tram or metro, while cycling levels are positively related to train use. Surprisingly, in contrast to our

expectations, the findings show that there is a significant positive relationship between levels of car use and the preference to walk. These findings suggest that there is an underlying factor that mediates this effect.

Results of the sub-sample

Overall, the findings from the multiple linear regression analysis of the sub-sample data reveal that socio-demographic variables have a very limited effect on transport mode preferences and frequency of use (see Table 6). The findings indicate that only age has a significant effect on the preference to choose to cycle. In particular, people in their 30′s and 40′s tend to have a preference to cycle and women are more likely to walk to meet their transport needs. Taking a closer look at access to active travel modes, the results show that having access to an e-bike leads to an increased preference for cycling. Unsurprisingly, bicycle access has a positive effect on levels of cycling, while access to an e-bike reduces regular bicycle use. Moreover, car access leads to a reduced preference to cycle. Furthermore, results on the effects of trip purpose on active travel mode preference and use show significant relationships. ethnic Dutch prefer to walk for shopping, leisure and business trips, while they often walk or cycle to visit relatives or friends.

Finally, estimations of the effects of the dependent variables on each other reveal that the preference to cycle has a negative effect on the preference to walk. Furthermore, the preference to use the car is negatively associated with the preference to cycle and the preference to walk has a negative impact on travelling by train. But again, substitution effects cannot be derived yet from the results. When taking a look at frequency of mode use, findings show that levels of cycling have a positive influence on the preference to use the bus, tram or metro and the bicycle. This finding suggests that cycling might act as a complementary mode to other type of transport modes in fulfilling the transport needs of ethnic Dutch. Furthermore, using the car on a frequent basis leads to decreased walking among ethnic Dutch. Interestingly, the preference to walk has a significant positive, but very limited, effect on levels of cycling. In addition, frequent walking has a positive effect on train use. These findings suggest that other factors mediate the relationship between mode preferences and actual use, as indicated by correlations between the regression errors (see Table 6).

Discussion and conclusions

This study presents quantitative findings on differences between the transport choices and uses of professional immigrants and a comparable sample of native Dutch people living in the Netherlands by means utilising two different data sources. In contrast to previous work in this area, this study is the first to examine the active travel behaviour of highly-educated immigrants with sufficient financial resources to be able to afford a range of transport options. This is important as it means that if these immigrants use active transport modes, it is through choice and not because they cannot afford more expensive modes, specifically the car. By means of a multiple linear regression model of dichotomous and ordinal variables using their polychoric correlations, this study examines the simultaneous effects of mode preferences on actual use (and vice versa), while controlling for structural effects not specified in the conceptual model. Overall, the findings show significant differences in walking and cycling levels between the survey sample and the sub-sample drawn from the 2018 MPN dataset, with professional immigrants walking and cycling more days per month on average than ethnic Dutch. This is in contrast with earlier findings on active travel behaviour of immigrants in the Dutch context which show that immigrants are less likely to use active travel modes than ethnic Dutch (Haustein et al., 2020; Kaplan et al., 2018). Findings from this study suggest that various immigrant groups differ significantly from each other in their cultural adaptation to the way they walk and cycle through routinised behaviour in the Netherlands, as they are part of different multi-national cultural and socio-economic communities (Jackson, 2016; McKercher and Yankholmes, 2018).

Older ethnic Dutch overall tend to cycle more, and women tend to walk more. In contrast, female immigrants frequently cycle, while male and highly educated female immigrants tend to walk more often. Furthermore, access to transport modes among ethnic Dutch has a significant influence on preferences to use public transportation modes and the car. In the case of the professional immigrants, transport mode access has a significant effect on the preference to walk or cycle, while having a very limited effect on alternative travel modes. Furthermore, findings on the effects of trip purpose on mode preference and use reveal that walking and cycling is performed for different purposes across both population groups. These findings substantiate previous findings on professional immigrants, or expats, displaying unique travel behaviours different from that of the local population (Jackson, 2016; McKercher and Yankholmes, 2018). The findings from the multiple regression analysis also demonstrate that walking and cycling significantly influence each other and other transport mode choices and uses. This finding is in line with previous research on the role of walking and cycling in multi-modal transport use in the Randstad, the Netherlands (Bertolini, 2006). Among ethnic Dutch, the preference to walk leads to a reduced preference to use a bicycle or e-bike. In the case of immigrants, frequent train use leads to increased bicycle use, while frequent car use results in lower levels of cycling, suggesting that it is replacing active travel mode trips. In contrast, immigrants who frequently use the car also walk more. However, as argued before, whether these effects represent substitution and complementary effects cannot be concluded yet, and further research into these found effects is clearly needed. Furthermore, together with the correlation analysis, these findings suggest that active travel mode preference and use varies significantly and is also influenced by other variables not specified in the conceptual model, such as built environment related characteristics, including population density (Fraser and Lock, 2010; Wang et al., 2016), mixed-land use areas (Heinen et al., 2010; Muñoz et al., 2016; Wang et al., 2016), geographical factors (e.g. presence of hills) (Carstensen and Ebert, 2012; Gatersleben and Appleton, 2007; Manaugh et al., 2017), the availability of storage facilities (Heinen et al., 2010); and, the presence, density and continuity of walking and cycling infrastructures (Heinen et al., 2010; Mitra, 2013). Trip characteristics, such as travel time and distance (Ralph et al., 2020; Ton et al., 2019) and combinations of trip purposes (Pred, 1977), and seasonal and weather effects (Böcker et al., 2013; Heinen et al., 2010), may also induce effects on active travel mode preference and use. However, causes of the differences in walking and cycling behaviour between immigrants and ethnic Dutch remains a subject of further research, as the role of residential location and cultural norms in influencing professional immigrants' active travel behaviour is ambiguous. In order to understand the determinants that influence walking and cycling behaviour among various immigrant and native populations, future research should focus on (a) the effects of intermediary variables on actual levels of walking and cycling, and (b) the manner in which mode preference is formed and the factors that influence this process by means of qualitative research. Finally, we additionally tested for the effects of length of stay in the Netherlands on levels of walking and cycling among immigrants using Pearson's correlations, whose estimates showed no significant relationships. This finding is in contrast with earlier findings on immigrants' travel behaviour, which found that immigrants adapt towards commonly used transport modes in the respective mobility culture (Chatman and Klein, 2013; Handy et al., 2008; Lee et al., 2021), suggesting that walking and cycling behaviours are not related to the length of cultural exposure to immigrants and is likely due to other cultural and socialisation factors.

Although this study provides new insights in the differences in walking and cycling behaviour of professional immigrants and a comparable Dutch population group, and their socio-demographic characteristics and other relevant factors, there are some limitations. First, as we were unable to draw professional newcomers from the 2018 MPN

dataset due to privacy restrictions imposed on socio-demographic information, especially income, both samples have been collected differently. While linking different data sources allows for richer analyses, it introduces biases with regard to the generalisability of the study findings. As a result, both samples and the study findings cannot be generalised to the wider ethnic Dutch and professional immigrant populations or other immigrant population groups. Secondly, due to the sampling method chosen for this study, study participants are not randomly selected, but rather included based on self-selection. As a consequence, preferences to use active travel modes and actual active travel mode use might be considerably higher among the study participants, thereby giving a distorted image about the average walking and cycling behaviour among immigrants living in the Randstad, the Netherlands. In addition, professional immigrants who significantly changed their active travel behaviour since arriving to the Netherlands might have been more interested to participate in the study than those who did not experience a major change in their walking and cycling, and, as a result, are included more in the sample. Therefore, it is not appropriate for the findings from this study to be generalised to larger populations and other study contexts. Thirdly, as this study used Facebook to recruit potential participants, engagement and selection biases should be considered. The chosen method excludes the random sampling of participants, and could be better described as convenience sampling. Consequently, the respondents in the final sample provide a bias sample of professional immigrants and not a random sample. Whether the results are obtained from the sample utilised can be generalised to the wider population of professional immigrants in the Netherlands is not assured beforehand. However, this issue of biased representation is also present in random samples due to the selective non-response by the respondents included in the study. Accordingly, such sample also lead to biased representation. Furthermore, differences in Facebook advertisement content leads to different recruitment rates and engagement with the study (Choi et al., 2017), which, in turn, might affect the representativeness of the sample. Moreover, different content could also lead to selection biases in terms of socio-demographic characteristics of the potential participants (Choi et al., 2017). With regard to this study, the immigrant sample is skewed towards young and highly-educated women. Previous research found that younger and/or highly-educated people walk and/or cycle more than other population groups (Adams, 2010; Scheepers et al., 2013), although mixed results have been reported (Beenackers et al., 2012; Heinen et al., 2010; Ton et al., 2020; Ton et al., 2019). In addition, empirical findings show inconclusive results on gender differences in cycling in the Netherlands (Heinen et al., 2010; Ton et al., 2019). Furthermore, information about the gross personal income of ethnic Dutch was not available in the MPN 2018 dataset due to privacy restrictions imposed on using this data. As a result, there is a limitation in comparing the survey sample with the sub-sample with respect to levels of income. However, this approach also has some benefits. In order to compare the two samples, we chose a double approach; first, by comparing the effects within the immigrants' survey without income control with the comparable Dutch native sub-sample; and, secondly, by comparing the effects within the immigrant survey with and without income control. Moreover, trip purpose is measured differently in each respective survey; resulting in significant differences between the two samples. In the MPN 2018 travel survey, participants were asked about their most preferred means of transport for a specific purpose, while in the survey study participants were asked which activity they most frequently go to when using a particular mode. As these variables are measured on a dichotomous scale, information about the active travel mode use for different kind of purposes of ethnic Dutch is very limited and gives a one-sided view about their actual use. As a result, we were unable to compare the survey sample with the sub-sample with regard to which modes were used for which kind of trip purposes. However, when comparing the findings of the multiple linear regression analysis of both datasets, results show that levels of walking are significantly associated with different type of trip purposes for each respective sample. These findings indicate that despite the variables having been measured differently, significant differences between the two samples can be identified. Furthermore, the data collection process took place during the beginning of the COVID-19 pandemic. However, the MPN dataset contains information on travel behaviour in a non-pandemic setting. To control for the potential influence of COVID-19 on the study findings and to allow both cases studies to be compared, participants in this study were asked to provide information of their travel mode use and preferences before the COVID-19 pandemic. Furthermore, as the MPN 2018 dataset does not provide any information on the influence of subjective norms with regard to particular transport modes, we could not control for these effects on intentions to use active travel modes. Empirical evidence on the role of travel socialisation on travel behaviour show that subjective norms transmitted through parents, peers and society as a whole have a significant influence on travel behaviour and should be accounted for in future travel behaviour related research (Baslington, 2008; Haustein et al., 2009; Nello-Deakin and Nikolaeva, 2021). Finally, we could not estimate the effects of travel distances and times from immigrant's and Dutch native's residence to key services and amenities on their walking and cycling behaviour due to privacy restrictions imposed on the MPN data with regard to residential location. The distance between immigrants' residence and employment may have a significant influence on travel time and distances (Frank et al., 2008; Ralph et al., 2020), access to required transport infrastructures (Hull and O'Holleran, 2014; Saelens and Handy, 2008) and combination of trip purposes (Pred, 1977). Consequently, the role of residential location, cultural norms and life experiences with active travel modes in shaping active travel behaviour remains unambiguous and requires additional accessibility research. Recent research in this area highlights a mismatch between subjective versus objective accessibility (Ettema et al., 2023). It could be argued that further inclusion of opportunity variables for transport mode use are subject to actual and subjective accessibility measures. This stresses the need to account for trip chaining and socialisation factors in studying travel behaviour.

Despite these limitations, the findings of this study will allow Dutch policymakers and practitioners to gain insight into the differences in active travel behaviour between immigrants and ethnic Dutch, and the factors that influence their walking and cycling. These findings will inform policy priorities that contribute to more equitable walking and bicycle planning practices that stimulate active travel mode use among immigrant populations. As the findings of this study reveal that car access and frequent car use leads to both reduced cycling preference and use, policy should aim to encourage bicycle access among immigrants early on in order to increase the likelihood of continued bicycle use among this population group. Previous research suggest that, as cycling is an integral part of the Dutch mobility culture (Carstensen and Ebert, 2012), stimulating cycling among these population groups might, in turn, improve cultural adaptation (Haustein et al., 2020; Nello-Deakin and Nikolaeva, 2021), and, hence, increase social integration in society (Kaplan et al., 2018; van der Kloof, 2015). Car ownership/access among immigrants in the Netherlands is, however, heavily influenced by their ability to obtain a Dutch driver's license. Immigrants originating from the EU or EFTA or those who are subject to the 30% tax ruling might find it easier to exchange their foreign driver's license than immigrants who do not meet these conditions (RDW, 2021). As a result, some immigrants in the Netherlands may be more dependent on public transit and active travel modes to meet their daily mobility needs than others. In addition, differences in car access between professional immigrants and ethnic Dutch might also be due to variations in income and residential location (Oakil et al., 2014; Woldeamanuel et al., 2009).

Furthermore, this study shows that professional immigrants walk and cycle more than ethnic Dutch. This finding suggests that in addition to the importance of high-quality walking and cycling infrastructure investments in promoting active travel, cultural norms and socialisation factors are likely to play a role in the uptake of walking and cycling as well. With regard to cycling, we argue that high-quality bicycle

Table A1
Type of variables specified in the conceptual model. Source: Authors.

Variable code	Variable name	Measurement scale	Measurement values
SD1	Gender	Dichotomous	0 = 'Male'; 1 = 'Female'
SD2	Level of education	Ordinal	1 = 'Left school at 16 or younger'; 2 = 'Left school at 18'; 3 = 'Trade/Vocational qualification'; 4 = 'Bachelor's degree'; 5 = 'Master's degree or higher'
SD3	Age	Ordinal	1 = '20 years old or younger'; 2 = '21–28 years old'; 3 = '29–34 years old'; 4 = '35–44 years old'; 5 = '45–54 years old'; 6 = '55–64 years old'; 7 = '65 years old or older'
SD4	Income	Ordinal	1 = 'Minimum (<€12,500)'; 2 = 'Below the national benchmark income (€12,500 - < €26,200)'; 3 = 'National benchmark income (€26,200 - €38,800), including negative income'; 4 = 'Between 1 and 2x the national benchmark income (€38,800 - < €65,000)'; 5 = '2x the national benchmark income (€65,000 - < €77,500)'; 6 = '>2x the national benchmark income (>=€77,500)'
AC	Access to a travel mode	Dichotomous	0 = 'Person does not have access to this mode'; 1 = 'Person does have access to this mode'
TP	Trip purpose	Dichotomous	0 = 'Person prefers this mode the most for this specific purpose'; 1 = 'Person does prefer this mode the most for this specific purpose'
PM	Preferred mode	Ordinal	Strength of a preference for a particular mode ranging from 0 to 6, based on the sum over all trip purposes
FR	Trip frequency	Ordinal	0 = 'Never'; 1 = 'Less than once a month'; 2 = 'Once a month'; 3 = '2–3 days per month'; 4 = '1–3 days per week'; 5 = '4 or more days per week'

infrastructure stimulates cultural and social norms associated with the uptake of cycling, such as perceived safety (Jensen, 2008), increased social pressure to cycle due to the presence of other cyclists (Lugo, 2013), and active travel modes being normalised by other people as a way to travel around (Nello-Deakin and Nikolaeva, 2021). In turn, these cultural and social norms promote further cycling uptake among people, causing a positive feedback loop. However, the relative importance of infrastructure versus culture and social norms in leading to high rates of bicycle use in the Netherlands remains unknown and can be designated as an area of future research. Further (qualitative) research is, therefore, needed in order to address this and gain a more detailed understanding of the influence of long-term socialisation factors, such as social and cultural norms, in active travel behaviour changes.

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CRediT authorship contribution statement

Koen Faber: Investigation, Conceptualization, Methodology, Data curation, Writing – original draft, Visualization. **Simon Kingham:** Conceptualization, Supervision, Writing – review & editing, Validation. **Lindsey Conrow:** Conceptualization, Supervision, Writing – review & editing, Validation. **Dea van Lierop:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A

Table A1

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