

Mobility of non-binary and gender nonconforming individuals: A systematic literature review

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ABSTRACT

The gendered nature of travel behaviours and experiences have long been recognised in research and policy making. However, research on non-binary people and their mobility is scarce, as is the acknowledgement of a spectrum nature of gender within the transportation discipline. This paper presents the first systematic literature review, using PRISMA guidelines, of the mobility and travel experiences of non-binary people. The review identified that to date the main research domains for non-binary people's mobility considered issues of harassment and violence on public transit, fear, security measures, intersectionality, and strategies to deal with discrimination. The paper highlights spatial and geographical constraints, such as immobility and inaccessibility, that non-binary people face when interacting with public transportation system. Strategies to improve mobility for the gender nonconforming community included upgrading public transport stations, increasing funding for public transportation, and providing gender diversity training for transit workers. The findings draw attention to the need for substantial further transportation research into the field. By including non-binary perspectives in transport research, a unique range of insights and experiences can be unlocked, while increasing inclusivity in transport research.

1. Introduction

An effective transition towards a sustainable transportation system requires addressing widespread barriers, such as immobility, harassment and fear of violence. To create an equitable and just transportation system it is necessary to understand and evaluate the complex gendered experiences of mobility and public transit. This aligns with the UN's 2030 sustainable development goals, specifically Goal 5 (Gender Equality) and Goal 11 (Sustainable Cities and Communities) (United Nations, 2015).

There is a greater threshold for overcoming transport poverty and immobility barriers for gender minorities due to marginalisation and discrimination (Gorman-Murray and Nash, 2016; Luibheid, 2008). Historically, socio-economic discrimination of vulnerable groups, including gender minorities, have resulted in vulnerable populations depending more on public transportation (He et al., 2022). Furthermore, it is important to acknowledge that justice in mobility stems not only from physical accessibility but also from eliminating social, cultural, and spatial constraints that burden individual mobility (Shakibaei and

Vorobjovas-Pinta, 2022).

Gender is one of the major intersecting marginalised identities that creates unique barriers to accessibility for transit riders (Loukaitou-Sideris, 2016). There is a significant body of research on the travel experiences of women and men, how their travel behaviours differ, and what kind of mobility challenges they face (Law, 1999; Pollard and Wagnild, 2017). However, with the public space being constructed as heterosexual and gender-normative, all diversions from the gender structures often fall out of the scope of research and implemented policies in public transportation systems (Cresswell and Priya Uteng, 2008). Beyond this, Cresswell and Priya Uteng (2008, p. 7) argue that if a person's "gender is not male, they are mobility-poor", highlighting the significant gender bias that exists in the transportation system. Those who do not fit into the traditional binary standards of gender, encounter further barriers and challenges while using the public transportation system (see Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022).

Butler (1999, p.178) states that "gender is a performance with clearly punitive consequences", rather than a binary form. People whose gender

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identity corresponds with the sex they were assigned at birth are considered to be cisgender, otherwise they are considered to be on the transgender spectrum (American Psychological Association, 2018). However, transgender people may not distinctively fall into one of the two gender categories, instead they are “outside of or between” those categories (Monro, 2019, p. 1); the most common terms and self-identification labels for those people are non-binary, genderqueer, and gender nonconforming. There are different estimates of the proportion of the non-binary population within the transgender population; in a UK study, 52 % of 14,320 transgender participants identified as non-binary (Government Equalities Office, 2018), while in Canada, 41 % of 839 transgender youth were non-binary (Clark et al., 2018). An aggregate literature analysis estimated that approximately 20 % of the general transgender population identifies as non-binary or gender nonconforming (Nieder et al., 2018). Irrespective of the exact proportion, non-binary persons represent a non-negligible proportion of the population, yet they are often overlooked in transport research.

The concept of *queer mobilities* covers a range of research on how members of the LGBTQ+, (an umbrella term for marginalised sexualities and gender identities) community experience mobility; it includes questions of identity, visibility and harassment on public transport (Weintrob et al., 2021). However, a noted limitation of queer research to date is that most studies were conducted amongst samples of educated, gay, white, cisgender, males that were significantly less marginalised and more represented (Weston, 1995), when compared with people of colour, feminine-presenting, transgender and non-binary members of LGBTQ+ communities.

While queer mobility research mostly focuses on how sexual minorities interact with transportation, a newly emergent branch of research on transmobilities covers mobility experiences of transgender and gender nonconforming individuals, including non-binary and genderqueer people (Lubitow et al., 2017). This term is oriented towards the research goal of this study, as it explores the unique non-homogenous experiences, patterns and challenges of gender nonconforming transit riders who are often affected by “intersecting forms of oppression” (Lubitow et al., 2017, p. 2). Mobility is considered to be one of the “dimensions of LGBTQ discrimination” (Weintrob et al., 2021, p. 10), as it poses restraints of accessibility on queer people when using the transportation system, such as travel stress, fear of violence and hypervigilance of the surroundings.

The novelty of sustainable mobility paradigm lies in the idea of “strengthening the links between land use and transport” (Banister, 2008). Transportation constitutes one-fourth of all greenhouse gas emissions in Europe (European Environmental Agency, 2024); thus, to transition towards a sustainable way of living, carbon-neutral accessible mobility must become a priority in policy making, land use and transportation planning. Moreover, a shift towards sustainable mobility does not only concern environmental aspects of transport, but also the economic and social components. To account for those aspects of sustainability, a mobility justice approach is implemented to analyse social and economic accessibility challenges of public transit. Mobility justice is a modern theorisation of a transition towards more just and equitable mobilities for all; it's a key to creating an environmentally and socially sustainable transportation system (Sheller, 2018). Intersecting identities of the transit riders inevitably influence their mobility, creating uneven access to the transportation system. Mobility justice helps to understand different political, cultural and ethical implications of varying accessibility levels related to uneven distribution of resources and opportunities (Shakibaei and Vorobjovas-Pinta, 2022). Another approach to dissecting the accessibility of public transport is through the lens of Walzer's “spheres of justice” (Martens, 2012; Shakibaei and Vorobjovas-Pinta, 2022, p. 4; Walzer, 1983). Applying Walzer's spheres of justice leads to the paradigm that access to public transportation should not be contingent on factors such as privilege, money and power. Despite an increasing number of scholarship on mobility justice, it is yet to become a “mainstream concern in transport mobility research” (Ernste et al.,

2012, p. 5). It can be argued that transit justice faces limitations in “theorization of mobility, space and justice”; as accounting for redistribution of resource is often not enough, with a shift in the way resources are created and valued being a crucial step to overcoming “geographies of domination” (Enright, 2019, p. 2). Moreover, transit justice relates to the idea of the “right to the city”, a desire for collective public space that accounts for spatial and social interests of marginalised groups (Lefebvre, 1996). These concepts are interconnected, as the residents' capacity to engage in travel leads to their ability (or inability) to access opportunities and resources of the city (Enright, 2019). To conclude, researching mobility justice in terms of intersecting identities is crucial in retheorising movement, motility and space.

Transport policies and mobility research need to account for the marginalised riders, as they are more likely to be affected by the changes due to their transit dependency. Moreover, it is crucial to make public transit safe and welcoming, since upon overcoming socio-economic barriers and transit dependency, marginalised populations are more likely to increase their car dependency to avoid unpleasant experiences, which has a negative impact on the climate, environment and land use (García et al., 2022). The omission of non-binary individuals in transport research imminently leads to data violence, the negative effect of systematic exclusion of certain groups from information and research field (Hoffmann, 2017). The negligence leads to an oversight in the implementation of policies, often due to a lack of language to address these groups (Elliott et al., 2022a).

It is apparent that research on non-binary people and their mobility is scarce, as is the acknowledgement of a spectrum of gender within the transportation discipline. As such, the aim of this study was to systematically review the existing literature on the mobility and travel experiences of non-binary people along with identifying research gaps and to provide best practice recommendations that can improve the inclusivity of the transportation system and mobility research.

2. Methodology

A systematic literature review was carried out to identify research papers and articles on the mobility and travel experiences of non-binary individuals using the updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The search was carried out in September of 2023 using two databases, the Transport Research Board and the Web of Science. Initially, the search also included terms related to sexualities to have a grasp on the existing queer mobilities literature, however those articles were considered to be out of scope for the research question and therefore, the search string was modified.

The search in the Transport Research Board aimed to capture an exhaustive list of articles mentioning gender nonconforming persons and their experiences with the transportation system. Therefore, the search was performed using the following search string: Non-binary OR Nonbinary OR Genderqueer OR Genderfluid OR Transgender OR Queer OR LGBT OR LGBT+ OR LGBTQ OR “Gender identity” OR Agender OR “Gender Nonconforming” OR “Gender Minority”.

In the Web of Science, the aforementioned search terms were used along with the topic-specific category for “Transportation”. Both searches were limited to peer-reviewed articles, papers and reports and the language to English. A snowballing technique, referred to as “pursuing references of references” (Greenhalgh and Peacock, 2005, p. 2), was implemented to identify missing literature and expand the pool of publications by reviewing reference lists of the selected articles.

2.1. Synthesis of the selected articles

The initial search identified 44 articles in the Transport Research Board and 79 articles in the Web of Science, resulting in a total of 123 articles, as shown in Fig. 1. Three (3) articles were identified through the snowballing technique. Amongst the selected articles, 14 duplicate

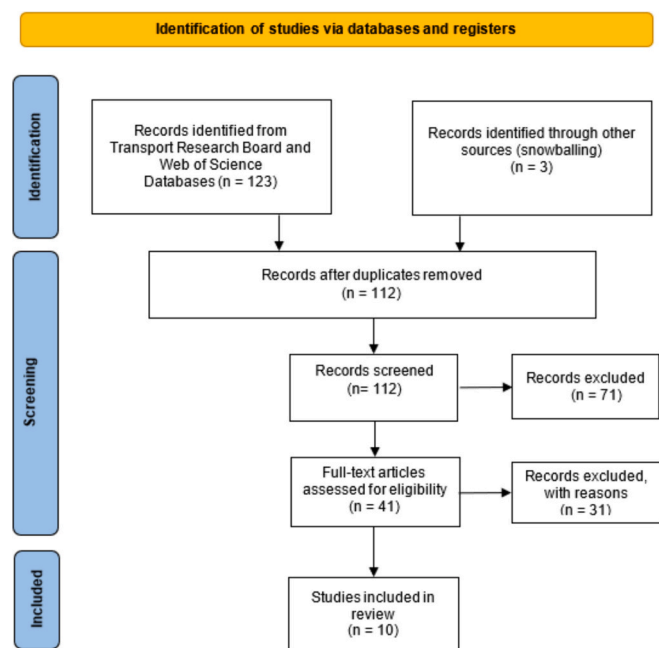


Fig. 1. Flow diagram for systematic review of non-binary people in transport research.

articles were removed. 71 articles were removed during screening due to irrelevant uses of search terms that were outside of the scope of the research, reducing the sample to 41 articles. The remaining 41 articles were assessed for eligibility, with 10 articles fitting the criteria to be evaluated in the literature review. There were two main criteria to assess the eligibility of the articles: an explicit mention of non-binary or gender nonconforming people in the body of text and transportation or mobility-related topics included in the article. The articles were excluded for several reasons:

- the research focused on queer mobilities, but did not consider gender nonconforming people ($n = 10$);
- the research was focused on gender identity and mobilities yet only considered binary genders ($n = 15$);
- the research was not related to transportation or mobility ($n = 6$).

It is noted that some of the eliminated articles were used for the general theoretical background and discussion on queer mobilities, however they were not considered in the results and findings of the literature review as they did not specifically address the research question. Thus, the analysis was performed on the selected 10 full-text articles that mentioned non-binary or gender nonconforming people and are directly related to mobility.

2.2. Analysis

The summary of the papers is presented in Table 1. Thematic analysis was performed on the selected articles, and they were classified according to the findings in relation to non-binary and gender nonconforming participants. Thematic analysis was chosen as the desired analysis method due to flexibility and accessibility of this “bottom-up” approach; it allows for systematic identification and organisation of mentioned patterns and themes (Braun and Clarke, 2012). An inductive approach is most appropriate for this research question, as it allows for the themes to be derived from the literature itself rather than the “top-down” deductive method that “brings to the data a series of concepts, ideas, or topic” for analysis and interpretation of the said data (Braun and Clarke, 2012, p. 3). Each of the identified themes is discussed in Section 3.2 with references to analysed papers. Based on the findings of

the papers and additional literature, transport policy implications and best practice recommendations for inclusive mobility research are provided in the discussion.

3. Results

3.1. Summary of included studies

Table 1 provides a summary of the included studies, including the authors and year of publication, study design and method (which refers to the methodological approach of the selected papers), the purpose of the study (which refers to the aim and the desired outcomes of the studies), the sample size of non-binary people, recognised gender identities beyond the binary (which refers to all the recognised and mentioned gender identities in the studies), the country of the conducted research, and the results of the study in relation to non-binary people, where the outcomes of the papers in the direct relation to non-binary or gender nonconforming individuals are presented.

The majority of the studies used qualitative (García et al., 2022; Lubitow et al., 2017, 2020; Shakibaei and Vorobjovas-Pinta, 2022; Weintrub et al., 2021) or mixed method (Abelson et al., 2023; Gandy et al., 2021) study approaches, with the exception of three studies that used quantitative methods (Cubells et al., 2023; Elliott et al., 2022b; He et al., 2022). All the included studies were published between 2017 and 2023, despite no time restrictions being placed on the article searches.

Concerning the sample size and future analysis in the included articles, two articles did not have any non-binary participants in their sample data; non-binary people were either only mentioned in the theoretical section (García et al., 2022) or the study had a non-binary option in the gender question, yet none of the respondents chose it (Cubells et al., 2023). Four articles had limitations and did not find specific results during analysis due to the small sample size of non-binary participants; the paper by Elliott et al. (2022b) excluded the non-binary participants ($n = 58$) from secondary analysis, the paper by He et al. (2022) combined non-binary participants ($n = 16$) with female participants in some of the statistical analysis, the paper by Abelson et al. (2023) did not find any specific outcomes for non-binary participants ($n = 2$) and the paper by Gandy et al. (2021, p. 10) mentioned “limited generalizability” of findings due to a nonrepresentative sample ($n = 7$). Two articles have mentioned a lack of analysis of gender minorities' experiences in the limitations of the articles (Cubells et al., 2023; Elliott et al., 2022b). The remaining studies presented significant findings related to the mobility and transit of non-binary and/or gender nonconforming people.

Most of the articles were written in the US (7), while the remaining three originated in the UK and Israel (1), Spain (1), and Turkey (1). As the language of the articles was restricted to English, the scope of the research inevitably excluded research written not in English. Furthermore, some countries may have different terms for what is considered to be non-binary, and therefore, remain unaccounted for in this study. The majority of the selected research articles centre around the Global North, and therefore only address the people, challenges and issues therein. Notwithstanding the non-homogeneity of the non-binary population that was researched within the transportation field, there were some patterns that can be traced throughout different contexts, both cultural and geographical.

3.2. Travel experiences of non-binary and gender nonconforming individuals

3.2.1. Harassment and violence

Transport research on non-binary individuals often explores the aspects of harassment and discrimination while interacting with the transportation system, with seven out of ten selected articles mentioning these phenomena in one way or another (Gandy et al., 2021; García et al., 2022; He et al., 2022; Lubitow et al., 2017, 2020; Shakibaei and

Table 1
Full text literature retained.

Authors, year	Study design and method	Purpose	Sample size of n-b people	Gender identities defined beyond binary	Country	Results in relation to n-b individuals
Abelson et al., 2023	Mixed method; Photovoice methodology and video-call interviews	Studying the experience of marginalised groups on the transit and their social exclusion.	N = 2 (6 % out of total 35)	Non-binary, genderqueer	USA	<ul style="list-style-type: none"> No specific findings related to the gender minorities. General policy recommendations for marginalised groups.
Cubells et al., 2023	Quantitative analysis of GPS-tracked trips	Analysing travel behaviour of micromobility users by intersecting identities (including gender).	N = 0 (0 % out of 89)	Non-binary	Spain	<ul style="list-style-type: none"> No participants identified as non-binary despite being given as a gender option.
Elliott et al., 2022a	Quantitative analysis; Exploratory cross-sectional study	Analysing active transportation behaviour through the effects of gender identity/sexual orientation.	N = 58 (1.5 % out of 3947)	Agender, androgyne, demi gender, genderqueer, gender fluid, queer, questioning/unsure, trans man, trans woman	USA	<ul style="list-style-type: none"> Significant intersection between gender identity and sexuality in terms of preference for the active transportation (specifically biking).
Gandy et al., 2021	Mixed-methods study; Quantitative and qualitative analysis	Investigating unique barriers of transgender and gender diverse individuals in rural settings.	N = 7 (29.2 % out of 24)	Gender diverse, non-binary, genderqueer, agender, demigender	USA	<ul style="list-style-type: none"> Travel burden is exceptionally high for transgender and gender diverse individuals in the rural areas. Lower accessibility to gender-affirming care due to geographical isolation and immobility. Acknowledgment of a greater harassment levels faced by non-binary people in compassion with gender conforming individuals.
García et al., 2022	Qualitative interviews; Photovoice methodology	Demonstrating harassment faced by low-income women of colour on transit.	N = 0 (0 % out of 22)	Gender nonconforming individuals	USA	<ul style="list-style-type: none"> COVID-19 exacerbated existing transport burdens for non-binary and other marginalised groups. Unequal access to public transit, harassment, and lack of anti-discrimination policies.
He et al., 2022	Quantitative analysis of a survey that includes demographic characteristics	Understanding the impacts of COVID -19 on the essential transit users.	N = 16 (3 % of total 495)	Non-binary genderqueer, or other gender identities	USA	<ul style="list-style-type: none"> Visibly gender nonconforming riders reported a higher incidence of violence and harassment overall. Intersectionality of the issues faced by non-binary riders. Lack of mobility access perpetuates gender inequality on a large scale. Significantly higher levels of harassment and discrimination, along with travel stress and anxiety. Higher transit dependency. Policy recommendations for inclusion and accessibility of non-binary people on public transport. Interconnectedness between fear of violence (rather than violence itself) and immobility faced by non-binary individuals.
Lubitow et al., 2017	Qualitative interviews analysis	Analysing experience of gender nonconforming individuals on public transit, drawing connection between gender and urban mobility.	N = 12 (45 % out of 25)	Genderqueer (6), non-binary (1), agender (3), genderfluid (1), male and female (1), demigirl (1), two spirit (1)	USA	<ul style="list-style-type: none"> Significantly higher levels of harassment and discrimination, along with travel stress and anxiety. Higher transit dependency. Policy recommendations for inclusion and accessibility of non-binary people on public transport. Interconnectedness between fear of violence (rather than violence itself) and immobility faced by non-binary individuals.
Lubitow et al., 2020	Qualitative interviews analysis	Demonstrating the challenges faced by gender minorities on public transit.	N = 12 (48 % out of 25)	Genderqueer (6), non-binary (1), agender (3), genderfluid (1), male and female (1), demigirl (1), two spirit (1)	USA	<ul style="list-style-type: none"> Higher levels of gender-based fear and violence due to the diversion from social norm of gender presentation. Higher dependency on transit. Concealing one's identity for the sake of safety on transit.
Shakibaei and Vorobjovas-Pinta, 2022	Qualitative interviews; thematic analysis	Investigating the uneven access to mobility and urban leisure by marginalised groups.	N = 49 (not specified between trans and gender diverse individuals)	Gender-diverse individuals	Turkey	<ul style="list-style-type: none"> Intersectionality of discrimination and immobility. Policy recommendations for inclusion and safety. Higher levels of gender-based fear and violence due to the diversion from social norm of gender presentation. Higher dependency on transit. Concealing one's identity for the sake of safety on transit.
Weintrob et al., 2021	Qualitative analysis; Feminist epistemological and methodological analysis	Exploring “queer mobilities” and queer people's exclusion from heteronormative spaces.	N = 2 + 2 (out of UK (210) + Israel (118) sample)	Gender-fluid, non-binary, other-questioning, genderqueer	UK and Israel	<ul style="list-style-type: none"> Higher dependency on transit. Concealing one's identity for the sake of safety on transit.

Vorobjovas-Pinta, 2022; Weintrob et al., 2021). Non-binary and gender nonconforming people were more likely to have concerns about harassment using public transit than cisgender people (García et al., 2022; He et al., 2022). Everyday violence and discrimination on public transport were often associated with participants' visible appearance as non-binary (Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). The “diversion” from the social norm of gender presentation led to higher levels of perceived harassment (Lubitow et al., 2017; Weintrob et al., 2021). The majority of gender-based violence occurred in three

different scenarios while using public transit: at bus and train stops from passersby when waiting, while riding public transport from other passengers due to a lack of conductors and security officers, and on rare occasions, participants experienced verbal harassment or misgendering by transit employees (Shakibaei and Vorobjovas-Pinta, 2022). Ultimately, experiences of harassment and violence on public transit influence gender nonconforming people's perception of safety and comfort in public spaces, along with contributing to greater levels of travel anxiety and stress.

3.2.2. Fear

A commonly mentioned theme was the feeling of discomfort and fear due to the possibility of harassment; fear is a substantial barrier for queer and trans mobilities (Weintrob et al., 2021). Multiple articles focused on how fear shapes the experience of public transport and affects the travel patterns of marginalised populations (Lubitow et al., 2017, 2020; Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). However, the perception of fear does not necessarily correlate with the actual level of reported crimes. Perceived safety and reported violence often differ quite dramatically due to not all violent attacks being reported and accounted for in the statistics (Mason, 2001; Weintrob et al., 2021). Studies found that female and non-binary individuals have higher levels of fear about potential crime, yet male riders are more likely to experience violent attacks themselves (Lubitow et al., 2020; Shakibaei and Vorobjovas-Pinta, 2022). In contrast, Weintrob et al. (2021) found that women experience more violent incidents than non-binary persons and men, while non-binary persons experience more violence than men.

Queer women and non-binary participants raised the concept of “double victimisation” as a basis for increased harassment due to their feminine presentation (Weintrob et al., 2021, p. 8). Higher levels of travel stress may also be reflected in the transport mode choices of marginalised groups, such as choosing private transportation over micromobility (Elliott et al., 2022b) or avoiding public transit at night (Shakibaei and Vorobjovas-Pinta, 2022). Due to persistent fear of negative experiences on public transport, gender nonconforming participants often regarded the ideal experience on transit as “neutral and forgettable”, one that did not cause any confrontations (Lubitow et al., 2017, p. 7). This finding has potential impacts on the transition towards sustainable transportation, as the feelings of discomfort and fear may encourage people to use safer but less environmentally friendly modes of transportation (García et al., 2022).

3.2.3. Security measures

The attitudes concerning the police and surveillance on public transit were heterogeneous depending on the context. Some studies found a positive correlation between the feeling of safety and various types of law enforcement, such as security guards, police and random patrols, and additional security measures, including CCTV and alarm buttons (Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). In Istanbul, participants indicated that they feel safer in “the visible presence of transport officers” (Shakibaei and Vorobjovas-Pinta, 2022, p. 15), and in the UK, participants also mentioned the significance of security measures and the visibility of transport staff for the feeling of safety (Weintrob et al., 2021). In contrast, other studies found that police presence intensifies feelings of fear and persecution (García et al., 2022; Lubitow et al., 2017, 2020). The fear of police involvement may be attributed to the cultural perception of police in the geographical location of the studies. The studies that showed a negative impact on the feeling of safety were conducted in the US, which has documented instances of police brutality (Lyle and Esmail, 2016). Moreover, this phenomenon is attributed to the intersectionality of mobility, as participants often referred to their other marginalised identities (e.g. race, ethnicity, and class), as the reason for unfair treatment by the police (García et al., 2022; Lubitow et al., 2017). Additionally, during the COVID-19 pandemic, transit-dependent marginalised individuals had greater concerns about police interactions due to reduced ridership of transit non-dependent people explained by the “feelings of isolation and vulnerability” (He et al., 2022, p. 9). Therefore, there is no consensus on whether law enforcement improves the experiences of gender nonconforming people on public transport as it varies drastically in different socio-cultural and geographical contexts.

3.2.4. Accessibility and transit dependency

Non-binary and gender nonconforming individuals generally have a lower level of accessibility to transit and mobility due to historical

marginalisation and systematic oppression (He et al., 2022). Rural gender nonconforming individuals face unique barriers related to geographical isolation and high travel burden affiliated with low accessibility of gender-related care services (Gandy et al., 2021). In their study, Gandy et al. (2021) identified that 70 % of the participants had to travel out of state with an average of an hour and a half of travel time to access gender-affirming care and most (83.3 %) relied on private transportation. Non-binary riders were also more likely to have greater difficulty accessing essential services (grocery, pharmacy, healthcare, child care) compared to male riders (He et al., 2022). Due to their transit dependency, non-binary and gender nonconforming participants reported greater difficulties during the reduction of transit services throughout the COVID-19 pandemic (He et al., 2022). The difficulty with accessing and safely using public transportation attributes to the general “immobility” of LGBTQ+ persons and can be considered one of the aspects of discrimination (Lubitow et al., 2017; Weintrob et al., 2021, p. 11). To conclude, the nature of immobility in rural areas stems predominantly from the geographic isolation and physical inaccessibility, whereas in urban areas they are mostly related to socially constrained mobility barriers.

3.2.5. Intersectionality

Intersectionality is a theoretical framework that accounts for multifaceted systems of oppression faced by marginalised group, it investigates the discrimination and privilege through the lens of intersection of social positions, such as race, class, gender and sexuality (Bauer et al., 2021). A large part of problematic experiences on public transportation system stem from discrimination based on the intersecting identities of oppression held by non-binary and gender nonconforming individuals (García et al., 2022; He et al., 2022; Lubitow et al., 2017, 2020; Shakibaei and Vorobjovas-Pinta, 2022). Mobility justice research argues that persons with intersecting marginalised identities (low-income, racial, ethnic and gender minorities, etc.) while having lower accessibility to public transit, are more likely to depend on it (Abelson et al., 2023; Lubitow et al., 2020). In the study by Lubitow et al. (2017), the overwhelming majority of participants were transit-dependent, which is related to the broader economic disadvantage of marginalised groups. The socio-economic status of transit riders was often detrimental to their use of public transport even while not feeling safe (Lubitow et al., 2017). Participants' other marginalised identities (often race or ethnicity) made them feel targeted by the police and lessened their feeling of safety; their identities made them subjected to “overlapping systems of oppression” (García et al., 2022; Lubitow et al., 2017, p. 16). In the (2017) study by Lubitow et al., the only participants who did not report any violent experiences on public transport were white people. This finding shows how certain privileges, such as race, can help gender nonconforming people bypass harassment in public spaces. Being a part of the lower socio-economic class exacerbated mobility barriers during COVID -19 for gender nonconforming participants, as they were more likely to be transit-dependent (He et al., 2022). Participants also identified public transport in lower socio-economic and more conservative areas as bearing higher risk of harassment and potential violence (Shakibaei and Vorobjovas-Pinta, 2022). Disability was mentioned as one of the identities that contributed to the immobility and other challenges gender minorities face on public transportation (Lubitow et al., 2017). The lack of intersectional analysis makes it difficult to differentiate between what forms of privilege help mitigate harassment and violence on public transit (Lubitow et al., 2017).

3.2.6. Strategies to deal with harassment

To deal with harassment and discrimination based on visual gender nonconformity, non-binary participants indicated that they often had to conceal their gender expression for the sake of preventing potentially violent outcomes on public transit (Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). Moreover, the ability to “pass”, altering one's gender expression to fit into binary normative

gender boundaries, resulted in participants gaining mobility and avoiding discrimination on public transport (Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). Constant awareness and hypervigilance of the surroundings to prevent acts of violence were mentioned as a way of protecting oneself; however, continuous stress from these routines causes negative health outcomes for gender minorities (Lubitow et al., 2017; Scandurra et al., 2019; Weintrob et al., 2021). Ignoring harassment was a commonly used strategy to deal with unpleasant experiences (Lubitow et al., 2017; Weintrob et al., 2021). Non-binary and gender-diverse persons often changed their commuting schedule or altered their trips according to the times or routes they found safer and less problematic (Abelson et al., 2023; Lubitow et al., 2017; Weintrob et al., 2021). Conversely, despite the possibility of violence and harassment, LGBTQ+ participants often “refused to be excluded” from public transit spaces (Weintrob et al., 2021, p. 9) and rather adapted to the situation with various coping strategies.

3.3. Policy implications

3.3.1. Transport stations

A proposed way to reduce harassment at bus stations was ensuring “the visibility of the security officers, reliability of schedules and shorter waiting time” (Shakibaei and Vorobjovas-Pinta, 2022, p. 10); those are the attributes that usually made participants feel safer at train stations. However, as mentioned before, in the American context, participants refused to believe that additional surveillance and transit police presence would increase their feeling of safety due to the possibility of racial profiling and police brutality (García et al., 2022; Lubitow et al., 2017, 2020); therefore, geographically and culturally appropriate policies must be implemented accordingly. The use of diverse and proactive advertisements and messaging that includes gender minorities was mentioned as a way to enhance the feelings of safety of gender-diverse riders (Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022). Another suggested solution to improve the inclusivity of public transit is to encourage transit operators to collect data about anti-LGBTQ+ violence within their sphere of operation and to implement according policies to reduce the acts of violence (Weintrob et al., 2021). MaaS (mobility as a service) can prove to be helpful in the future for improving the feeling of safety for the gender-diverse public, in particular mobile phone applications were pinpointed as a tool to help safely navigate public transport (Shakibaei and Vorobjovas-Pinta, 2022).

3.3.2. Educating transit workers

One of the commonly mentioned recommendations in the articles on marginalised mobilities is the education of transit workers on gender diversity issues (Abelson et al., 2023; Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022). By providing appropriate education to the transit workforce, they should be able to “de-escalate problematic situations” and ensure the safety of the journeys (Shakibaei and Vorobjovas-Pinta, 2022, p. 14). Hiring a diverse transit workforce that comes from different underprivileged backgrounds can facilitate the creation of a “welcoming environment (...) and compassionate policy” that encourages safe and comfortable use of public transport for vulnerable riders (Abelson et al., 2023, p. 25). The use of gender-neutral terms was noted as important in the situation of interacting with transit employees (Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022), as misgendering was attributed to the aspects that made non-binary participants anxious and uncomfortable in public transport spaces.

3.3.3. Funding

Due to higher dependency on public transportation, cuts in the transit budget disproportionately affect non-binary and gender non-conforming people, as well as other marginalised groups. Therefore, “short-term funding injections” are not enough to compensate for the long-term underfunding of bus lines and alternative transit models that

are mostly used by vulnerable transit-dependent riders (He et al., 2022, p. 12). Potential measures to make public transportation accessible for LGBTQ+ travellers include fare reductions and subsidies for underprivileged riders and improving bus services to important LGBTQ+ events and venues (He et al., 2022; Weintrob et al., 2021). There is an evident lack of verbiage and explicit language to address marginalised populations in transport policy (Elliott et al., 2022a). It is especially problematic, as it negatively affects the possibility to acquire targeted funding and resources that would benefit non-binary and gender non-conforming riders.

4. Discussion

The aim of this study was to identify and systematically review existing literature related to the mobility of non-binary people. A total of 10 studies were identified that fit the eligibility criteria and were subsequently included in this systematic literature review. The main domains of research were identified to be harassment and discrimination on public transport, fear of violence, attitudes towards law enforcement, intersectionality, accessibility and strategies to cope with harassment. The vast majority of studies were conducted in the US, with the exception of three studies that were conducted in Spain, the UK and Israel, and Turkey. All studies were published recently (from 2017 to 2023), with a growing trajectory of research identified. This is a positive finding that highlights transmobilities becoming a growing area of scholarship with recognition amongst researchers of the need to investigate the spectrum nature of gender when considering the transportation system. Similarly, there is evidence of a growing number of non-binary and gender non-conforming persons amongst the youth population (Cameron and Stinson, 2019; Clark et al., 2018; Monro, 2019), implying that the current challenges with addressing this group will only become more prevalent in the near future.

A perspective that most of the articles delved into is the accessibility of transport for all, in relation to the mobility justice paradigm; it states that mobility research should account not only for the physical accessibility of transport but also for the socio-economic barriers that vulnerable riders face. A substantial difference in levels of accessibility of urban and rural non-binary populations is related to the social constraints to the mobility of the first and physical immobility due to geographical isolation of the second. Public policies related to public transportation often “overlook the feelings and vulnerabilities of LGBTQ people” (Weintrob et al., 2021, p. 6); thus, in order to create an equitable and just transportation system, interests and needs of the marginalised populations must be accounted for in research, planning and implementation of policies. Moreover, the exclusion from public spaces attributes to the geographic and spatial injustice that constitute the discrimination LGBTQ+ people face.

While this study sought to identify literature using a systematic process, a potential limitation of this research comes from restricting the language of search to English, limiting the paper to a Western perspective. An example of a non-Western and non-English speaking perspective that could have contributed greatly to the discussion on non-binary individuals and their experiences would be research from Thailand. Thailand legally recognise multiple non-binary gender categories, with 18 genders being part of the common language (Coomo et al., 2020). Gender diversity is much more visible and accepted in Thai society, providing insight into the lived experiences of non-binary individuals along with policy implications and research practices, which could bring a new perspective into the Western research field (Skorska et al., 2021).

The generalisability of the findings from this study is quite low due to the small sample of non-binary persons within the reviewed literature and the limited amount of studies themselves. As most of the non-binary participants were recruited through local LGBTQ+ networks, the findings of the review are based on the people involved within the community, who can differ from those who do not affiliate with it; thus, affecting generalisability of the findings to non-binary population

(Scandurra et al., 2019). Furthermore, the qualitative methodologies used by most studies highlight limitations regarding transferability, as the research is highly dependent on the circumstances of the study, such as socioeconomic, cultural and geographical context. While many issues were common amongst the reviewed articles, a notable geographic difference was in attitudes towards law enforcement on public transit in the US and Europe. The complex intersectional relationship between gender minorities, privilege and power is understudied and has broader societal dynamics and implications; it needs to be researched in the context of their influence on the mobility of gender nonconforming persons (Lubitow et al., 2020).

“Differential mobility can weaken the leverage of the already weak” (Massey, 2008, p. 3); thus, attributing to the unequal and harmful power dynamics. Not having equal access to mobility can significantly undermine the socioeconomic opportunities of vulnerable groups; mobility justice seeks to alleviate societal constraints that burden individual mobility. The shortcoming of traditional planning stems from the focus on land use and transportation planning over catering the system to the unique needs and lived experiences of people (He et al., 2022). Widespread urban planning policies, such as car-oriented planning and suburban zoning are perpetuating “structures of heterosexual domination” (Frisch, 2002, p. 3). To free the public spaces, substantial conscious efforts in undoing rigid heterosexist and gender-normative policies have to be undertaken. To transition effectively to a sustainable mobility paradigm, it is necessary to account for the fact that harassment and discrimination on public transport work as a factor that can influence modal shift. As an example, there is a pattern of women dealing with harassment on public transit by switching to private transportation modes and “increasing car dependency”, which has adverse environmental impacts on the climate crisis (García et al., 2022, p. 2). Thus, ideas of spatial justice and “right to the city” can be helpful in undermining the existing planning practices and moving towards a more equitable and just urban planning and human geography that accounts for accessible and just transportation for all.

Data violence is a phenomenon that captures harm that is caused by the continuous omission and exclusion of trans, non-binary and gender nonconforming people from information and government-run systems due to a lack of data collection (Hoffmann, 2017). Being invisible in research is often intertwined with “becoming invisible in culture more broadly” (Jaroszewski et al., 2018, p. 2); to understand the world with non-binary people in it, research must refrain from using gender binary methods. Exclusion from research surveys contributes to the exclusion in a broader context; as an example, the lack of acknowledgement of non-binary individuals in the health sphere and its research directly affects the quality of gender-related healthcare and attributes to the perception of non-binary people “as an anomaly to health systems” (Jaroszewski et al., 2018, p. 2). It is particularly evident when looking at the research domains that transmobilities cover, while being an emergent field of research, it mostly covers the barriers that non-binary people face, however there are more mobility-affiliated domains that are characterised by gendered behaviours. For example, the gendered differences in travel behaviours, such as trip chaining (McGuckin and Murakami, 1999), transport poverty (Iqbal et al., 2020), automated (and e-) vehicle use (Hohenberger et al., 2016) and sustainability attitudes (Hanson, 2010) could differ drastically for those that do not fall into gender-normative categories, yet little is known about those differences. Therefore, aforementioned topics can become the focus of future research on transmobilities, as they will build on the existing literature about gendered behaviours in transport yet bring in a new (non-binary) perspective. Researching the needs of marginalised people will make it possible to account for the unique challenges they face and to design policies in a way that will raise the overall transit experience for everyone. Moreover, with the constantly emerging new technologies in the transportation field, for example MaaS, it is possible to facilitate new practices and policies that would help alleviate the issues non-binary people experience on the transit. The advantages that MaaS can bring

non-binary and gender nonconforming travellers are similar to those of women, as they experience similar negative experiences on public transport (McIlroy, 2023). Enhanced safety can be achieved through up-to-date information about security, services and stations that is based on users' perception of safety or through safest route suggestions by the MaaS (McIlroy, 2023). Therefore, to accommodate and design for people of different backgrounds, their experiences must be taken into consideration without generalising the complexities of their lives. Qualitative analysis of lived experiences of the targeted underrepresented groups can be helpful in bringing in the overlooked perspective.

In order to create inclusive research practices in the transportation field, best practice recommendations can be adopted from other fields of research that have established practices concerning inclusive gender data collection: for example, HCI (human-computer interaction) and psychology (Cameron and Stinson, 2019; Jaroszewski et al., 2018). It can be argued that despite a common perception of the objectivity of research demographics data collection, gender questions are often “anything but inconsequential”, as they communicate researchers' current understanding of gender diversity and ethics involved (Cameron and Stinson, 2019, p. 2). Data collection and analysis is not neutral but rather expressive of the political stances of the researchers that construct data collection design and categorise the data itself (Jaroszewski et al., 2018). A common practice across different fields is “othering” non-binary participants, putting them in the same “other” gender box; yet, not only it assumes the similarity in behaviours of a diverse community, but it also separates them from the general demographic (Cameron and Stinson, 2019; Jaroszewski et al., 2018). Cameron & Stinson (2019, p. 6) argue that giving “other” as an only option outside of male/female dichotomy in research surveys implies that “genders beyond the binary are abnormal”. Therefore, researchers must consider how the differences in gendered travel behaviours can be acknowledged without becoming a dividing and alienating factor.

By focusing on addressing gender variation, rather than “dismissing it as noise” (Jaroszewski et al., 2018, p. 1), researchers can capture gender demographics better and account for the gendered differences. Some of the proposed methods for inclusive survey design are offering gender options beyond male/female dichotomy or allowing the choice of multiple genders rather than just one (Jaroszewski et al., 2018). Cameron and Stinson (2019) argue that the most inclusive way to collect gender data is by asking an open-ended question, and then if necessary, coding into categorical data for further statistical analysis in SPSS or R within existing guidelines. Additionally, a crucial step for creating reproducible research and fostering inclusive research practices is reporting in detail the way demographics data is collected and measured (Cameron and Stinson, 2019).

Multiple articles from the review mentioned the importance of the methodology and building rapport between researchers and participants (Lubitow et al., 2017, 2020; Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). One of the commonly proposed methods of collecting demographic details was asking participants to talk freely about their gender and not impose gender categories on them (Lubitow et al., 2017; Shakibaei and Vorobjovas-Pinta, 2022; Weintrob et al., 2021). Asking respondents to describe their gender identity in their own terms resulted in a much more diverse and fluid gender presentation of identity (Lubitow et al., 2017). Another proposal to building rapport included not having a rigid structure to the interview so that respondents feel more comfortable with the interviewer (Lubitow et al., 2020; Shakibaei and Vorobjovas-Pinta, 2022). Queer and feminist methodological approaches were also deemed to be appropriate and helpful; disclosing personal information about researchers themselves being part of the LGBTQ+ community was seen as beneficial for building rapport (Weintrob et al., 2021).

5. Conclusion

This study presents the first systematic literature review on the

mobility of non-binary and gender nonconforming people, providing insight into the gendered travel behaviours that extend beyond binary gender norms. Despite significant limitations, there are tangible findings on the mobility of non-binary people, that call for demographic-specific transport policies and research that directly addresses the gender-diverse public. The growing number of people who identify as non-binary or gender nonconforming and their interactions with different public spaces shows the need for established methodological practices to address and analyse the specific barriers these people face. Using inclusive language in data collection and research, implementing targeted traffic safety policies and designing transit stations in a safer and more accessible way are the first steps towards a more inclusive and sustainable mobility paradigm. The literature review not only outlines the existing research on gender nonconforming people within the transport field and pinpoints the research gaps but will also hopefully serve as call for more inclusive research practices in the field and implementation of policies.

CRedit authorship contribution statement

Oxana Ivanova: Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Steve O'Hern:** Supervision, Methodology, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors report there are no competing interests to declare.

Data availability

The data is from a literature review. The search string is included in the manuscript.

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