



Exploring the focus and gaps in mobility justice-related surveys. A scoping review approach

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ABSTRACT

In mobility, justice is often assessed through distribution principles, focusing on large-scale accessibility analyses. However, these evaluations are normative and lack subjective insights. Surveys offer an opportunity to capture individual beliefs and extract subjective evaluations of justice, yet no standard approach exists for measuring mobility justice through surveys. This scoping review examines 56 studies that use surveys to understand perceptions of mobility justice, identifying key focus areas and highlighting gaps in the research. The analysis revealed that despite no year limitations on the search, all papers presented were undertaken since 2005, and more than half were published in the last five years. Our approach distinguishes between direct justice measures, where individuals are directly asked about the perceived fairness, and indirect justice measures, which ask individual opinions on assumed fair concepts. Findings show that minorities are underrepresented in mobility justice surveys, highlighting the need for additional focus on this target group. Moreover, surveys predominantly use indirect justice measures, revealing a gap in understanding specific mobility inequities perceived as just or unjust by disadvantaged groups. A conceptual framework for the future design of mobility surveys has been developed, aiming at advancing the development of a standardised measure of mobility justice.

1. Introduction

Justice is a socially constructed concept that ‘exists within the mind of all individuals’ (Tyler et al., 1997). It is usually perceived through a subjective lens that consists of individualised beliefs based on cultural attributes and demographic characteristics (Primeaux et al., 2003). It is this subjective nature that makes it difficult to measure. Although it is challenging to measure and generalise, it is crucial for identifying disparities and evaluating the impact of laws and policies (Martens, 2016). When justice is not achieved in mobility, it is linked to social exclusion, poverty, bad quality of life, social conflict and health issues. To overcome injustices, the first step should be to identify them (Jones and Lucas, 2012; Beyazit, 2011; Cass et al., 2005). Transport researchers have drawn on theories from political philosophy to conceptualise justice and identify injustices within the context of transport policies (e.g. Pereira et al., 2017; Martens, 2016; Davoudi and Brooks, 2014).

Utilitarianism, which underpins tools like cost-benefit analysis in infrastructure projects, focuses on maximising overall utility, often measured by reduced travel time or willingness to pay (van Wee and Geurs, 2011; Mullen, 2021). However, it disregards who benefits,

potentially prioritising higher-income groups due to their capacity to pay (Pereira et al., 2017). This critique has led to deontological approaches such as sufficientarianism and egalitarianism (Verlinghieri, 2024). Sufficientarianism ensures a minimum level of resources (e.g., basic accessibility) but struggles with defining thresholds and addressing inequalities above that minimum (Lucas et al., 2016; Vandamme, 2017). Egalitarianism, inspired by Rawls’ Theory of Justice, prioritises fairness by benefiting the least advantaged through the “veil of ignorance” (Rawls, 1999, as cited in Verlinghieri, 2024). Yet, it is criticised for assuming rational, individualistic choices (Mullen and Marsden, 2016). The capabilities approach (CA) developed by Sen shifts the focus from resource distribution to enabling individuals to achieve meaningful activities. CA emphasises how personal abilities and social context impact access to transport, highlighting issues like physical barriers that prevent individuals from using nearby services (Sen, 1993; Robeyns, 2017).

It can be argued, that, conceptually, the field of mobility justice has extensively drawn from other disciplines focused on justice, transforming a somewhat subjective concept into a more normative framework. However, without directly engaging with individuals impacted by

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the mobility system – e.g. to understand if the lack of bicycle ownership is perceived as unfair – we cannot determine whether it is truly unjust. Historically, the advancement of scientific theories has been aided by the ready availability of standard measuring (Greenberg, 1993). Many methods exist that help operationalise mobility justice theories. For instance, using surveys, researchers have mainly explored how transportation systems affect different socio-economic groups, including low-income communities, older people, and people with a migration background. Despite some efforts to establish comprehensive measures that can support the identification, evaluation, and quantification of transport disadvantages (see, for instance, Pyrialakou et al., 2016; Vecchio et al., 2020), there is no consensus on what “general” or “international” transport-related disadvantages should be used to assess mobility justice.

As in many other justice-related fields (e.g. organisational justice), surveys can capture large-scale data while still reflecting individual beliefs and subjective perceptions. However, mobility surveys usually remain context-specific, mainly informing local policies at a specific location and time. Therefore, this research aims to perform a scoping review to summarise the existing literature focusing on perceptions of mobility justice in mobility-related surveys by exploring the types of disadvantaged social groups and the transport-related themes studied. This research is significant for transport planners because its main output is providing an overview of previous research on mobility injustices, thus aiding in developing a focused quantitative assessment approach via surveys. Looking into the potential of the systematic use of surveys in other fields (e.g., criminal justice, organisational justice, health justice) to inform justice-related concepts and decision-making, this study may serve as a starting point for advancing a standardised measure for mobility justice.

To date, no review of mobility justice-related surveys and the nature of questions included in such surveys have been conducted. Therefore, this study’s contributions stem from focusing on a scope review analysis of existing surveys investigating mobility for disadvantaged socio-economic groups to (I) identify recurrent patterns (e.g. disadvantaged social groups, predominant transport-related topics, methods used for the analysis and types of justice-related questions) and (II) highlight areas where further research is needed to develop a standardised way to measure justice in mobility.

The remainder of the paper is structured as follows. Section 2 gives an overview of different objective and subjective approaches used to assess mobility justice. The scoping review method used for this study has been described in detail in Section 3. Section 4 shows survey results that capture mobility perceptions by highlighting key transport-related topics, analysing demographic groups, examining the types of justice-related questions utilised, and the methodologies used for the analysis. Section 5 offers an in-depth discussion of the research gaps identified, the need for further research, and a proposed framework that can serve as the first step towards a standardised measure of justice in mobility. We end the paper with a conclusion section on systematically using surveys to gain more insights into mobility justice perceptions and generalise the outcomes for decision-making (Section 6).

2. Assessing mobility justice

Being able to define ‘justice’ is an important aspect to evaluate and quantify it. Transport planners, researchers, and policymakers have been trying to integrate the concept of justice into the transport planning process to address the inequities that have developed over time (Martens, 2016). Concerned with the fair distribution of resources, benefits, and burdens in society, distributive justice theory has gained traction within the transportation field. It allowed for the examination of fair distribution of resources and burdens in different spatial scales, usually based on large-scale accessibility studies as an indicator for a just transport system (Sheller, 2018; Verlinghieri and Schwanen, 2020; Karner et al., 2020). Such studies aim to evaluate the distribution of

resources, infrastructure and services and assess how transportation systems impact different socio-economic groups, considering factors such as spatial distribution, affordability, and the availability of varied modes of transport to promote fairness and social equity. Nevertheless, some argue that the conventional accessibility framework overlooks that not all individuals can transform existing resources into opportunities (Vecchio and Martens, 2021). If accessibility is considered a one-size-fits-all approach, it would fail to consider the diversity in needs and experiences of daily mobility.

‘Equity’, a key principle of justice theory, describes how benefits and costs are distributed in society (Litman, 2002). Horizontal equity is associated with an egalitarian approach, ensuring equal treatment and distribution regardless of individual differences, while vertical equity takes into account socio-economic, demographic, and ability-related differences, aiming to provide resources based on specific needs and circumstances (Di Ciommo and Shifan, 2017; Litman, 2002). Karner et al. (2020) argue that most research and planning practices related to transport equity still rely on state-sponsored methods to analyse the distribution of benefits and costs, harms and risks associated with decisions, actions, and changes by state actors. These normative ‘equity’ evaluations rely on large-scale simulation models of future land use and travel behaviour (Karner, 2016; Karner et al., 2020; Martens et al., 2012; Manaugh et al., 2015). The focus on normative evaluations of equity and justice has fallen short of reflecting the real identities and geographies of the mobility justice problem, limiting the ability of policies and interventions to provide tailored solutions. The shift towards society-centric approaches, beginning with individual needs, in evaluating and implementing mobility justice has given rise to integrating diverse justice theories such as recognition justice, procedural justice, and epistemic justice into transportation. Researchers advocate for recognising the different individual needs and abilities when evaluating and implementing justice in mobility (Pereira et al., 2016; Verlinghieri, 2020; Sunio, 2021). Lucas (2012) and Lucas et al. (2016) emphasised the importance of recognising the voices and needs of marginalised communities in addressing the transport disadvantages they face, reducing their social exclusion from the broader society.

Even though it is a growing field of research, there is a lack of consistent evaluative approaches focusing on understanding mobility justice from an individual’s perspective (Verlinghieri and Schwanen, 2020; Haxhija et al., 2024). Aiming to provide an analytical framework for mobility justice by mixing distributive and recognition justice principles, Haxhija et al. (2024) identify several methods employed in society-centric mobility justice research. Such methods include: participatory action research (e.g. Lucas, 2013; Verlinghieri, 2020; Sagaris et al., 2020), microstory interviews (e.g. Vecchio, 2020), autophotography (e.g. Butz and Cook, 2017), multi-criteria mapping of stakeholder (e.g. Sunio, 2021), as well as, using the Capability Approach linked to the distribution of mobility resources, such as accessibility (e.g. Beyazit, 2011; Pereira et al., 2017; Randal et al., 2020).

However, the scalability of these approaches remains challenging, as they focus on a limited population segment, making it difficult to generalise findings at the city level for effective policy guidance. Surveys are recognised as a valuable method to understand mobility justice, aiming at capturing the perceptions of disadvantaged socio-economic groups at a large scale and providing valuable insights that can inform decision-making processes. However, a common approach to social and transport-related disadvantages that should be considered to measure justice perceptions in mobility is still missing, making it challenging to generalise knowledge on mobility justice and to feed into mobility justice theories and analytical frameworks. Highlighting the need for themes to explore when referring to mobility justice, the literature method developed below aims to identify a common focus in mobility justice-related surveys that have been used so far.

4.2. Defining transport disadvantaged populations

One of the fundamental objectives of transport systems is to ensure inclusivity. This necessitates that transport planners pay special attention to population groups currently facing or at risk of facing transport-related challenges. These groups are collectively known as transport-disadvantaged populations. Identifying these groups is crucial in designing a system accessible to all and responsive to their diverse needs. Transport planners can rely on three key pillars to identify transport-disadvantaged populations to achieve this.

The first pillar focuses on the geographical location of individuals or groups and its impact on their travel times and accessibility to essential activities. People residing in remote, rural, or poorly connected areas often experience significantly longer travel times than the average population. This reduced accessibility affects their ability to participate in key activities such as employment, education, shopping, and health-care services (Bantis and Haworth, 2020; Dodson et al., 2006). For instance, individuals living in suburban or rural areas may face limited public transport options, which further exacerbates their difficulties in accessing vital services and opportunities.

The second pillar pertains to the transportation system itself, particularly the availability and adequacy of different modes of transportation. This dimension examines the extent to which public transportation systems (e.g., buses, trains, or subways) are available and provide sufficient coverage. Furthermore, it considers the availability of private motorized vehicles, such as personal cars, which can significantly influence an individual's or group's ability to reach their destinations conveniently. A lack of reliable or affordable transport options often restricts people's ability to fully engage in social and economic activities (Pereira et al., 2017). Thus, assessing the quality and availability of transport modes is integral to identifying those who might face exclusion due to transport constraints.

The third and final pillar involves the sociodemographic characteristics of the population, which play a critical role in determining overall vulnerability. Individuals who possess one or more of these characteristics are often at a higher risk of being transport-disadvantaged. These characteristics include but are not limited to being an elderly adult, having mobility challenges, having physical or cognitive disabilities, or being a single parent (Bejleri et al., 2018; Delbosc and Currie, 2011). Members of these groups frequently encounter unique barriers, such as inaccessible infrastructure or limited service availability, which compound their difficulties in accessing essential services and participating in daily activities. Consequently, these groups are disproportionately affected by transport-related social exclusion (TRSE), a phenomenon in which restricted mobility leads to broader social and economic isolation (Yigitcanlar et al., 2019).

In summary, addressing transport disadvantages requires thoroughly understanding the interplay between geographical location, transportation system characteristics, and sociodemographic factors. Also, it is very important to understand how these groups perceive transport justice to be able to address their needs.

3. Scoping review

Mobility justice is an abstract concept primarily conveyed through perceived values. In this study, we conducted a scoping review to explore how surveys capture the perception of mobility justice for different user groups. Our review focuses on the inability of specific groups or individuals (typically the most disadvantaged) to access essential services and opportunities due to insufficient transportation options. The categorisation of disadvantaged socio-economic groups is informed by a systematic review conducted by Hidayati et al. (2021), which analysed 230 articles. The review revealed a diverse set of sociodemographic factors – including income level, gender, age, race, disability, migrant status, and family size – that significantly contribute to mobility injustices.

For the literature review, studies that used surveys to test mobility justice were identified. It is imperative to mention that the study initially sought mobility surveys explicitly to capture justice, which would be a straightforward task to identify; however, when the word 'justice' was added to the queries, no results coming from the mobility field could be identified in Scopus and Web of Science. Therefore, it was important to look for surveys that might indirectly address mobility justice by focusing on mobility and socio-economic disadvantaged population groups. This approach allowed for a broader topic exploration while focusing on key mobility justice elements. Aiming at capturing the perception of mobility-justice for disadvantaged socio-economic groups, the following search terms were used:

((mobility OR transport) AND survey AND perception) AND (vulnerable OR disadvantaged OR marginalised OR immigrants OR older OR elderly OR young OR low-income OR single-parent OR unemployed OR gender OR disability) NOT (social AND mobility).

The first set of terms aimed to limit mobility and transport-related studies by focusing on studies that used surveys to conduct their analysis. The word 'perception' was used because the study focuses on individuals' subjective experiences and interpretations of justice rather than structural or systemic dimensions of justice. This term ensures that our search retrieves studies that align closely with the conceptual framework and objectives of our research, particularly those exploring how justice is understood and experienced by different populations. The second group of terms is set to highlight survey studies on disadvantaged socio-economic groups using a set of exclusion terms that helped narrow down the number of search results by eliminating literature not relevant to the focus of this research. For example, the term 'social mobility' refers to the ability of individuals or families to move up or down the social and economic hierarchy within a society, which resulted in many false results. Two scientific databases were explored to search for relevant studies: Scopus and Web of Science. After the initial advanced search using the above query, each database was screened for articles in English and relevant fields of study or sources (see Table 1).

An initial 376 studies resulted from the search results (see Fig. 1). The studies were imported to Covidence (online systematic review management software), and duplicates (32) were identified and removed, bringing down the number of studies to 344. However, despite the extensive list of exclusion terms, many were still irrelevant papers for this study; therefore, we manually excluded them by screening titles and abstracts. The excluded papers generally discussed issues related to the future of the transport industry (e.g. autonomous vehicles and urban air mobility), electric vehicles, the housing market and energy inequities, accessibility of communication technology and digitalisation in general. These studies went beyond the scope of this study, which focused mainly on identifying mobility-related factors surveyed so far in mobility justice studies and tackled areas related to the future of mobility and its related fields. Moreover, they tend to focus on population sub-groups unrelated to this paper's initial focus (i.e., disadvantaged socio-economic groups). Papers that surveyed car drivers' attitudes and perceptions of justice were also excluded.

4. Key findings from the scoping search

Out of the 344, 56 studies were selected based on the topics and if they focused on disadvantaged social groups (Table 2).¹ It is worth highlighting that the papers were not considered if the study was not focused on justice or equity. From the 56 included studies, seven main transport-related topics were identified. Accessibility to the different opportunities and needs (n = 71), perception of safety and security (n = 51), and transport service quality (n = 33) were the most repeated topics analysed for all disadvantaged socio-economic groups. Accessibility was

¹ For a more detailed overview of the studies included in this scope review refer to Appendix 1.

Table 1
Methodological database search for relevant studies.

	Initial search terms	In English only	Field restrictions	Results (as imported to Covidence)
Scopus	449	433	Exclude subject areas: Medicine, Business, Management and Accounting, Computer science, Energy, Psychology, Nursing, Mathematics, Economics, Econometrics and Finance, Biochemistry and Molecular Biology, Earth and Planetary Sciences, Agricultural and Biological Sciences, Neuroscience, Physics and Astronomy, Materials Science, Immunology and Microbiology, Dentistry, Chemistry, Chemical engineering	163
Web of Science	1814	1778	Limited to research areas: Transportation, Geography, Environmental Studies, Urban Studies, Regional Urban Planning, Sociology, Social Sciences Architecture, Social Issues	213
Total no. of studies	2263	2211		376

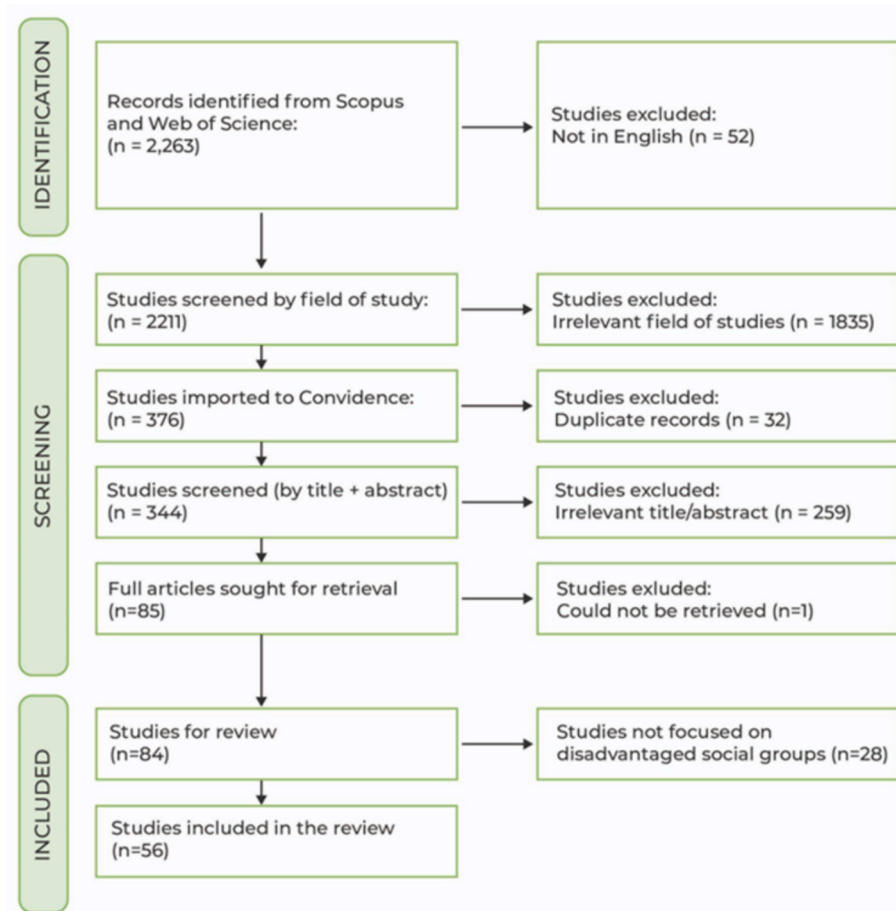


Fig. 1. Literature search diagram (based on PRISMA flow diagram template).

mainly linked to studies focusing on older people ($n = 15$). Behavioural questions were asked in both older people ($n = 6$) and gender studies ($n = 5$), aiming at capturing mobility perceptions and travel behaviour. A topic that has gained popularity in perceptions of mobility research is 'health,' with studies in the intersection of these two fields increasing in the last five years. It is usually encountered in studies exploring walking as a mode of transport.

In these studies, the surveys' preferred spatial scales were the local level ($n = 30$) followed by the neighbourhood, metropolitan, national, and international levels. Studies exploring walking as a means of transport focused mainly on the local and neighbourhood scale. It is important to note that the categorisation process of the 'Themes' employed an inductive, bottom-up approach. Categories were not pre-defined but were instead developed organically as themes and topics emerged from the studies analysed. This inductive approach allowed for a more accurate and nuanced representation of the range of issues

identified in the research.

Several modes of transport were explored in the analysed studies; the perceived mobility related to walking (21) and public transport (13) were the most common, followed by cycling (11), shared mobility (6), and paratransit (3). An increasing trend was identified in studies exploring walking as a means of transport, gaining more importance in the last five years. Surveys in this sphere aimed at targeting perceptions of people with disabilities (Early et al., 2021; Hwang, 2022), older people (Hess, 2012; Pinto et al., 2020; Li et al., 2005; Pulvirenti et al., 2020; Van Cauwenberg et al., 2016), and young people (Early et al., 2021; Lizárraga et al., 2022; Eboli et al., 2023), and only two of them focused on gender perspectives (Pirra et al., 2023; Georgiou et al., 2021). These studies consistently assess various aspects such as frequency of pedestrian street use, trip purposes, and attitudes toward neighbourhood-built environment features, such as sidewalks, crosswalks, and public transportation stops, to understand the general users'

Table 2
Transport-related topics.

Topic	Themes	Theme description	No of studies	Author(s), Year /Examples
Safety and security	<i>Perception of safety</i>	<i>Individual's subjective assessment of personal safety within a transport system.</i>	27	e.g. Carboni et al., 2022; Böcker et al., 2023; Yasir et al., 2022; Buehler et al., 2021; Li et al., 2005; Ryan et al., 2016; Hidayati et al., 2020.
	<i>Exposure to road traffic</i>	<i>A.k.a objective safety: road crashes and exposure to noise and air pollution.</i>	11	e.g. Ma et al., 2016; Bouaoun et al., 2015; Chevalier and Charlemagne, 2020; de Meester et al., 2014; Ryan et al., 2016.
	<i>Perception of security</i>	<i>External threats posed by criminal activities and the security perceived at stations for people and goods.</i>	11	e.g. Carboni et al., 2022; Lizárraga et al., 2022; del Mar Alonso-Almeida, 2019; Ryan et al., 2016; Pirra et al., 2023; Soto et al., 2022.
Accessibility to activities and different needs	<i>Harassment</i>	<i>Verbal or physical abuse, discrimination or unwanted advances.</i>	6	e.g. Yasir et al., 2022; Malik et al., 2020; del Mar Rodas-Zuleta et al., 2022; Soto et al., 2022.
	<i>Accessibility to different activities</i>	<i>Easiness to reach services or activities using different transport modes</i>	28	e.g. Ryan and Pereira, 2021; Wang et al., 2021; Lowe, 2014; Van Cauwenberg et al., 2016; Ahmad et al., 2019; Deka, 2022.
	<i>Physical barriers</i>	<i>Obstacles or structures that impede or restrict the free movement of individuals when using specific modes of transport.</i>	19	e.g. Hess, 2012; Hwang, 2022; Ravensbergen et al., 2023; Sabyrbekov and Overland, 2020; Al-Rashid et al., 2020.
	<i>Mobility of care</i>	<i>Accompany other people/dependants.</i>	9	e.g. Al-Rashid et al., 2020; Deka, 2022; Goralzik et al., 2022; Hernandez and Rossel, 2022; Kim and Ulfarsson, 2021; Malik et al., 2020.
	<i>Time/Delays</i>	<i>Time to reach specific destinations, including delays.</i>	8	e.g. Georgiou et al., 2021; Goralzik et al., 2022; Malik et al., 2020; Yang, 2018; Olabayonle et al., 2023.
	<i>Affordability</i>	<i>Ability to afford the chosen mode of transportation.</i>	5	e.g. Buehler et al., 2021; Chaisomboon et al., 2020; Diaz et al., 2023; del Mar Alonso-Almeida, 2019; Al-Rashid et al., 2020; Rahman, 2022.
	<i>Information</i>	<i>Digital and physical information on the means of transport.</i>	6	e.g. Chaisomboon et al., 2020; Das Mahapatra et al., 2021; Al-Rashid et al., 2020; Zheng et al., 2022; Deka, 2022.
Behavioural attitudes and norms	<i>Travel behaviour</i>	<i>Actions, decisions, and habits that individuals exhibit when travelling, including their mode choices and route selections.</i>	27	e.g. Buehler et al., 2021; Elias and Gitelman, 2018; Pulvirenti et al., 2020; Hernandez and Rossel, 2022; Kim and Ulfarsson, 2021.
	<i>Attitudes/Norms</i>	<i>Cultural norms associated with transportation.</i>	7	e.g. Lowe, 2014; Ryan and Pereira, 2021; Ryan et al., 2016; Kim and Ulfarsson, 2021; Soto et al., 2022; Zhang et al., 2022.
Health	<i>Health</i>	<i>Impact of transportation systems on physical, mental, and environmental well-being.</i>	15	e.g. Diaz et al., 2023; Khaleghi and Kato, 2023; Franke et al., 2017; Pulvirenti et al., 2020.
Service quality	<i>Quality of infrastructure</i>	<i>The overall physical condition of transport infrastructure, including roads, cycle lanes, pedestrian paths, and public transport systems.</i>	18	e.g. Bionassoni et al., 2023; de Meester et al., 2014; Georgiou et al., 2021; Hwang, 2022; Ravensbergen et al., 2023; Eboli et al., 2023.
	<i>Quality of service</i>	<i>Perceived quality of the service provided by transport operators for both public transport and shared services.</i>	14	e.g. Chaisomboon et al., 2020; Diaz et al., 2023; del Mar Alonso-Almeida, 2019; Goralzik et al., 2022; Mitra, 2021; Zheng et al., 2022.
	<i>Sufficiency</i>	<i>Capability of the transport system to meet the demands of the user: spatial coverage, frequency, capacity.</i>	4	e.g. Hwang, 2022; Pulvirenti et al., 2020; Deka, 2022; Malik et al., 2020.
Service satisfaction and convenience	<i>Satisfaction</i>	<i>Contentment of individuals with their travel experience.</i>	10	e.g. Bionassoni et al., 2023; Chaisomboon et al., 2020; Early et al., 2021; Khaleghi and Kato, 2023; Olabayonle et al., 2023; Wennberg et al., 2010.
	<i>Convenience</i>	<i>The ease and efficiency that travellers experience in fulfilling their travel needs.</i>	11	e.g. Buehler et al., 2021; Ravensbergen et al., 2023; Sabyrbekov and Overland, 2020; Ahmad et al., 2019; Goralzik et al., 2022.
	<i>Comfort</i>	<i>Pleasantness experienced by passengers during their journey, encompassing factors such as seating quality, temperature control, and noise levels.</i>	9	e.g. Georgiou et al., 2021; Sabyrbekov and Overland, 2020; Ahmad et al., 2019; Eboli et al., 2023; Goralzik et al., 2022.
	<i>Stress</i>	<i>Anxiety, frustration, or discomfort experienced due to delays, overcrowding, or lack of reliable transportation options.</i>	3	e.g. Böcker et al., 2023; Khaleghi and Kato, 2023.
Built environment	<i>Green infrastructure</i>	<i>Parks, trees, bushes.</i>	7	e.g. Georgiou et al., 2021; Li et al., 2005; Van Cauwenberg et al., 2016; Wang et al., 2021; Eboli et al., 2023.
	<i>Urban form</i>	<i>Street interconnectedness, built environment.</i>	6	e.g. Lizárraga et al., 2022 ; Deka, 2022; Hidayati et al., 2020; Matsuo, 2016; Mitra, 2021; Eboli et al., 2023.
	<i>Urban furniture/design</i>	<i>Benches, lighting, water fountains, ramps, traffic lights, tactile paving.</i>	6	e.g. Hwang, 2022; Pinto et al., 2020; Wang et al., 2021; Eboli et al., 2023; Wennberg et al., 2010
Public participation	<i>Public participation</i>	<i>Participating in public events related to decision-making</i>	2	e.g. Das Mahapatra et al., 2021; Early et al., 2021.

travel behaviour impact on their perception of mobility-justice.

Moreover, the evaluation extends to preferences for modes of transport used and the perceived security linked to the built environment. Open-ended questions were also part of the survey structures, allowing for a mixed understanding of respondents' experiences as road users and their suggestions for addressing critical issues in pedestrian paths. Additionally, socio-economic characteristics are frequently

considered, along with perceptions, preferences, and hypothetical choice-based exercises (stated preference surveys), providing a comprehensive view of the complex interplay between personal attributes and environmental factors shaping walking habits. Although all these mobility-related topics serve as a proxy for direct questions related to mobility justice, some general patterns can be observed when discussing the perceptions of mobility from the disadvantaged socio-

economic groups' points of view.

4.1. Social disadvantages and geographical coverage

The 56 explored studies showed that most case studies focusing on the intersection of mobility and social disadvantage came from Europe (18), closely followed by North America (14). Southeast Asia (6) and South America (5); notably, studies from South and East Asia have witnessed a rising trend in the past three years compared to previous years. Case studies from the European context have focused mainly on studying mobility perceptions by targeting age and gender, where older people make up most age-related studies. Such studies explored mobility-related topics focusing on the perception of safety, accessibility, travel behaviour, perception of security, health, satisfaction, quality of infrastructure, green infrastructure, and the built environment. Similarly, gender studies explored the mobility of care, affordability, and trip convenience. Low-income groups and people with disabilities have also been studied within the European context but to a lesser extent.

In North America, studies largely mirror European trends, concentrating on older and low-income demographics, strongly emphasising accessibility, health, travel behaviour, safety perceptions, physical barriers, built environment, green spaces, and attitudes. Additionally, gender dynamics, youth perspectives, and disability issues are gaining traction. Underexplored in mobility surveys were individuals with a migration background and those belonging to minorities or specific racial/ethnic groups. The population compositions of the USA and Canada (North America) are particularly relevant for addressing research gaps related to individuals with migration backgrounds and minority ethnic or racial groups. As shown in Fig. 2, it is the only region actively addressing this gap through comprehensive analysis. Studies focusing on capturing mobility perceptions from people with a migration background explored mobility-related factors such as accessibility, behaviour, mobility of care, the built environment, and attitudes/norms.

In Southeast Asia, South Asia, and South America, there is a growing interest in gender, older age groups, and low-income groups; contrary to Europe and North America, these regions explore additional factors such as exposure to road traffic, information access, and harassment. East Asian literature focuses on young people (children and teenagers) with a renewed emphasis on active mobility following a period of rapid development and mass motorization. However, the transition to more sustainable modes presents heightened road safety risks, particularly for younger populations, who tend to adapt more quickly to these changes. Simultaneously, studies in this region examined issues relevant to people with disabilities, including accessibility, participation, physical barriers, and information availability. Central Asia has only one study focusing on low-income groups, which explores transport-related factors such as health, physical barriers, service quality, infrastructure, and convenience. Studies from the Middle East targeted older people, gender issues and young people, addressing mobility-related topics such as quality of service, quality of infrastructure, comfort, perception of safety, perception of security, information, mobility of care, and affordability. While Europe and North America dominate the discourse, there is a global shift towards exploring a more comprehensive array of transport-related factors across diverse demographic segments and geographical regions. It could be observed that the direction of research in the different locations is somehow impacted by the composition of the location's population sociodemographic characteristics.

4.2. Transport-related factors and disadvantaged socio-economic groups

Hidayati et al. (2021) conducted a review encompassing 230 empirical studies, shedding light on various intrinsic factors directly influencing individual perceptions of mobility. These intrinsic factors include income level, gender, age, race, disability, migrant status, and number of children that affect perceptions of mobility. Except for the

number of children, the disadvantaged socio-economic groups affected by the mobility system analysed in this current study are based on these findings. Often, these groups were analysed together to create a more complete profile. The most common intersectionality was found to be between gender and age (Wang et al., 2021; Bouaoun et al., 2015; Biassoni et al., 2023), and sometimes income was an additional factor studied together with gender and age (Carboni et al., 2022; Ma et al., 2018; Kim and Ulfarsson, 2021). Based on the analysis performed in this scoping review study, Table 3 provides a synthesised overview of the number of studies addressing each transport-related factor, and the disadvantaged socio-economic groups analysed for each factor. The disadvantaged socio-economic groups will be explained in more detail below.

Older people. The majority of studies focused on older people. The most frequently studied modes of transport for this target group were walking, public transport and cycling. Common patterns for understanding older people's perceptions of mobility emerge from examining socio-demographic inequalities, daily mobility patterns and needs, and the built environment. The surveys focused on critical themes such as spatial perceptions of the neighbourhood, consistency in travel patterns, changes in physical health, and the influence of familiarity with the place and the level of access over time. In addition, insights into respondents' perceptions of the overall accessibility of bus stops, their experiences as transit users, and the age-related decline in their perceptual and physical abilities contribute to a comprehensive understanding (Pinto et al., 2020; Pulvirenti et al., 2020; Ryan et al., 2016).

Moreover, perceptions of older people in mobility surveys also included considerations of bike and car ownership, desired activities and perspectives on cycling (Franke et al., 2017; Ahmad et al., 2019). A choice-based conjoint exercise involving manipulated photographs of streets elicits preferences and perceptions related to socio-demographics and trip characteristics in relation to their level of accessibility, road exposure, health, quality of infrastructure, physical barriers experienced by older people and urban greenery (Van Cauwenberg et al., 2016). Stress, harassment, and flexibility of transport modes were not found to be topics of interest when exploring transport-related surveys for older people.

Gender studies. As mentioned above, gender-specific studies have also been extensively researched, focusing on capturing women's perceptions of mobility. The region from which these studies originate varies widely, with a significant number coming from Southeast Asia and South America, demonstrating the extent of the problem of mobility justice in developing countries. Studies that examined mobility perceptions from a gendered perspective focused on the availability of private transport modes and travel behaviour (Hidayati et al., 2020; Hernandez and Rossel, 2022). In addition, a common focus is placed on safety perceptions, including harassment on public transport and in public spaces, and their impact on mobility decisions, recognising the gendered dimensions of safety concerns that may influence men's and women's travel behaviour differently (Böcker et al., 2023; Georgiou et al., 2021; Yasir et al., 2021). Al-Rashid et al. (2020) and Malik et al. (2020) investigated women's mobility needs and challenges, including experiences of harassment in transportation systems. The spatial configuration of the urban environment was also considered an essential aspect as it shapes gender-specific travel behaviour, especially concerning the perception of safety when moving around the city. Following a similar perspective, Pirra et al. (2023) found significant gender differences in European pedestrians' perceptions of safety.

Olabayonle et al. (2023) showed gender differences in the perception of public transportation's quality, including reliability, comfort and accessibility. Furthermore, an examination of sociocultural concepts reveals how implicit local norms and values contribute to gendered behaviours on the road (e.g., in Saudi Arabia, where women were not allowed to drive private cars until 2018), further highlighting the intricate interplay between societal expectations, cultural influences, and gendered mobility experiences (Hidayati et al., 2020; Al-Rashid

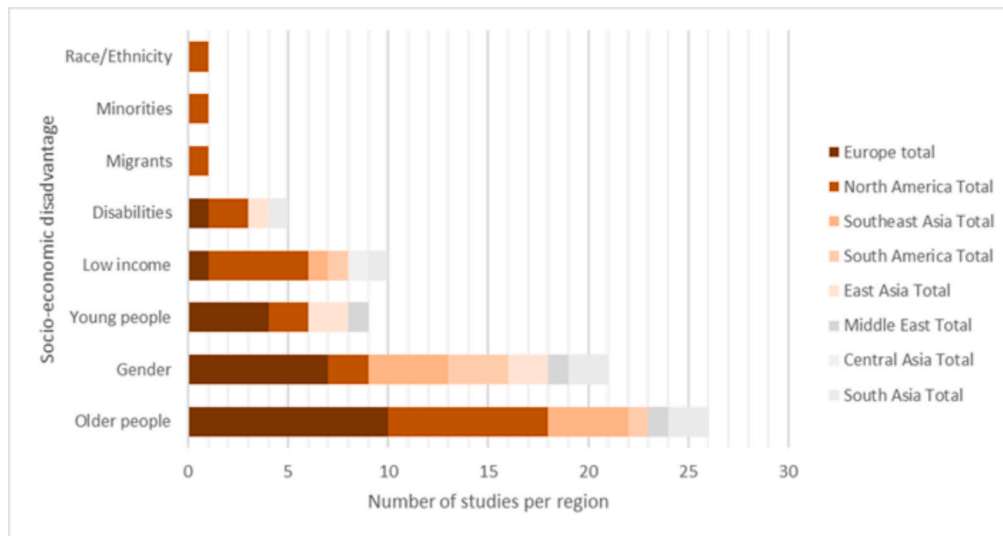


Fig. 2. Distribution of socio-economically disadvantaged groups per region.

et al., 2020). Such issues are captured using transport-related elements such as quality of services and infrastructure, comfort of walking and cycling, perception of safety and security against criminal activity, harassment in public spaces and transport, affordability, convenience, and attitudes. It is important to note that participation in public events was not a topic explored in women's mobility perception surveys.

Low-income. The analysis highlighted the complexity of low-income people's perceptions of mobility, which are influenced not only by affordability and accessibility but also by job considerations, contextual factors, and technological barriers (e.g. no internet access, no smartphone, lack of digital literacy). The findings on perceived job accessibility for low-income workers underscore the need for better integration of transportation and workforce research, taking race into account and a call for more longitudinal studies (Lowe, 2014). Sabyrbekov and Overland (2020) found factors like public transport support and environmental perceptions affecting cycling uptake in low-income countries, challenging assumptions from studies in developed nations. In

examining the impact of carsharing on mobility for low-income populations in California, carsharing was found to improve mobility, particularly for low-income families, when combined with public transportation (Mitra, 2021). Additionally, focusing on low-income disadvantaged travellers when exploring preferences for Mobility-on-Demand (MOD), Yan et al. (2021) emphasise the importance of addressing technological barriers for low-income populations in transportation planning.

People with mental and physical disabilities were another socio-demographic group studied in combination with age groups, mainly older people and young people (children and teenagers). Disability studies focused on modes of transport, such as walking, public transport, and shared mobility. While walking made up for most studies, the ability to access the means of transportation was also explored. For instance, Goralzik et al. (2022) examined the accessibility of shared mobility services for disabled users and concluded that current services do not meet their needs. Moreover, perceptions of people with disabilities were

Table 3

Transport-related topics capturing perceptions of disadvantaged socio-economic groups.

	Older people	Gender	Low-income	Disabilities	Children and Teenagers	Migrants	Race/Ethnicity/Minorities ^a
Accessibility	15	5	5	3	1	0	0
Road exposure	6	5	1	1	2	0	0
Public participation	1	0	0	2	1	0	0
Health	9	2	4	1	2	0	0
Physical barriers	10	3	3	2	3	0	0
Quality of service	3	4	3	1	0	0	0
Quality of infrastructure	7	6	2	2	4	0	0
Comfort	3	2	1	1	1	0	0
Perception of safety	9	11	4	3	5	0	1
Information	4	2	0	1	0	0	0
Perception of security	3	6	2	1	0	0	1
Mobility of care	2	7	0	1	0	1	0
Sufficiency	2	1	0	1	0	0	0
Satisfaction	6	4	1	1	3	0	1
Stress	0	1	0	0	1	0	0
Harassment	0	5	0	0	0	0	0
Green infrastructure	4	2	0	0	2	0	0
Flexibility	0	1	1	0	0	0	0
Affordability	2	3	2	0	1	0	0
Convenience	4	4	2	1	1	0	0
Travel behaviour	12	8	4	0	3	1	0
Urban furniture	4	1	0	1	1	0	0
Attitudes/ Norms	3	5	1	0	0	0	0
Urban form	1	2	1	0	2	1	0
Time/Delays	2	4	0	1	1	0	0

^a Due to the low number of studies, minorities, race and ethnicity were merged together in Table 3.

usually captured in surveys by targeting themes such as the built environment and respondents' level of autonomy (Hwang, 2022; Goralzik et al., 2022; Early et al., 2021). This was done by exploring their levels of accessibility, ability to participate in different activities, levels of exposure to road traffic risks mainly related to road crashes, physical barriers experienced, perception of safety, quality of service and infrastructure, mobility of care, comfort, satisfaction, and time that takes to fulfil the activities. Das Mahapatra et al. (2021) added to the literature by connecting universal design principles with user perceptions of mobility for older people and people with disabilities.

Children and teenagers. Studies focus on capturing mobility-related perceptions for children and teenagers, considering safety elements, quality of infrastructure, and physical barriers. These were studied in relation to the neighbourhood environment (de Meester et al., 2014; Early et al., 2021). The focus is on understanding how environmental factors shape active transport and physical activity. The impact of perceived security on walking activity and its effects on walking as the preferred travel mode was explored (Lizárraga et al., 2022; Eboli et al., 2023). In contrast, Khaleghi and Kato (2023) investigated the impact of children's daily out-of-school trips on effective travel well-being and life satisfaction. The results showed a significant and positive relationship between travel-related well-being and life satisfaction in the five domains of self, school, friends, family, and living environment. Various methods were used for these studies, including Stated Preferences (SP) and mobility pattern surveys, which underline the multidimensional nature of these studies and contribute to a comprehensive understanding of attitudes, behaviours, perceptions, infrastructural barriers and influences in the field of transportation.

Migration background and ethnicity. Research into mobility perceptions within these demographic groups remains significantly underexplored. People with a migration background are studied mainly by exploring reasons for travelling linked to the mobility of care and the urban form (e.g. built environment and road connectedness) of their daily mobility environments (Matsuo, 2016). Regarding race and ethnicity, perceptions of safety, security, and satisfaction are considered.

4.3. Direct and indirect measures of justice in mobility surveys

The examined studies show that capturing perceptions of mobility for disadvantaged groups included mainly *indirect measures of justice*. As has been the case in transportation justice measurements, many transport-related factors serve as proxies to describe justice, usually with the common aim of addressing disadvantaged socio-economic groups. Even studies that focused directly on transport disadvantage, social exclusion, and theories of justice related to mobility (e.g. Ma et al., 2018; Plyusheva and Boussauw, 2020; Liu et al., 2021; Lazarus et al., 2021) did not include questions that directly asked about perceptions of mobility justice in their surveys. As a result, they aimed to advance their understanding of transport disadvantage by capturing the perceptions of how goods and burdens related to mobility were distributed among disadvantaged socio-economic groups. For instance, Ma et al. (2018) examined transport disadvantages by inquiring about respondents' perceptions of 'how easy or difficult they found covering transport costs, gaining access to reliable and safe transport, and the extent to which transport enables participation in daily activities' (p. 36). However, little can be said whether the ease or difficulty of covering transport costs is perceived as fair or unfair from the respondents' perspective.

On the other hand, *direct justice measures* have yet to be present in mobility surveys. When direct justice measures are employed in the survey instrument, they ask people for their direct perceptions of justice. For instance, instead of asking about the affordability of the public transport system, the question could be asked whether the '*pricing of public transport is considered fair*'. However, our search results showed that such questions were not part of surveys focusing on mobility justice studies.

4.4. Methods for assessing mobility justice; post-survey analysis

Results from this review show that descriptive statistics are commonly used to draw from large-scale data sources. They have been used to describe socio-economic characteristics and compare trip characteristics, perceptions, and needs among different socio-economic groups. Using descriptive analysis, Pirra et al. (2023) showed significant gender differences in perceptions of safety among pedestrians. Using the same methodological approach, it was possible to investigate women's mobility needs and challenges, including experiences of harassment in transportation systems.

Factor analysis was used to identify underlying factors or dimensions that explain patterns of correlations within a set of observed variables, providing insights into the preferences and perceptions of different demographic groups in transportation. For instance, Hwang (2022) used exploratory factor analysis to identify mobility issues in built environments for people with disabilities. This method led to the understanding of negative perceptions of the built environment, which were particularly pronounced among people with disabilities, especially those with low incomes who do not own a car. Meanwhile, Sabyrbekov and Overland (2020) used factor analysis to identify the factors affecting cycling uptake in a low-income country. Factor analysis was used to identify key drivers influencing perceptions and behaviours related to cycling. This made categorising and understanding the relationships between variables and factors easier, providing additional information about cycling adaptation and bicycle commuting behaviour.

Using parametric tests, t-tests and non-parametric tests (Mann-Whitney and Kruskal-Wallis), Carboni et al. (2022) investigated the differences between different users' mobility patterns to measure perceptions of the mobility and transport systems and their satisfaction. The tests used assumed a null hypothesis of no difference between groups. In another study, chi-square tests for binary data and t-tests were used to compare the attitudes and preferences of riders and non-riders before and after introducing the e-scooter system (Buehler et al., 2021). The two tests were used together in this study to determine statistical significance and compare proportions between different groups.

Most regression analyses focused on cycling as a mode of transport. Biassoni et al. (2023) used linear regression to explore how infrastructure perception, travel satisfaction, and pro-environmental attitudes influence cycling motivation. Multiple linear regressions evaluated the strength and direction of these factors, identifying key influences on bicycle usage frequency. In a similar study, regression analysis was used to estimate the variables that affect the decision to ride electric bicycles (Elias and Gitelman, 2018). In this case, logistic regression analysis helps understand the relationship between variables, such as demographic characteristics, travel needs, risk perception, and the likelihood of riding electric bicycles. Using linear regression analysis, De Meester et al. (2014) examined the associations between parental perceptions of neighbourhood environmental attributes and various measures of physical activity among children. The study aimed to determine the strength and direction of the relationships between these variables and if the parental perception of the neighbourhood environment could predict the level of active transport and physical activity in children – linear regression analysis allowed for quantifying these relationships and determining the predictors' significance.

Multiple studies using structural equation models (SEM) have uncovered significant insights in transportation research. Böcker et al. (2023) analysed gender and age disparities in public transport safety perceptions during the pandemic in Nordic cities. SEM was used in this study to analyse multiple variables and their relationships in a single model, assessing the effects of sociodemographic, geographic, and temporal predictors on key outcomes. It also modelled causal relationships between perceived stress and safety in public transport without assuming a specific direction and accounted for bi-directional feedback between stress, safety, and transport frequency. Diaz et al. (2023) analysed data from 305 respondents in low-income neighbourhoods,

comparing those with and without access to bus rapid transit (BRT). SEM was used to test hypotheses and explore complex relationships between observed and latent variables, shedding light on how the BRT system and socio-economic factors influence individual perceptions. [Khaleghi and Kato \(2023\)](#) and [Mitra \(2021\)](#) used partial least square structural equation modelling to explore the positive impacts of mobility on well-being.

5. Discussion

This section discusses the main outputs of mobility justice-related surveys. While many mobility surveys have been designed and used in research exploring various aspects of transportation and access, this study concentrates explicitly on surveys that address the experiences and needs of disadvantaged socio-economic groups within the context of mobility justice. Therefore, other mobility studies that use surveys but fall outside the scope of mobility justice – particularly those not focused on disadvantaged socio-economic groups – have not been included in this analysis. The synthesis of findings section will discuss this focus in detail.

5.1. Synthesis of findings

The research captured mobility perceptions of disadvantaged socio-economic groups in studies focusing on understanding justice and injustice through mobility surveys. The analysis revealed that despite no year limitations on the search, all papers presented were undertaken since 2005, and more than half were published in the last five years. This suggests that exploring perceptions of mobility justice via surveys is a relatively new and growing field, and there is an increased focus on investigating and implementing the concept of justice in transportation. An increased trend was identified in studies exploring walking as a means of transport, with studies conducted during the last five years (e.g. [Pirra et al., 2023](#); [Georgiou et al., 2021](#); [Pulvirenti et al., 2020](#)). This, together with the increased interest in health as a transport-related topic encountered in surveys, reflects a growing recognition of the multiple benefits associated with pedestrian mobility.

Older people and women are the two most extensively researched disadvantaged socio-economic groups in mobility justice-related surveys. The analysis also highlighted groups that have been overlooked so far, such as studies focusing on migration and ethnic background. This underscores the importance of expanding research to encompass a more comprehensive understanding of mobility justice across diverse socio-economic contexts. More needs to be done in terms of intersectionality studies, as well. An intersectional lens is essential to understanding how multi-level ‘social locations’ shape and influence human life and experiences ([Kakar et al., 2021](#)).

The review also aimed to show the mobility justice-related topics surveyed the most. [Table 2](#) gives a comprehensive overview of all mobility-related topics, with most of the studies focusing on topics such as the perception of safety, accessibility, behaviour, physical barriers, and quality of infrastructure. Topics receiving comparatively less attention in transport-related studies encompassed flexibility of moving around, public participation, and stress. Transport-related topics varied per region of study as well. Assessments from the literature review show that exposure to road traffic, information access, and harassment were explored more in Southeast Asia, South Asia, and South America than in Europe and North America. While this observation may suggest that preferences in studying transport-related topics vary across regions, it could also be attributed to differences in colloquial language and communication styles. For instance, even though separated for this review, harassment and perception of safety could be used interchangeably by survey developers. However, it is interesting to note that it is asked more about ‘perceptions of safety’ in Europe and more about ‘harassment’ in South America. This can lead us to think that depending on the region in which research is being conducted, terminologies are

affected by social norms and what is the politically correct word to be used.

Regarding the type of questions employed in mobility justice surveys, they mainly focused on indirect justice measures. This approach means that survey questions focus on topics like accessibility, quality of infrastructure and service, affordability, satisfaction, reliability, safety, etc. (see [Table 2](#) for more) rather than justice explicitly. Responses to these topics are then analysed and connected to broader theoretical frameworks of equity, equality, or justice. While this indirect approach offers insights into specific aspects of the mobility experience, it may miss more in-depth subjective views that respondents hold regarding fairness and justice in transportation. Direct justice measures have yet to be present in mobility surveys so far. [Karriker et al. \(2017\)](#) bring the example of the employee who believes they should have a say in decisions affecting their work. They might react negatively if excluded from decision-making, feeling the process was unfair. While they may rate specific fairness aspects low, they might still find other procedural aspects satisfactory.

The statistical techniques utilised for the analysis were predominantly descriptive, followed by predictive, including logistic regression, random forest, logit models, and structural equation models (SEMs), followed by hypothesis testing, including both parametric and non-parametric tests, and exploratory methods such as factor analysis and principal component analysis rounding out the approach. Descriptive statistics emerged as foundational tools for summarising socio-economic characteristics, trip patterns, and perceptions across demographic groups for their ease of use and effectiveness in showing and comparing the different patterns. Parametric and non-parametric tests were used to test the significance differences between the different groups, such as comparing the perceptions and behaviours. Factor analysis was pivotal for uncovering latent dimensions that shape mobility experiences, enabling insights into gender differences and accessibility challenges. Regression analyses include linear and logistic models, quantified relationships between variables, and the emphasis on predictors of active transport and cycling behaviour; regression model results are easy to understand and communicate to the different stakeholders. Finally, Structural Equation Modelling (SEM) provided a robust framework for analysing complex, multi-variable relationships, such as the cases of examining public transport safety, accessibility impacts, and mood-life satisfaction links.

5.2. A conceptual framework to advance the development of a standardised measure of mobility justice

One of the aims of this study was to serve as a starting point for advancing a standardised measure for mobility justice. [Fig. 3](#) presents a proposed framework synthesising the main findings, focusing on disadvantaged socio-economic groups through survey data. An explanation of the key essential features of the conceptual framework are provided below:

Direct justice measures in surveys. Transport-related factors ([Table 2](#)) show an overreliance on distributive justice principles and elements in mobility justice surveys, missing out on other important justice principles, such as procedural and recognition justice ([Verlinghieri, 2024](#)). It is equally important to understand what is perceived as just/unjust in the distribution of these mobility resources and burdens. However, direct justice measures are missing in mobility surveys. The mobility justice field remains rather normative and focused on objective evaluations ([Karner et al., 2020](#); [Verlinghieri and Schwanen, 2020](#)). When direct justice measures are employed in the survey instrument, they ask people for their direct perceptions of justice. Empirical evidence in this direction shows that mobility justice research needs to start exploring how direct measures of justice can be integrated into survey studies in the future. Findings from studies on organisational and income research reveal that indirect measures of justice, which are widely accepted, cannot wholly replace direct measures ([Karriker et al., 2017](#)).

Instead, they should be utilised selectively to offer unique and complementary perspectives that enhance our comprehension of fairness. Future mobility surveys need to start understanding what transport-related factors are perceived as just/unjust by asking respondents directly.

Statistical analysis. Most of the statistical analysis employed in mobility surveys remains strongly oriented toward hypothetico-deductive confirmatory studies (check Appendix A for a better overview). [Jebb et al. \(2017\)](#) noted that in these settings, the entire domain of theory is specified a priori, and there is not much space for exploration. Despite evidence of exploratory data analysis used to advance theories ([Tukey, 1980](#); [Jebb et al., 2017](#)), this is often lacking when analysing survey data focused on mobility justice research.

Towards a standardized measure of mobility justice. The framework can guide future research based on surveys to gather data for standardising mobility justice metrics. The ultimate goal of the proposed framework is to develop a standardised measure of mobility justice, allowing for comparative evaluation across various contexts. Insights from such evaluations will contribute to new theoretical developments in mobility justice, aiming to better reflect the lived experiences and justice concerns of disadvantaged groups.

5.3. Methodological limitations

The study's authors point out a few practical limitations of the scoping review method. Firstly, during the manual screening, topics like autonomous vehicles, energy inequities, and digitalisation were deliberately excluded to narrow the focus on mobility justice, specifically regarding the experiences of disadvantaged socio-economic groups. This decision aimed to provide a more concentrated analysis of the core themes directly impacting mobility justice. However, it is important to acknowledge that excluding these topics may limit the comprehensiveness of the review and the broader understanding of interconnected factors influencing mobility. Secondly, excluding non-English literature means missing out on colloquial and local insights, which could be interesting to compare later. Lastly, the search scope is limited to journal articles, excluding valuable non-peer-reviewed sources such as books, reports, proceedings, book reviews, and theses.

Other limitations must be considered, specifically focusing on how the research was conducted, such as the inability to access the questionnaires. Most studies focus on describing and evaluating the variables

they used, but very few provide full access to the questionnaire developed for the study. Therefore, knowing how the surveys were designed or implemented was difficult. Future research on similar topics can use the main transport-related factors identified per disadvantaged socio-economic groups within this study and explore how direct measures of justice can be developed. Moreover, it is worth noting that while surveys were the primary data collection method investigated in this study, due to their strength in providing generalisable findings, it is important to consider that other qualitative data collection methods, such as interviews or focus groups, might offer deeper insights into direct justice measures employed to capture individual perceptions ([Yilmaz, 2013](#)). This study did not focus on qualitative data collection methods, which may have led to missing important insights into direct measures of justice that qualitative approaches might use. Therefore, future research focused on designing surveys that include direct measures of justice could benefit from reviewing existing qualitative studies that have applied similar measures, if available. While this can provide essential context and help inform question design, it is also crucial to consider the varied interpretations and cultural nuances associated with the term 'justice'. In different settings, 'justice' may carry specific connotations that could affect its usability and acceptability in a survey aimed at a broad population ([Jasso, 2005](#); [Baumert et al., 2020](#)). Unlike interviews or focus groups, where researchers can clarify and explore the interpretations of respondents in real-time, surveys require careful wording to avoid potential misinterpretations or issues linked to translation into different languages.

6. Conclusions

The scoping review method initially aimed at identifying common patterns of disadvantaged socio-economic groups surveyed the most and the type of transport-related factors they were asked about. Studies on older people primarily focus on infrastructure-related barriers, accessibility, safety perceptions, health, and travel behaviour. Gender studies emphasise perceptions of safety, behaviour, mobility of care, perception of security, and quality of infrastructure, while low-income individuals also consider quality of service. Studies on people with disabilities prioritise accessibility, infrastructure quality, safety perceptions, physical barriers, and participation in public events. Surveys targeting children and teenagers include perceptions of safety, quality of infrastructure, and behaviour, along with traffic exposure and satisfaction. Migrants

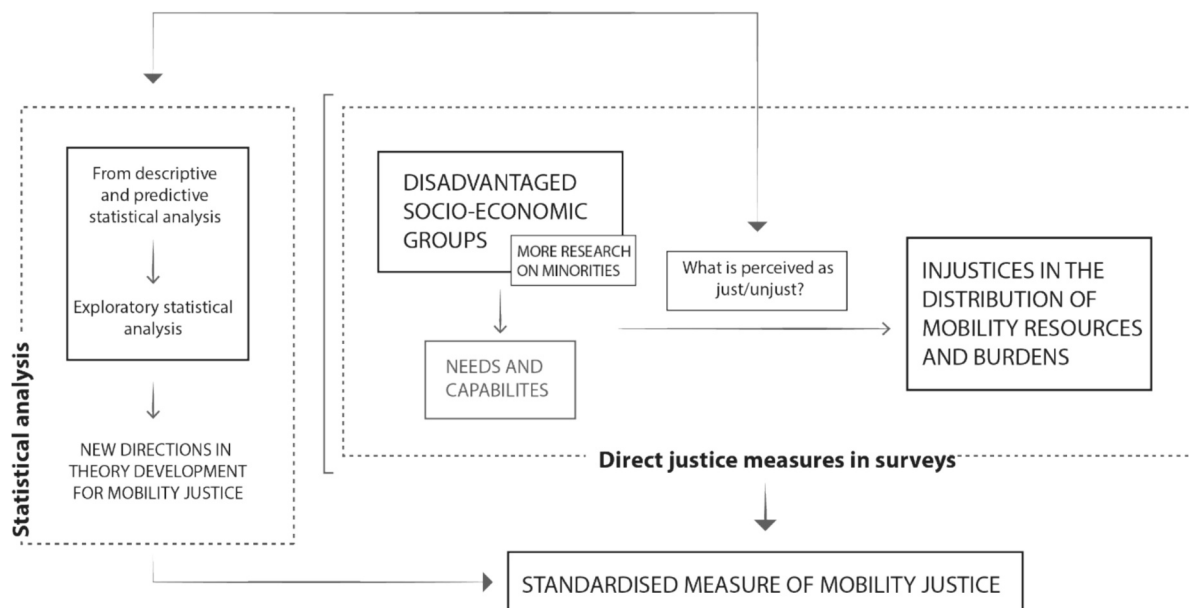


Fig. 3. A conceptual framework to be used in future mobility justice surveys.

and ethnically diverse groups were surveyed mainly about their perceptions of safety, perceptions of security, mobility of care, satisfaction, and behaviour.

By advocating for a more bottom-up approach to mobility justice, this study, among others, emphasises the importance of asking respondents directly what they perceive as just or unjust. Based on the review, mobility surveys have not been used to directly query respondents on the type of transport inequities they might perceive as just or unjust. Once data is collected, such decisions are left to decision-makers and those involved in implementing transport policy and planning (Curl, 2018; Lucas et al., 2019). Fig. 3 proposes a conceptual framework that could guide future survey design to focus on direct measures of justice.

By gaining a better understanding of the various mobility elements that determine whether mobility is just or unjust across diverse socio-economically disadvantaged groups, we will be better equipped to support the transition toward a more just and inclusive transport system (Ternes et al., 2024). Knowing what is perceived as just or unjust can help decision-makers prioritise mobility projects and interventions effectively, ensuring equitable distribution and addressing community needs. We encourage continued exploration of these direct justice measures in mobility surveys to further refine mobility justice evaluations from a society-centric point of view. While this can benefit policymakers and transport planners by legitimising their mobility measures and ensuring greater acceptance, it can also be of similar importance for researchers working on justice-related theories. Based on the studies analysed for this literature review, empirical research on mobility justice remains more reactive than proactive. However, there is still a need for further research in this area, whereby mobility justice decision-making

processes and policies can be analysed based on their reactive or proactive nature.

CRediT authorship contribution statement

Sindi Haxhija: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Mohamed Abouelela:** Writing – review & editing, Supervision, Methodology. **David Duran-Rodas:** Writing – review & editing, Methodology.

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.

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Appendix A

Table

. Results from the scoping literature review on exploring the focus and gaps of mobility surveys.

No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
1	Active mobility perception from an intersectional perspective: insights from two European cities	Carboni et al	2021	Italy, Europe	Local	Gender, age, income, ethnicity	Turin – 422, Valencia – 443	Factor analysis		Perception of safety, perception of security, satisfaction.	Active mode of transport
2	Using the 2017 National Household Travel Survey Data to Explore the Elderly's Travel Patterns	Sadeghvaziri and Tawfik	2020	USA, North America	National	Older people, race, income	N/A	Descriptive analysis, comparative analysis	x	Travel behaviour	Active mode of transport, public transport
3	Transport disadvantage, social exclusion, and subjective well-being: The role of the neighborhood environment—evidence from Sydney, Australia	Ma et al	2016	Sydney, Australia, South-east Asia	District /Neighbourhood	Gender, age, income,	562 households in 4 neighbourhoods	Structural equation models	x	Exposure to road traffic, health	Active mode of transport, public transport
4	Pandemic impacts on public transport safety and stress perceptions in Nordic cities	Böcker et al	2023	Sweden, Norway, Europe	Local	Women	6000	Structural equation models		Perception of safety, stress	Public Transport
5	An analysis of the harassments and challenges faced by the public transport users in a developing country of South Asia	Yasir et al	2022	Bangladesh, South Asia	Local	Women	N/A	Descriptive analysis, binary logit model, multivariate analysis	x	Perception of safety, travel behaviour, harrasment	Public transport
6	Choosing the Bicycle as a Mode of Transportation, the	Biassoni et al	2023	Italy, Europe	Metropolitan	Gender, age	1130	Linear regression		Quality of infrastructure, satisfaction	Cycling

(continued on next page)

Table (continued)

No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
7	Influence of Infrastructure Perception, Travel Satisfaction and Pro-Environmental Attitude, the Case of Milan Road crash fatality rates in France: A comparison of road user types, taking account of travel practices	Bouaoun et al	2015	France, Europe	National	Gender, age	N/A	Chi square, Poisson distributions		Exposure to road traffic, health	Walking, cycling
8	Changes in travel behavior, attitudes, and preferences among e-scooter riders and nonriders: First look at results from pre and post e-scooter system launch surveys at virginia tech	Buehler et al	2021	Virginia, USA, North America	District /Neighbourhood	Age, gender, university	870	Factor analysis		Perception of safety, affordability, convenience, travel behaviour	E-scooter
9	Elderly Users' Satisfaction with Public Transport in Thailand Using Different Importance Performance Analysis Approaches	Chaisomboon et al	2020	Thailand, South-east Asia	National	Older people	2700	Descriptive analysis		Accessibility, quality of service, perception of safety, information, satisfaction, flexibility	Public transport
10	When connectivity makes safer routes to school: Conclusions from aggregate data on child transportation in Shanghai	Chevalier and Charlemagne	2020	China, East Asia	District /Neighbourhood	Young children being transported by their parents	400	Spatial data analysis, descriptive analysis		Exposure to road traffic, quality of infrastructure, perception of safety	Cycling
11	Universal Mobility in Old Core Cities of India: People's Perception	Das Mahapatra et al	2021	India, South Asia	Local	Older people, people with disabilities	435	Descriptive analysis	x	Accessibility, political participation, physical barriers, information	Walking, public transport
12	Parental perceived neighborhood attributes: associations with active transport and physical activity among 10–12 year old children and the mediating role of independent mobility	de Meester et al	2014	Belgium, Europe	Regional	Children (10–12)	736	Descriptive analysis and linear regression		Accessibility, exposure to road traffic, physical barriers, quality of infrastructure, perception of safety, urban green spaces	Walking and cycling
13	Understanding how individuals perceive changes in the built environment and the transport system after implementing a BRT system. The case of Barranquilla, Colombia	Diaz et al	2023	Colombia, South America	Local	Low-income	305	Structural equation models	x	Accessibility, health, quality of service, perception of safety, affordability, travel behaviour	Public transport
14	Latinx Parents' Perceptions of Neighborhood Walking Safety for Their Youth With Intellectual Disabilities A Mixed-Methods Investigation	Early et al	2021	USA, North America	Local	Young people with disabilities	21 surveys; 5 focus group interviews	Mixed method	x	Political participation, health, quality of infrastructure, perception of safety, travel behaviour	Walking
15	Youngsters' opinions and attitudes toward the use of electric bicycles in Israel	Elias and Gitelman	2018	Israel, Middle East	Regional	Young people	326	Regression and factor analysis		Physical barriers, perception of safety, travel behaviour	Electric bicycles
16	A grounded visualization approach to explore sociospatial and temporal	Franke et al	2017	Canada, North America	Metropolitan	Older people with low income	161	Spatial data analysis, descriptive analysis,	x	Accessibility, health, quality of service, perception of	Walking

(continued on next page)

Table (continued)

No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
17	complexities of older adults' mobility Perceived pedestrian level of service in an urban central network: The case of a medium size Greek city	Georgiou et al	2021	Greece, Europe	Local	Pedestrians (gender and age)	200	qualitative data analysis Logit model		safety, travel behaviour Exposure to road traffic, quality of infrastructure, comfort, perception of safety, urban green spaces, convenience, travel behaviour, time/delays	Walking
18	Walking to the bus: Perceived versus actual walking distance to bus stops for older adults	Hess	2012	NY, USA, North America	Regional	Older people	N/A	Bi-variate analysis	x	Accessibility, physical barriers	Walking
19	A factor analysis for identifying people with disabilities' mobility issues in built environments	Hwang	2022	Texas, USA, North America	Metropolitan	People with disabilities	240	Factor analysis	x	Accessibility, exposure to road traffic, physical barriers, quality of infrastructure, perception of safety, urban green spaces, sufficiency, urban furniture	Walking
20	Children's non-school trips, travel-related subjective well-being, and life satisfaction: Evidence from young adolescents in rural Japan	Khaleghi and Kato	2023	Japan, East Asia		Young people	487	Structural equation models		Health, perception of safety, satisfaction, stress, travel behaviour, time/delays	All
21	Multilevel modelling of built environment characteristics related to neighbourhood walking activity in older adults	Li et al	2005	Oregon, USA, North America	District /Neighbourhood	Older adults	577	Spatial data analysis		Accessibility, exposure to road traffic, health, perception of safety, urban green spaces, travel behaviour	Walking
22	Do University Students' Security Perceptions Influence Their Walking Preferences and Their Walking Activity? A Case Study of Granada (Spain)	Lizarraga et al	2022	Spain, Europe	District /Neighbourhood	University students	312	Descriptive analysis, Non-Linear Principal Component Analysis and Logit Model		Perception of security, built environment	Walking
23	Accessibility for Low-Income Workers in New Orleans, Louisiana, After Hurricane Katrina	Lowe	2014	USA, North America	District /Neighbourhood	Low-income	50	Descriptive analysis	x	Accessibility, quality of infrastructure, attitudes/norms	Walking
24	Senior Tourists' perceptions of tactile paving at bus stops and in the surrounding environment: Lessons learned from project ACCES4ALL	Pinto et al	2020	Portugal, Europe	District /Neighbourhood	Older people	51	Descriptive analysis	x	Accessibility, health, physical barriers, quality of infrastructure, information, urban furniture	Walking
25	Elderly perception of critical issues of pedestrian paths	Pulvirenti et al	2020	Italy, Europe	Local	Older people	306	Cluster analysis (K-means)	x	Health, physical barriers, quality of infrastructure, sufficiency, satisfaction,	Walking

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No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
26	A mixed-methods investigation of older adults? public transit use and travel satisfaction	Ravensbergen et al	2023	Ontario, Canada, North America	Local	Older people	1002	Descriptive analysis and factor analysis	x	travel behaviour, urban furniture Accessibility, physical barriers, quality of service, quality of infrastructure, comfort, satisfaction, convenience, travel behaviour	Public transport
27	What are we missing when we measure accessibility? Comparing calculated and self-reported accounts among older people	Ryan and Pereira	2021	Sweden, Europe	Local	Older people	1149	Spatial data analysis	x	Accessibility, health, travel behaviour, attitudes	Car, walking, cycling
28	Cycling and cycling cessation in later life: Findings from the city of Malmö	Ryan et al	2016	Sweden, Europe	Local	Older people	456	Binary logistics regression model		Exposure to road traffic, physical barriers, perception of safety, perception of security, travel behaviour, attitudes	Cycling
29	Why choose to cycle in a low-income country?	Sabyrbekov and Overland	2020	Kyrgyzstan, Central Asia	Local	Low-income	900	Logit model	x	Health, physical barriers, quality of infrastructure, comfort, perception of safety, convenience, travel behaviour	Cycling
30	Street characteristics preferred for transportation walking among older adults: A choice-based conjoint analysis with manipulated photographs	Van Cauwenberg et al	2016	Belgium, Europe	Local	Older people	1131	Descriptive analysis, Multinomial Logistic Regression		Accessibility, exposure to road traffic, health, physical barriers, quality of infrastructure, urban green spaces, travel behaviour	Walking
31	Perceived importance of inclusive street dimensions: a public questionnaire survey from a vision(ing) perspective	Wang et al	2021	Singapore, South-east Asia	Local	Age, gender	816	Categorical canonical correlation analysis		Accessibility, physical barriers, perception of safety, perception of security, urban green spaces, urban furniture	All
32	Understanding mobility characteristics and needs of older persons in urban Pakistan with respect to use of public transport and self-driving	Ahmad et al	2019	Pakistan, South Asia	Local	Older people	450	Pearson and Chi squared tests		Accessibility, health, quality of service, comfort, convenience, time/delays	Public transport
33	Carsharing: Another gender issue? Drivers of carsharing usage among	Alonso-Almeida	2019	Germany, Europe	Local	Women	228	Pearson correlation analysis,	x	Quality of service, perception of	Car-sharing

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No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
34	women and relationship to perceived value Gender-Responsive Public Transportation in the Dammam Metropolitan Region, Saudi Arabia	Al-Rashid et al	2020	Saudi Arabia, Middle East	Metropolitan	Women	104	Principal component analysis Correlation analysis		security, affordability, convenience Physical barriers, quality of service, quality of infrastructure, comfort, information, perception of security, mobility of care, affordability	Public transport
35	Trip deprivation among older adults in the context of the capability approach	Deka	2022	USA, North America	Local	Older adults	3003	Multilevel logit model	x	Accessibility, information, mobility of care, sufficiency, travel behaviour, built environment	All
36	How young pedestrians perceive walkways: gender differences	Eboli et al	2023	Italy, Europe	Local	University students	240	Mixed logit models		Physical barriers, quality of infrastructure, comfort, satisfaction, urban green spaces, urban furniture, built environment	Walking
37	Shared mobility services: an accessibility assessment from the perspective of people with disabilities	Goralzik et al	2022	Europe	International	People with disabilities	553	Descriptive analysis, inductive content analysis for open ended questions	x	Accessibility, quality of service, comfort, perception of safety, reasons to travel, convenience, time/delays	Shared modes
38	Gender inequality, transport, and wellbeing: The case of child healthcare in Uruguay	Hernandez and Rossel	2022	Uruguay, South America	Local	Gender	409	Mixed-method	x	Accessibility, health, quality of service, comfort, perception of safety, mobility of care, convenience, time/delays	All
39	How gender differences and perceptions of safety shape urban mobility in Southeast Asia	Hidayati et al	2020	South-east Asia	District /Neighbourhood	Gender	383	Space syntax model		Exposure to road traffic, physical barriers, quality of infrastructure, perception of safety, travel behaviour, built environment, stress	Walking and private car usage
40	Staying home or going places: Mobility factors of older minority women's daily trip making in the United States	Kim and Ulfarsson	2021	USA, North America	National	Older people, Women, Minorities	4565	Binomial regression, Cragg's exponential hurdle regression	x	Accessibility, mobility of care, travel behaviour, attitudes	All
41	Women's mobility via bus rapid transit:	Malik et al	2020	Pakistan, South Asia	Local	Women	429	Descriptive analysis. Chi-square tests	x	Quality of infrastructure, mobility of	Bus

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No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
	Experiential patterns and challenges in Lahore									care, sufficiency, harassment, time/delays, attitudes	
42	Gender differences in mobility of Hispanic immigrants	Matsuo	2016	USA, North America	National	Gender, Immigrants	10,246	Descriptive analysis. Logit regression model	x	Reasons to travel, built environment	Car
43	Impact of carsharing on the mobility of lower-income populations in California	Mitra	2021	USA, North America	Local	Low-income	12,036	Multiple-group Structural Equation Modeling	x	Quality of service, behaviour, built environment	Car-sharing
44	AN ASSESSMENT OF GENDER DISPARITY THAT EXISTS IN THE TRANSIT SERVICE PROVISION: A CASE STUDY OF MRT FEEDER BUS SERVICE IN KLANG VALLEY, MALAYSIA	Olabayonle et al	2023	Malaysia, South-east Asia	Local	Gender	380	Correlation analysis		Quality of service, perception of safety, satisfaction, flexibility, convenience, travel behaviour, time/delays, attitudes	Bus
45	Walking in European cities: a gender perception perspective	Pirra et al	2023	Europe	International	Gender	4000	Descriptive analysis		Accessibility, perception of security, mobility of care, satisfaction, Accessibility, physical barriers, quality of service, perception of security, flexibility, affordability, convenience, reliability	Walking
46	Exploring paratransit service quality based on low-income women's perception: A case study in Dhaka city by structural equation model (SEM)	Rahman	2022	Bangladesh, South Asia	Local	Low-income	410	Structural equation models	x	Accessibility, physical barriers, quality of service, perception of security, flexibility, affordability, convenience, reliability	Paratransit
47	Gender-based violence and Women's mobility, findings from a medium-sized Colombian city: A quantitative approach	Rodas-Zuleta et al	2022	Colombia, South America	Local	Gender	N/A	Descriptive analysis, Chi-square correlation analysis	x	Accessibility, perception of safety, harassment, travel behaviour	All
48	The impacts of COVID-19 on older adults' active transportation mode usage in Isfahan, Iran	Shaer and Haghsheenas	2021	Iran, Middle East	Local	Older people	453	Binary logistic regression		Travel behaviour, accessibility	Walking and cycling
49	Public transportation and fear of crime at BRT Systems: Approaching to the case of Barranquilla (Colombia) through integrated choice and latent variable models	Soto et al	2022	Colombia, South America	Local	Gender	500	Confirmatory factor analysis		Perception of safety, perception of security, mobility of care, harassment, travel behaviour, attitudes	Public transportation
50	Examining mobility behaviour among youth – a progress report	Stark et al.	2015	Austria, Europe		Young people	N/A	Correlation analysis		Travel behaviour, accessibility	All
51	Gendered mobility and activity pattern: implications for gendered mental health	Wang and Yang	2023	China, East Asia	Local	Gender	2144	Multigroup path analysis model		Travel behaviour, accessibility, health	All
52	Barrier-free outdoor environments: Older peoples' perceptions before and after	Wennberg	2010	Sweden, Europe	National	Older people	244	Mixed-method (analysis of survey results)	x	Accessibility, physical barriers, quality of	Walking

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No	Title	Author	Year	Country/ Region	Spatial scale	Target group	Sample size	Statistical model	Mobility justice ^a	Transport- related factor	Mode of transport
	implementation of legislative directives							included significance tests: Sing tests, McNemar test)		infrastructure, perception of safety, satisfaction, travel behaviour, urban furniture	
53	Mobility-on-demand versus fixed-route transit systems: An evaluation of traveler preferences in low-income communities	Yan et al	2021	USA, North America	Metropolitan	Low-income, disabilities, older people	457 and 443	Descriptive analysis, Order logit model	x	Accessibility, quality of service	On-demand mobility
54	Modeling the mobility choices of older people in a transit-oriented city: Policy insights	Yang	2018	Hong Kong, South-east Asia	Local	Older people	N/A	Mixed binary logit model, Conditional logit model		Accessibility, time/delays	Public transport
55	Constructing women's immobility: Fear of violence and Women's constricted nocturnal travel behaviour	Zhang et al	2022	China, East Asia	Local	Women	1112	Structural equation model	x	Perception of safety, harassment, attitudes, travel behaviour	All
56	Gender differences in the user satisfaction and service quality improvement priority of public transit bus system in Porto Alegre and Fortaleza, Brazil	Zheng et al	2022	Brazil, South America	Local	Gender	1765	Random forest method		Accessibility, exposure to road traffic, physical barriers, quality of service, quality of infrastructure, comfort, perception of safety, information, perception of security, satisfaction, harassment, convenience, reliability	Public transport

^aStudies that explored socio-demographic inequities in accessing the transport system.

Data availability

Data will be made available on request.

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