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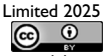
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Social representation, self-identity and anticipated guilt in universal access: A constructivist approach to (non-)visible disabilities

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Abstract

Conventional transportation research often focuses on physical barriers, sidelining the social and psychological challenges faced by individuals with (non-)visible disabilities. This narrow focus neglects the broader societal impact on those with non-visible disabilities or varying degrees of mobility restrictions. This study, rooted in the social constructivist perspective, investigates how the social perception of universal access, self-identity regarding disabilities, physical impairment and feelings of guilt influence walking route preferences in Hong Kong, a transit-centric city. Using a mixed-methods approach, including a stated-reference experiment with 305 participants, structural equation modelling–hybrid discrete choice model and semi-structured interviews with 13 participants, we reveal that walking route choices are influenced by anticipated guilt, familiarity, travel habits, and physical impairment. Perceptions of mobility-aid facilities as convenient yet exclusive for individuals with disabilities significantly impact route selection, particularly among females, due to cultural norms. Guilt intensifies when they are perceived as inadequate, discouraging use, while physical impairment informs self-identity as disabled without fully aligning with the medical model of disability. Interview insights highlight a trade-off between physical needs and social discomfort, supporting a discrete choice model of decision-making. These findings highlight the interplay of social representation, guilt and identity, calling on policymakers and urban designers to adopt a more empathetic, inclusive approach to urban accessibility.

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mixed-methods, non-visible disabilities, route choice, social construct, universal design

摘要

传统的交通研究通常重点关注物理障碍，而忽视了残疾（包括隐性和显性残疾）人士所面临的社会和心理挑战。对患有隐性残疾或存在不同程度行动不便者来说，这种狭隘的关注忽视了更广泛的社会影响。本文以社会建构主义视角为基础，探讨在香港这个以公共交通为核心的城市中，通用无障碍环境的社会认知、残障相关自我认同、身体障碍程度以及愧疚感如何影响步行路线偏好。我们采用混合方法，包括对 305 名参与者进行陈述性参照实验、结构方程模型 – 混合离散选择模型，以及对 13 名参与者进行半结构化访谈，揭示步行路线选择受预期愧疚感、熟悉度、出行习惯和身体障碍影响的情况。由于文化规范的原因，人们认为行动辅助设施虽然方便但只供残疾人使用，这极大地影响了路线选择，尤其是女性的路线选择。当身体障碍使人自我认同为残疾人，但本人又并不完全契合医学上的残疾模型，从而被认为不够格使用这些设施时，愧疚感会加剧，进而阻碍其使用。访谈见解凸显了身体需求与社会不适之间的权衡，这印证了离散选择决策模型。这些发现强调了社会表征、愧疚感和身份认同之间的相互作用，呼吁政策制定者和城市设计师采取更具同理心、更具包容性的城市无障碍建设方法。

关键词

混合方法、隐性残疾、路线选择、社会建构、通用设计

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Introduction

The discourse in transportation literature often highlights physical barriers to mobility faced by individuals with (non-)visible disabilities (Shen et al., 2023) but tends to overlook the socially constructed aspects of disability (Goodley, 2014; Shakespeare, 2006). This narrow focus leads to universal design and accessibility measures being perceived as exclusive to those with visible physical disabilities (Andrade et al., 2024), neglecting the needs of people with non-visible disabilities who also face mobility challenges, such as walking difficulties or stair use. Moreover, disabled bodies are often seen as a source of anxiety in contemporary society, with concerns about mobility extending beyond transportation alone (Middleton and Byles, 2019; Shildrick, 2007). By neglecting the social aspect of disability, current approaches fail to account for the full spectrum of individuals who experience mobility limitations, reinforcing social inequities that exacerbate health conditions (Frank et al., 2022). Creating more inclusive environments necessitates a shift towards a social constructivist perspective in transportation planning and design. This approach recognises disability as a multifaceted phenomenon shaped by both physical and social factors. Addressing these gaps is crucial for promoting equity and accessibility in urban transportation systems. A growing body of research emphasises the importance of considering the social dimensions of disability to enhance inclusivity.

Disability is perceived differently across cultures, as highlighted by various models (Henschke et al., 2016; Retief and Letšosa, 2018; Stevelink and van Brakel, 2013). The medical model views disability as a bodily defect requiring medical intervention, but it

overlooks how environmental factors impact functional abilities (Petasis, 2019). In contrast, the social model defines disability as a socially constructed phenomenon, emerging from interactions between individuals with disabilities and physical, attitudinal, and social barriers (Oliver, 1983). The biopsychosocial model integrates elements from both the medical and social models, recognising that disability is dynamic and influenced by factors such as age, injury and culture. This perspective, endorsed by the United Nations and the World Health Organization (WHO, 2023), emphasises the need for societal support to ensure the full participation of individuals with disabilities in social life (Creamer, 2008).

In the transportation literature, Sen's (2003) Capabilities Approach (CA) is widely used to address transportation disadvantages and social exclusion, including those experienced by individuals with disabilities (Beyazit, 2011; Hananel and Berechman, 2016; Shen et al., 2023). The CA aligns with the social model of disability, viewing it as a social construct influenced by resource limitations (Burchardt, 2004; Thurman et al., 2019). This approach considers personal, sociopolitical, and environmental factors that affect an individual's capacity for mobility, recognising that disability is shaped by societal barriers rather than being purely a personal impairment. It emphasises the importance of social justice for individuals with disabilities and highlights the interplay between individual characteristics and societal constraints (Thurman et al., 2019; Trani et al., 2011). While the CA has proven valuable for understanding disability at both functional and capability levels, studies using this approach tend to focus on recognised disabilities, often through qualitative methodologies, with limited recent quantitative research (Bhogal-Nair et al., 2024; Mitra, 2006). As a result, the experiences of individuals with non-visible disabilities remain underexplored, particularly regarding their use of accessible facilities, which is shaped by societal perceptions of disability.

Additionally, within the domain of disability studies in transportation literature, the focus has primarily centred on 'recognised' disabilities, such as visual, hearing, and walking impairments, identified through self-reporting techniques in both quantitative studies (Uddin et al., 2023; Zhang et al., 2024) and qualitative inquiries (Cochran, 2020). This narrow focus on mobility disability neglects the diversity of human conditions, needs and lived experiences (Levine and Karner, 2023). Limited quantitative investigations exist that address a broader spectrum of the population's perceptions of disabilities, encompassing aspects related to self-identity and how individuals perceive facilities designed for disabilities, ultimately influencing travel behaviours. Notably, there is a persistent gap in acknowledging individuals with non-visible disabilities who may encounter challenges during travel. Their utilisation of barrier-free facilities is constrained by societal structural forces stemming from prevailing social perceptions of disability.

This study adopts a social constructivist approach to address the social barriers faced by individuals with disabilities, including those with non-visible disabilities who may not be traditionally recognised as disabled. We focus specifically on how self-identity, physical impairments, and feelings of guilt influence decisions related to walking route selection, particularly routes that pass by mobility-aid facilities designed for specific social groups (as illustrated in the case of cyclist lift by Suboticki and Sørensen, 2021), in our case individuals with (non-)visible disabilities. By exploring these factors, we aim to shed light on the complex interactions between disability, social perceptions, and transportation choices.

Literature review

Social representations are systems of knowledge or forms of common sense that individuals use to navigate and interact with the world around them (Sammut et al., 2015). These mental constructs help people interpret their surroundings and guide meaningful actions. Rooted in social psychology, social representations theory – classified as a mild form of socio-constructivism (Sarrica et al., 2019) – posits that humans develop shared perspectives to understand the complexities of their environment and communicate effectively (Moscovici, 1981). Emerging from everyday interactions, these shared perspectives include concepts, statements and explanations that function as contemporary equivalents of myths or belief systems in traditional societies. Social representations are inherently collective, shaping both individual behaviours and group dynamics (Moscovici and Hewstone, 1983; Wagner, 2020).

In transportation studies, social representations theory has provided valuable insights into how shared perceptions influence mobility practices. Early research by Dickinson and Robbins (2007, 2008) demonstrated how social representations shape justifications for transportation choices. For instance, cars are commonly perceived as essential for leisure and tourism, while buses and bicycles are viewed as inadequate, often due to a lack of experience with these alternatives. However, regular users of buses or bicycles tend to develop more favourable attitudes towards these modes, highlighting the potential for firsthand experience to shift entrenched perceptions and reduce car dependency (Dickinson et al., 2009). The integration of social representation and practice theories has further enriched our understanding of mobility habits. Shove et al. (2012) explored how cycling practices persist despite the dominance of private car use, emphasising the cultural significance of cycling. Similarly, Piatkowski and Marshall (2015) identified distinct barriers and motivations among casual and regular cyclists, reflecting differences shaped by personal experience. Sarrica et al. (2019) advanced this work by examining the symbolic, emotional and sensory dimensions of cycling, showing how functional, environmental and emotional factors influence transportation mode representations and behaviours.

Social representations also play a critical role in shaping perceptions and practices related to disability and mobility. Transportation planning often oversimplifies the complexities of disability, missing opportunities to examine its intersections with non-disability (Levine and Karner, 2023). Studies like Brewer et al. (2019) challenge assumptions about service providers' willingness to accommodate disabled passengers, while Wilkin (2020) reveals the hostility towards disabled individuals frequently endured on public transport, including verbal abuse and physical assaults. The social barriers created by social representations are not only limited to people with disabilities but also affect persons without disabilities and those with non-visible disabilities. These non-visible disabilities refer to a range of mental and physical conditions that, like visible impairments, vary in their origins, degree of severity, and whether they are episodic or permanent (Thomas, 2014). Research frequently frames disability as a 'problem', inadvertently reinforcing marginalisation, rather than acknowledging it as a social construct shaped by societal attitudes and structures (Jones, 1996; Rapley, 2004). This framing undermines the inclusivity of policies and planning, despite evidence that built and social environments significantly affect the travel behaviour of disabled individuals (Shen et al., 2023). For instance, while universal design aims to benefit all passengers, it disproportionately targets individuals with visible disabilities, raising

questions about its true inclusivity (Aarhaug and Elvebakk, 2015). Non-visible disabilities, such as post-stroke conditions (Stone, 2005) or chronic pain (Roland and Fairbank, 2020), add another layer of complexity. These impairments, which vary in severity and permanence, are often met with microaggressions and scepticism about the need for accommodations, such as accessible parking or priority seating (Olkin et al., 2019). Social representations of disability influence not only how society perceives individuals with disabilities but also how these individuals view themselves. Holt (2008) described how young disabled individuals internalise societal expectations of dependence, perpetuating inequalities in situations that prioritise self-reliance. This underscores the dual role of social representations as both barriers and opportunities for redefining norms and fostering inclusivity (Schwanen et al., 2015).

Emotions add further complexity to transportation decision-making (Chan et al., 2024; Montello et al., 2023; Pullano et al., 2024). In particular, anticipated guilt has been widely studied in the context of pro-environmental behaviours, serving as a powerful motivator for adhering to societal norms and expectations (Fischer et al., 2012). Bamberg et al. (2007) demonstrated a positive association between guilt and the moral inclination to use public transportation, while Schneider et al. (2017) and Hurst and Sintov (2022) emphasised the role of guilt in encouraging eco-friendly behaviours. Although pride often emerges as a stronger motivator for sustainable actions (Shipley and van Riper, 2022), guilt remains a significant influence, compelling individuals to conform to social expectations to avoid feelings of wrongdoing (Lindsey et al., 2007). Cultural differences further shape the relationship between guilt and behaviour. Fischer et al. (2012) found that in Scottish and Dutch samples, guilt was strongly tied to personal actions, whereas participants from other countries linked normative beliefs more to others' actions. Lindenmeier et al. (2017) identified anticipated guilt as a major driver of fair-trade purchasing behaviour among American consumers. Such variations underscore the importance of examining social representations to better understand cultural differences in norms and behaviours. Building on these insights, this study hypothesises that guilt mediates the influence of social representations on route choice behaviours. Social classifications and care practices, internalised as common sense, shape individuals' self-perceptions and their interpretations of others' actions. By examining these dynamics, this research aims to illuminate how emotions and representations collectively influence mobility practices, with implications for fostering more inclusive and equitable transportation systems.

Methodology

This study adopts a quantitative-driven mixed-methods phenomenological research (MMPR) approach (Mayoh and Onwuegbuzie, 2015). From a pragmatic standpoint, this choice is referred to as explanatory sequential mixed methods. In such an approach, precedence is often accorded to the quantitative data, a practice justified by its capacity to furnish the research with a deductive theoretical foundation (Tashakkori and Teddlie, 2010). The primary quantitative component of our study involves a questionnaire survey coupled with structural equation modelling (SEM)–hybrid discrete choice modelling to scrutinise individuals' behaviours in utilising universal access to metro stations. In this framework, socio-psychological variables are introduced. Consequently, a secondary qualitative stage helps to explore any unanticipated quantitative findings. This model proves particularly advantageous when the study prioritises a paradigm necessitating an overall more

deductive approach. In essence, a quantitatively driven MMPR approach holds significant promise, especially when unanticipated quantitative findings emerge, prompting the need for further exploration to broaden our understanding.

Questionnaire design

Our questionnaire survey comprised three distinct sections: stated preference (SP) route choice, socio-psychological evaluation and socio-demographic information. The survey was administered online for convenience and accessibility.

The assessment of social representation encompasses a wide range of methodologies, both qualitative and quantitative. Qualitative approaches include ethnography, focus groups, interviews and content analysis of media, which allow for an in-depth exploration of participants' experiences and interpretations (Wagner et al., 1999). Quantitative methods, such as statistical analysis of word associations and characterisation questionnaires inspired by Q-sort methodologies (Lo Monaco et al., 2012), provide structured frameworks for analysing cognitive and semantic fields related to social objects. Mixed approaches, such as those involving word association prompts (Tsoukalas, 2006) or visual techniques like drawings (Martikainen and Hakokõngäs, 2023), offer additional insight by combining exploratory and structured data collection. In this study, we adopted a qualitative approach, following the methodology outlined by Sarrica et al. (2019). Specifically, we included an open-ended question in our survey to explore respondents' perspectives on universal access to metro stations. While self-reported methods primarily reflect individuals' subjective perceptions, they serve as a valuable tool for understanding how participants internalise and interpret societal norms and values. Open-ended responses, analysed thematically, enable us to capture the nuances of self-perceived social value in relation to universal access. Although limitations of self-reported data are acknowledged, these methods provide a meaningful proxy for examining social constructs that influence mobility behaviours and decision-making. By situating our approach within the broader methodological landscape of social representation research, we aim to offer both theoretical and practical contributions to the understanding of social dynamics in transportation contexts.

In assessing disability, we adopted a comprehensive approach by soliciting both objective and subjective evaluations. Objective assessment criteria were derived from questions pertaining to medical conditions sourced from the Hong Kong Census Statistic Department and the Walking Impairment Questionnaire (WIQ; Jain et al., 2012). Subjective self-identity related to non-visible disability was determined following the framework outlined by Lois et al. (2015). Respondents were provided with a validation statement, including examples, to ensure a clear understanding of the concept of non-visible disability. Importantly, we recognised that individuals without formally recognised disabilities, as indicated by their responses to health-related binary variables, might still perceive themselves as having non-visible disabilities. Such self-perceptions were captured through a 1–5 scale assessing the extent of their non-visible disability, reflecting how these perceptions could affect their sense of entitlement to accessibility accommodations. By including both groups – those with recognised disabilities and those without – we aimed to capture the nuanced interplay between formal diagnoses and self-identity. To gauge anticipated guilt within the transportation context, we adapted statements from Bamberg et al. (2007) to suit our study's focus. All statements and scales utilised in the survey are detailed in Appendix 1 for reference.

The SP choice sets presented in this study are grounded in a hypothetical scenario of walking travel within real-life built environments (cf. Chan et al., 2025). In this setting, pedestrians are presented with two choices: one featuring a universal access lift-only entrance (see examples from Chan et al., 2022) and the other an entrance equipped with escalator/staircase access. Pedestrians make their decisions based on the information provided. Careful consideration was given to ensure that the important attributes and relevant levels incorporated in the choice sets accurately reflect their influence on pedestrian preferences. Appendix 1 provides a comprehensive overview of the attributes and levels considered in our experiment. Prior to the main survey, a pilot study was conducted to identify key attributes essential for the choice experiment. Twenty participants were recruited via university campus publicity efforts. Each questionnaire in the pilot study presented participants with four SP scenarios. However, due to the complexity of choice set generation and the need for efficient parameter estimation, not all potential attributes could be included in the main survey. Consequently, the main survey focused on six key attributes: cover, distance, crowdedness, daytime, rain, and temperature conditions. To enhance participants' understanding of the scenarios presented, weather conditions adhered to the warning signs and conditions issued by the Hong Kong Observatory. Additionally, the crowdedness of crossing facilities was visualised within the questionnaire script, drawing from actual urban scenes in Hong Kong. Given the multiple factors involved for four origin–destination pairs across four stations, employing a full factorial design would have resulted in a large number of combinations ($2 \times 2 \times 2 \times 3 \times 3 \times 3 = 216$ in total). However, for practicality and efficiency in measuring pedestrian perception, we adopted an orthogonal fractional factorial design using the software package Minitab (Rose et al., 2008). This approach reduced the number of choice scenarios to 16, without compromising the validity of our results. Furthermore, to mitigate potential biases, the choice scenarios were organised into four sets of four choice tasks using a randomised block design approach. Four sites, Yuen Long, Long Ping, Yau Ma Tei and Causeway Bay Stations, were selected to match the attributes as real-life choice sets. Respondents were able to select their familiar setting to ensure effective communication of choices. Consequently, the online survey platform randomly allocated one of the four blocks of four SP scenarios to each respondent.

SEM–hybrid discrete choice modelling

The formulation of the model presented in Figure 1 involves two key stages: (1) the construction of a latent variable structural equation model (SEM) alongside a latent variable measurement equation model; and (2) the development of the discrete choice model (DCM). The integration of SEM with discrete choice modelling, referred to as SEM–hybrid discrete choice modelling, has gained significant traction within the transportation literature (e.g. Gupta et al., 2022). This approach employs a sequential methodology, wherein socio-psychological factors are initially assessed through observed indicators using SEM, followed by the incorporation of estimated latent variables into a discrete choice model. The SEM model comprises two primary components: (a) the structural part, which establishes connections between latent variables through systems of simultaneous equations; and (b) the measurement part, which links latent variables to observed variables via confirmatory factor modelling. For DCM, individuals select a mode based on maximising their utility according to random utility theory. In the present study, a

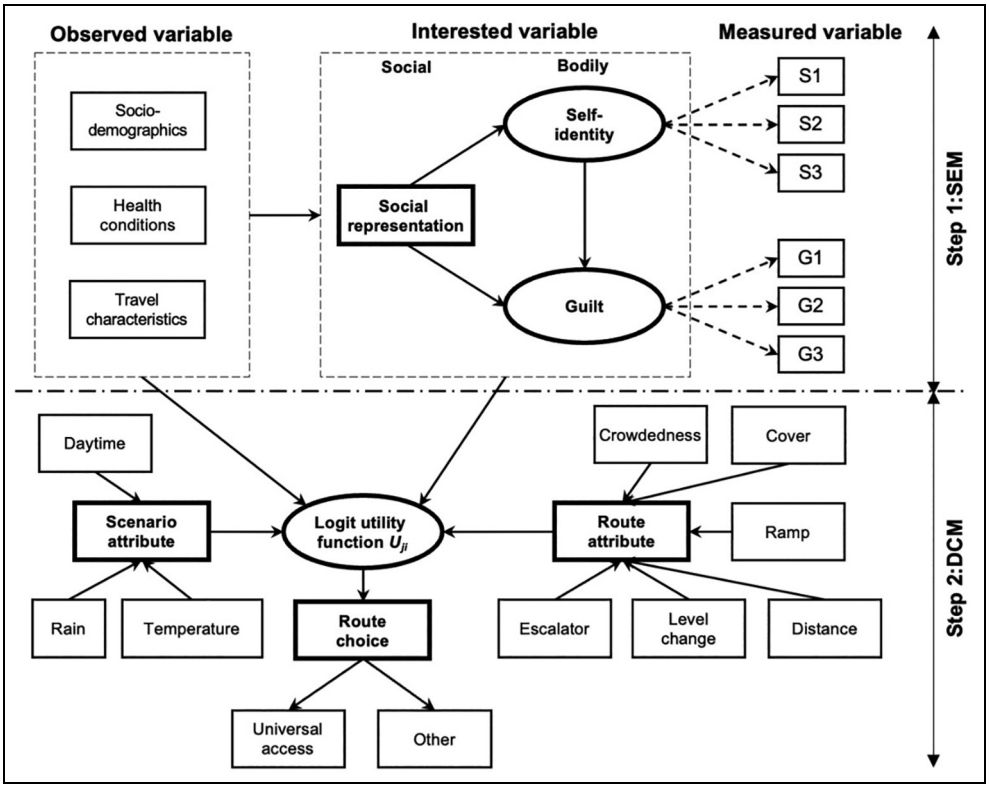

Figure 1. Conceptual model.

hybrid DCM, as proposed by Yáñez et al. (2010) is employed.

Semi-structural interview

The data collection method utilised in this study involved a purposeful approach through semi-structured interviews conducted in person on a walking basis. The study used a convenience sample, recruiting older adults aged >40 with non-visible disabilities who were readily available and willing to participate. The interviews, which lasted between 10 and 15 minutes, were conducted from August to September 2024, focusing on participants' route choices along the walk-along, with a specific emphasis on universal access. During data collection, participant preferences were respected, with options for either audio recording or note-taking. Verbatim transcription and translation from Cantonese to English were carried out by the second author. To ensure participant confidentiality, all responses were anonymised with pseudonyms. Only gender, age groups, and self-identified levels of non-visible disabilities (SI-NVD) were shown. All potential personal identifiers were removed from the responses.

Findings

Descriptive statistics and model fit

The analysis of the data reveals a total of 305 respondents, distributed across three age

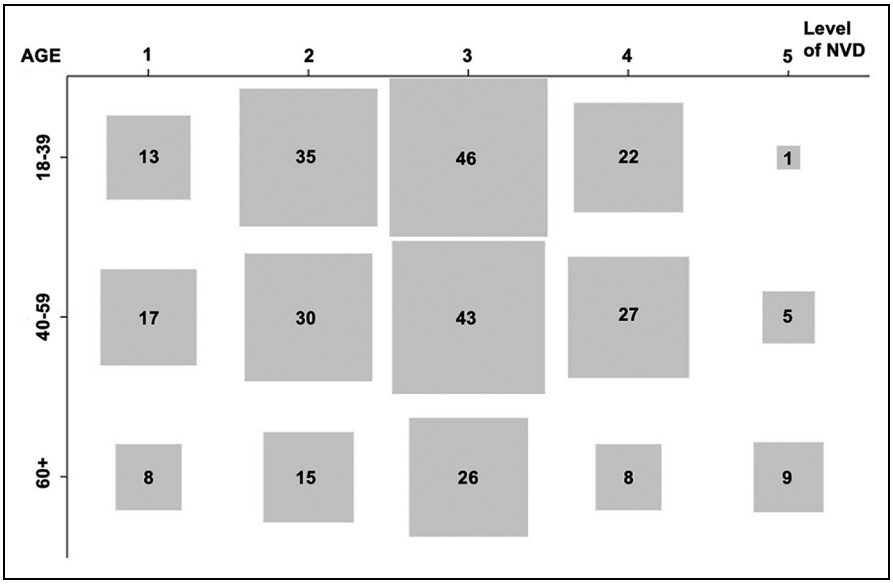

Figure 2. Distribution of survey respondents across age categories and self-reported levels of non-visible disability.

groups: 18–39, 40–59 and 60 + . Across all age groups (Figure 2), the most frequently reported SI-NVD is Level 3, while Level 5, representing the highest level of NVD, is the least reported. Within the 18–39 group, Levels 2 and 3 are dominant, and the 40–59 age group shows a similar pattern. For the 60 + group, Level 3 remains the most common, but higher levels show a notable increase compared to younger groups. These trends indicate a possible relationship between age and the severity of SI-NVD, with higher levels being more prevalent in older respondents.

The measurement models indicate acceptable reliability, with Cronbach's alpha values of 0.923 for self-identity towards disability, 0.636 for anticipated guilt and 0.691 for impairment, all suggesting satisfactory reliability. Therefore, we incorporate these constructs into both the SEM and DCM. Initially, the structural relationship between parameters was estimated using the entire sample (the base model), and subsequently, a subgroup analysis was conducted on those who perceive universal access with social meanings. Model fit indices (i.e. CFI > 0.9, TLI > 0.9 and SRMR < 0.08) suggest satisfactory reliability. The model results can be found in Appendices 3 and 4.

Structural path estimates and discussions with qualitative findings

Social representation. Individuals with greater mobility capabilities (e.g. lower walking impairment) and functionings (e.g. using public transportation efficiently and utilising digital trip planning) often perceive universal access as limited and exclusive, but with negligible effects ($\beta < 0.1$, $p < 0.01$). This is except for health conditions that negatively contribute to the perception of universal access as limited ($\beta = 0.189$, $p < 0.01$), exclusive ($\beta = 0.268$, $p < 0.01$), and inaccessible ($\beta = 0.123$, $p < 0.01$).

This perception significantly influences their decision to utilise universal design features (Appendix 4). Those who view universal access as limited are less likely to use it. Conversely, individuals who see it as a means of improving mobility and accessing convenient facilities are more inclined to embrace it. Anticipated guilt serves as a mediator between individuals' choices and their perception of universal access.

The social representation of lifts among the interviewees ($N = 13$) centres on two key themes (Appendix 2): exclusivity and convenience, which reflect different perspectives based on self-identity as disabled or non-disabled and societal expectations for lift usage. For many, exclusivity is tied to the belief that lifts should primarily serve the 'elderly, (visibly) weak, and disabled' (male, age 40–49, SI-NVD = 1) and 'especially for us elderly people' (female, age 60–69, SI-NVD = 4). This view is shaped by societal norms that designate lifts for those with obvious physical limitations. Even though respondents may or may not (self-)identify as disabled, they acknowledge the social expectation that lifts should be reserved for these groups. This belief is prevalent across all ages of the sample ($N = 11$), indicating a shared social perception for older adults. Conversely, the theme of convenience represents a practical view, where lifts are seen as useful for everyone, particularly when carrying heavy items or feeling tired. Individuals with/out non-visible disabilities ($N = 6$) acknowledge the convenience of lifts for 'mainly convenience and reducing the need to walk so much' (female, age 50–59, SI-NVD = 3) but face mental barriers due to societal expectations, often avoiding them unless a strong physical need justifies their use. These perspectives intersect depending on self-identity. Non-disabled individuals or those with non-visible disabilities struggle between the lift's convenience and the social judgement they anticipate (see details in the next section), whereas those who self-identify as disabled see lifts as essential, with convenience inseparable from their necessity.

Self-identity and anticipated guilt. Pedestrians with physical impairments tend to prefer routes equipped with 'designated' facilities such as lifts ($B = 0.976$, $p < 0.01$), with physical impairment itself remaining a significant factor influencing self-identity as having a disability ($\beta = 0.149$, $p < 0.01$). This underscores the direct impact of physical impairment on individuals' low-mobility lifestyles, highlighting their genuine need for mobility aid facilities. Consequently, they prioritise accessibility and often choose routes designated for them, regardless of feelings of guilt associated with using such facilities.

However, pedestrians also experience feelings of guilt when opting for routes with lifts ($B = -0.365$, $p < 0.01$), as indicated by an absolute value of coefficient higher than that for walking impairment ($B = 0.250$, $p < 0.1$) and self-identity ($B = 0.153$, $p < 0.1$). This suggests that individuals, regardless of their walking capabilities, may grapple with guilt when utilising resources perceived to be primarily designed for those with disabilities. This finding contradicts the hypothesis that individuals with low mobility capabilities tend to utilise facilities designated for them (e.g. lifts, ramps) over those designed for every individual (e.g. stairs, escalators), irrespective of their actual need for assistance during travel. Research by Cochran (2020) supports this phenomenon, revealing that changes in travel behaviour can occur among individuals with disabilities due to perceived social isolation and stress, which affect self-efficacy. Personal guilt may influence their route choices, leading them to avoid lifts and opt for alternative paths. Additionally, studies on disability discrimination by Hackett et al. (2020) found that approximately 10% of sampled individuals

reported encountering perceived disability discrimination, resulting in increased stress and guilt. Social norms regarding universal design for accessibility may contribute to these perceptions, with individuals fearing being labelled as disabled when using designated facilities, alongside potential social discrimination against disabled individuals. The implementation of universal design, which recognises disability as a dimension of human plurality (Lid, 2014), can inadvertently exacerbate social psychological barriers between individuals with low mobility and those without disabilities. This exclusion experienced by individuals with disabilities can foster negative societal perceptions and impede their ability to lead normal lifestyles (LeSure-Lester, 2000), thereby perpetuating inequity for individuals with low mobility.

The interviews reveal how individuals with non-visible disabilities balance physical needs against the mental cost of anticipated guilt when deciding whether to use facilities like lifts or priority seats. Their decisions are shaped by factors such as social judgement, the presence of others and their specific needs at the time. Around 70% reported feeling guilt or pressure, especially when their disability is not visible or when others appear more deserving (Appendix 2). For instance, one interviewee stated, 'If I see disabled people or pregnant women queueing for the lift, I won't use it' (female, age 40–49, SI-NVD = 3). However, this guilt decreases when fewer people are around, making it easier to justify using the lift. The decision to use mobility aids is highly context-dependent. Carrying heavy items, for example, reduces guilt and increases the likelihood of using the lift. The fear of social judgement also plays a key role, with many avoiding these aids due to their non-visible disability, although they may still use them when their need outweighs discomfort. Social pressure, particularly in crowded settings, further discourages usage, especially around 'older' or 'visibly disabled' individuals. Overall, interviewees weigh physical needs against the mental cost of social discomfort, showing a trade-off that supports a discrete choice model for understanding their decision-making.

Together with self-identity as disability, these findings underscore the combined physical and psychological factors influencing route choice with or without universal access. Individuals who strongly identify with their disability may feel a sense of attachment and entitlement to universal access, including lifts. Conversely, those who perceive their disability as less central to their identity may feel less inclined to utilise such facilities, especially if they possess the physical capability to navigate stairs or ramps comfortably.

Gender disparities in anticipated guilt. Gender differences are evident, with females showing a slightly higher tendency to experience guilt when utilising universally designed facilities ($\beta = -0.312$, $p < 0.01$). This intriguing result highlights a divergence in guilt perception between genders. Existing research on gender and emotion supports this finding, with studies indicating that women are more prone to experiencing guilt than men in travel contexts (Hanks and Mattila, 2014). Additionally, research on gender differences in risk aversion suggests that females tend to exhibit more risk-averse behaviour than males (Halek and Eisenhauer, 2001). This suggests a gender differentiation effect on anticipated guilt, with females having a lower threshold for experiencing guilt and potentially being more inclined to choose routes with lower perceived difficulty compared to those of higher perceived difficulty.

The perception of guilt is also influenced by self-identity as having a disability ($\beta = -0.111$, $p < 0.01$) but is not statistically significantly impacted by physical impairment. These findings suggest that an individual's experience of guilt is not primarily shaped by

their own physical disability or low-mobility status. Despite facing challenges in utilising facilities, individuals do not necessarily experience increased feelings of guilt. One potential explanation is that societal norms and perceptions surrounding pedestrians have a stronger influence on guilt. Social stereotypes about disability can contribute to feelings of guilt, irrespective of whether individuals have impairments or disabilities. Consequently, the results suggest the presence of cultural norms and discrimination between low-mobility individuals and individuals without disabilities, leading low-mobility individuals to prefer using universal access facilities to mitigate perceptions of guilt.

In the interview sample (Appendix 2), women tend to use lifts more frequently (7 out of 7) compared to men (3 out of 6). One of the reasons could be due to practical reasons, such as carrying groceries, pushing a shopping cart or using a stroller during caregiving trips. These activities create a greater physical burden, making the lift a more convenient option. Several women specifically mentioned needing to use lifts when shopping or handling heavy items, which aligns with the utility argument in previous sections, where using the lift is seen as more practical to reduce physical strain and mental pressure. However, this is not the only explanation. Other factors, such as societal norms and perceived safety concerns, may also contribute to women's greater reliance on lifts. Women might perceive lifts as safer than crowded or isolated staircases and escalators, especially in urban environments. Additionally, cultural expectations that disproportionately assign caregiving and household responsibilities to women may shape their mobility choices, reinforcing the need for more accessible options. Interviews provide richer contextual information than questionnaires, allowing participants to share personal, scenario-based experiences. Women, for example, highlighted tasks like grocery shopping and caregiving, which made using the lift more necessary for them, hence justifying their choice to use lifts despite the general societal expectations. This kind of contextual detail helps explain decision-making processes more deeply than the broader patterns seen in questionnaires, where participants may not elaborate on individual circumstances. As a result, the interview responses offer insights into the specific factors influencing lift usage and anticipated guilt, particularly for women, in a more interactive and detailed way.

Conclusion

This study adopts a social constructivist perspective, examining how social perceptions of universal access, self-identity regarding disabilities, physical impairment and feelings of guilt influence walking route preferences. Set against the backdrop of Hong Kong, a transit-centric city, our research utilises a mixed-methods approach, encompassing a stated-reference experiment, SEM-DCM model and semi-structured interviews. Through these methodologies, we uncover how the social representation of universal access shapes the intentions and behaviours of individuals, both with and without walking impairments, in utilising universal access facilities. Notably, we find that anticipated guilt exerts a stronger influence compared to walking impairments and self-identity as (non-)visible disability. Furthermore, our semi-structured interviews shed light on the non-visible social forces that impact people's route choices, particularly in a transit-oriented development setting characterised by universal design features.

The implications of our study extend to both disability scholars and policy practitioners. Despite recent advancements in policy documents acknowledging non-visible disabilities (e.g. Disabled Persons Transport Advisory Committee [DPTAC], 2020), our

study underscores the importance of defining non-visible disabilities clearly to align with global policy conceptualisations. However, we caution against adopting overly strict definitions that may inadvertently foster reverse discrimination and social exclusion for individuals with non-visible disabilities who are in need of support. By uncovering the intricate interplay between social perceptions, self-identity and accessibility in shaping route preferences, our research offers valuable insights for policymakers and stakeholders striving to create inclusive environments that cater to the diverse needs of all individuals, regardless of their visible or non-visible disabilities.

To translate these insights into actionable guidance, planners can incorporate surveys or community engagement initiatives that assess self-perceived disability identity alongside mobility needs. Using validated scales, such as those adapted from Lois et al. (2015), planners can estimate the percentage of individuals who strongly identify with their disability versus those who do not, ensuring resource allocation reflects the actual demand for universal access facilities like lifts. Observational studies at transit points can further complement self-reported data, providing a holistic understanding of behavioural patterns under varying conditions. These insights can inform strategies such as optimising the location and signage of accessibility facilities, implementing educational campaigns to reduce stigma and promoting inclusivity. Additionally, planners should collaborate with disability advocacy groups to co-design accessibility standards that account for diverse levels of disability identity, fostering urban environments that are both equitable and accessible. Beyond its policy applications, our findings contribute to advancing understanding within the broader field of disability studies, shedding light on the nuanced dynamics at play in navigating urban environments and emphasising the need for inclusive practices that reflect the multifaceted experiences of individuals with disabilities.

This study has several limitations that should be acknowledged. First, the use of self-reported data, while valuable for capturing subjective perceptions and social constructs, may introduce biases such as social desirability or misinterpretation of survey questions. Additionally, the reliance on an online questionnaire, while convenient and accessible, may have excluded individuals without internet access or those less familiar with digital platforms, potentially limiting the diversity of the sample. The study's focus on hypothetical stated preference (SP) scenarios, while effective for isolating key attributes, may not fully reflect actual behaviours or decisions in real-world settings. Furthermore, the analysis of social representation often relies on open-ended responses, which provide valuable insights but may lack the depth and detail found in methods such as interviews or ethnographic studies. Finally, the geographical context of Hong Kong, with its unique urban density and transportation infrastructure, may limit the generalisability of findings to other regions with differing social, cultural, or infrastructural characteristics. These limitations highlight the need for further research using more diverse methodologies and broader geographical contexts to build upon the findings presented in this study.

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Appendix 1. Details of variables measured.

Variable	References	Statement/question	Code	Mean (SD)
Route choice	Questionnaire	According to your habit, when you walk from [location] to [location], which path do you usually choose?	Universal = 1; Steps = 0	0.54 (0.49)
Scenario attribute				
Rain		Raining condition	Yes = 1; No = 0	N/A
Temperature		Temperature condition	Issue of cold warning sign = 1; Normal = 2; Issue of hot warning sign = 3	
Daytime		Time of day	Daytime = 1; nighttime = 2	N/A
Route attribute				
Distance		Walking distance	Short = 1; Moderate = 2; Long = 3	N/A
Crowdedness		Pedestrian level of service, simplified version adapted from Lam and Cheung (1998)	Not crowded = 1; Crowded = 2, Very crowded = 3	N/A
Cover		Existence of cover	Yes = 1; No = 0	N/A
Level change		Level change to cross traffic roads	Yes = 1; No = 0	N/A
Escalator		Does the route pass through any of the escalators?	Yes = 1; No = 0	N/A
Staircase		Does the route pass through any of the staircases?	Yes = 1; No = 0	N/A
Social representation	Sarrica et al. (2019)	Consider your experience walking to and using the Mass Transit Railway (MTR). Describe your thoughts on universal design, such as a lift and ramp.	Open-end. Coding in Appendix 3.	

(continued)

Appendix 1. Continued

Variable	References	Statement/question	Code	Mean (SD)
Health condition	HK Census Statistic Department[a]	Do you have any forms of impairment? (Select all that applies) (1) restriction in body movement; (2) seeing difficulty; (3) hearing difficulty; (4) communication difficulty; (5) mental illness/mood disorder; (6) autism spectrum disorder.	Yes = 1; No = 0	0.07 (0.12)
Walking impairment	Jain et al. (2012)	(1) How often do you encounter pain, aching, or cramps in your calves when walking? (2) How often do you encounter pain, aching, or cramps in your thighs when walking? (3) How often do you encounter pain, stiffness, or aching in joints when walking? (4) How often do you feel anxious when you are in crowded areas? (5) How often do you want to seek help from others when you face obstacles? (6) How often do you use the following assistive products (e.g. canes, wheelchairs, crutches etc.)	Five-point Likert scale: 'Never' = 1, 'Rarely' = 2, 'Sometimes' = 3, 'Often' = 4, and 'Always' = 5	2.05 (0.86)

(continued)

Appendix 1. Continued

Variable	References	Statement/question	Code	Mean (SD)
Anticipated guilt	Bamberg et al. (2007)	G1: Seating on priority seats even when no vulnerable users (e.g. elderly, wheelchair users) are observed, I would feel guilty.	Five-point Likert scale: 'Strongly disagree' = 1, 'Somewhat disagree' = 2, 'Neutral' = 3, 'Somewhat agree' = 4, and 'Strongly agree' = 5	2.84 (1.04)
		G2: When there is a staircase/ escalator available, using lifts even when no vulnerable users (e.g. elderly, wheelchair users) are observed, I would feel guilty.		2.78 (0.99)
		G3: Walking on a ramp even when no vulnerable users (e.g. elderly, wheelchair users) are observed, I would feel guilty.		2.64 (1.04)
Self-identity	Lois et al. (2015)	S1: I think I have something in common with people who are person.	Five-point Likert scale: 'Strongly disagree' = 1, 'Somewhat disagree' = 2, 'Neutral' = 3, 'Somewhat agree' = 4, and 'Strongly agree' = 5	2.54 (1.04)
		S2: I identify myself as a disabled person.		2.53 (1.05)
		S3: I can envisage myself as a disabled person.		2.54 (1.09)
		Interview: (SI) On a scale of five, how do you perceive your identification with non-visible disabilities?	Five-point Likert scale: 'Strongly disagree' = 1, 'Minimal identification' = 2, 'Moderate identification' = 3, 'Significant identification' = 4, and 'Full identification' = 5	2.77 (0.92)
Social demographics				
Gender	Questionnaire	Male or female	Male = 1; Female = 0	0.47 (0.49)
	Interview		Male = 1; Female = 0	0.46 (0.52)
Age	Questionnaire	Age ranges	⩾40 years old = 1 ; 15–39 years old = 0	0.23 (0.41)

(continued)

Appendix 1. Continued

Variable	References	Statement/question	Code	Mean (SD)
	Interview		40–49 years old = 1 ; 50–59 years old = 2 ; ⩾60 years old = 3	1.85 (0.69)
Residence		Are the locations of your home near metro stations (about 10 minutes walking distance)?	Yes = 1; No = 0	0.16 (0.36)
Living with family		Are you living with family members in your household?	Yes = 1; No = 0	0.30 (0.46)
Travel characteristics				
Car ownership		Does your household own a car?	Yes = 1; No = 0	0.35 (0.47)
Frequent MTR rider		Have you possessed an MTR city saver pass for the past 3 months?	Yes = 1; No = 0	0.21 (0.41)
Frequent bus rider		Have you possessed a monthly bus pass for the past 3 months?	Yes = 1; No = 0	0.19 (0.37)
Walking		How often do you walk more than 30 minutes per day?	Seven-point: 3 times or above a day = 7, 1–2 times a day = 6, 4–6 times a week = 5, 1–3 times a week = 4, less than once a week = 3, less than once a month = 2, never = 1	3.76 (1.45)
App navigation		Do you typically use Google Maps or other route planning mobile applications to optimise your route?	Five-point Likert scale: 'Never' = 1, 'Rarely' = 2, 'Sometimes' = 3, 'Often' = 4, and 'Always' = 5	2.41 (0.96)

[a]Special Topics Report No. 63: Persons with disabilities and chronic diseases, https://www.censtatd.gov.hk/en/data/stat_report/product/B1130121/att/B11301632021XXXXB0100.pdf

Appendix 2. Excerpts from questionnaire and interview responses.

Category	Definition	Excerpts	Count
Questionnaire			*N* = 305
Social representation			
Exclusivity	Belief that mobility-aid facilities are reserved for vulnerable groups	'There are several steps to take before accessing certain escalators. This may pose inconvenience, particularly for the elderly […] Elevators are available, basically for their convenience'. 'Elevators should be conveniently located for wheelchair users' accessibility'.	24
Inadequacy	Belief that mobility-aid facilities are limited resources	'Some elevators only allow upward movement'. 'The operator should provide more accessible elevators as we rely on escalators or staircases'.	48
Inaccessibility	Belief that mobility-aid facilities are less accessible in terms of time and distance	'Elevators are often tucked away in inconspicuous spots'. 'The signages directing to the elevators are not always clear'.	39
Convenience	Belief that mobility-aid facilities are user-friendly and expedient	'It is convenient'. 'It connects all the floors of the shopping mall together'.	11
Interview			*N* = 13
Social representation			
Exclusivity	Belief that mobility-aid facilities are reserved for vulnerable groups	'The basic concept is that it should be reserved for the elderly and disabled people'. 'Mostly for the elderly, weak, and disabled'.	11
Inadequacy	Belief that mobility-aid facilities are limited resources	N/A	0
Inaccessibility	Belief that mobility-aid facilities are less accessible in terms of time and distance	'I think the location of the elevators is not particularly convenient for people to use'.	1
Convenience	Belief that mobility-aid facilities are user-friendly and expedient	'Elevators are for transportation, but they are not always necessary. Escalators can be used'. 'Most people think elevators are necessary because they are convenient'.	6
Utility			
Self-identity	How an individual views their need for mobility-aid facilities in relation to others.	'Because I don't think I need them more than others' 'Especially for us elderly, we don't consider these things too much'.	4

(continued)

Appendix 2. Continued

Category	Definition	Excerpts	Count
Crowdedness	Crowded spaces imply social pressure to influence decisions to use lifts.	'If there aren't many people around looking at me, I will use it'. 'If there are older people, or if it's too crowded, I may not dare to use it'.	5
Physical capabilities	Personal physical condition influences the decision to use a lift.	'Mainly because sometimes I get foot pain when going downstairs, and sometimes the handrails are too dirty, so I use the elevator'.	6
Distance	Distance to the elevator influences the decision to use it.	'If you take the elevator to the platform, you can avoid walking around stairs or escalators'. 'Sometimes if the elevator is not that close, I won't go out of my way to use it'.	4
Luggage	Carrying heavy items influences the decision to use lifts.	'Sometimes, if I'm carrying heavy things or have bought a lot of groceries, I'll go out of my way to use it'. 'Sometimes, when I'm pushing a cart, I'll use it'.	5
Social pressure and anticipated guilt	Belief that using elevators may evoke feelings of guilt or social judgment in individuals with non-visible disabilities	'People with non-visible disabilities may experience some psychological pressure. Even though they need to use it, they might hesitate. I used to wonder if I was old enough to use it'. 'If you have a non-visible disability, people may give you looks as if questioning why you are using the lift, thinking you might be doing it intentionally, especially when other choices are available'.	10
Travel accompanies	Belief that individuals use elevators to accompany others, even if they do not need to use them themselves	'I wouldn't specifically use it, but when I go shopping with my wife, I would usually accompany her'. 'Sometimes, when I'm with my family, and the elevator is right in front of me, I just use it'	2
Invisible violence	Fear of public confrontation or judgment for using mobility-aid facilities, sometimes captured on social media	'Nowadays, people like to film everything and post them to the social media, and there will be a lot of pressure'. 'Sometimes you feel like young people or those without grey hair get questioned for using these facilities. I always feel like I might be criticised'.	2

Appendix 3. Modelling results of SEM.

From	To										
	Model 1 (All population)						Model 2 (Sub-population)				
	Social representation				Identity	Guilty	Social representation			Identity	Guilty
	Exclusivity	Limited	Inaccessibility	Convenience			Exclusivity	Limited	Inaccessibility		
Social representation											
Exclusivity											0.142^{***}
Inadequacy					0.057^{**}						0.164^{***}
Inaccessibility						-0.072^{***}					
Convenience					-0.040^{*}	-0.057^{**}					
Identity						-0.059^{**}					-0.111^{***}
Guilty											
Health		-0.058^{**}			0.28^{***}		0.268^{***}	0.189^{***}	0.123^{***}	0.149^{***}	
Walking impairment	-0.094^{***}			0.055^{**}	0.095^{***}	-0.042^{*}					
Socio-demographics											
Male		0.109^{***}			0.052^{**}	-0.140^{***}		0.135^{***}		0.116^{***}	-0.312^{***}
Age: Older adult		0.086^{**}						0.141^{***}		0.238^{***}	
Travel characteristics											
Walking habit (>30 minutes)	0.063^{***}			0.041^{*}						-0.147^{***}	-0.117^{***}
Metro rider	0.097^{***}		0.060^{***}	0.069^{***}	-0.120^{***}	0.053^{**}	0.135^{***}		-0.185^{***}	-192^{***}	
App navigation	0.075^{***}	0.038^{*}	0.071^{***}	0.087^{***}	-0.061^{***}	0.167^{***}	0.120^{***}			-0.171^{***}	0.147^{***}
Measurement											
S1					0.866^{***}					0.867^{***}	
S2					0.933^{***}					0.893^{***}	
S3					0.900^{**}					0.894^{***}	
G1						0.649^{***}					0.770^{***}
G2						0.953^{***}					0.949^{***}
G3						0.773^{***}					0.811^{***}
Model fit											
R^2			0.236						0.455		
CFI (>0.9)			0.940						0.720		
TLI (>0.9)			0.915						0.620		
SRMR (<0.08)			0.033						0.077		

$^{***}p < 0.01$. $^{**}p < 0.05$. $^{*}p < 0.1$.

Appendix 4. Coefficient estimation and marginal effect (ME) of DCM.

	Model 1 (All population)				Model 2 (Sub-population)			
	Coefficient	Standard error	ME	Standard error	Coefficient	Std. error	ME	Standard error
Route attribute								
Ramp	0.546***	0.130	0.101***	0.023	−3.44***	1.099	−0.528***	0.162
Escalator	−2.07***	0.487	−0.385***	0.087	6.75***	2.284	1.04***	0.338
Level change	−2.57***	0.503	−0.477***	0.089	−4.04***	1.086	−0.621***	0.153
Cover	−1.88***	0.430	−0.349***	0.077	16.49***	4.436	2.54***	0.639
Distance × Temperature	−1.26***	0.287	−0.233***	0.051	−6.96***	1.354	−1.07***	0.179
Socio-psychological								
Social representation								
Exclusivity	−0.500*	0.272	−.093	0.050				
Inadequacy					−1.05***	0.434	−0.161**	0.065
Inaccessibility					0.624*	0.369	0.096*	0.056
Convenience	0.838**	0.428	0.156**	0.079				
Identity	0.153*	0.081	0.028*	0.015				
Anticipated guilt	−0.365***	0.128	−0.068***	0.023	−0.534**	0.281	−0.082**	0.042
Walking impairment	0.250*	0.088	−0.046***	0.016	0.976***	0.204	−0.150***	0.027
Social demographics								
Gender: Male					−0.702**	0.329	−0.108**	0.049
Age: Older adult	0.564***	0.194	0.105***	0.036	0.907**	0.424	0.139**	0.063
Living with family					−1.09***	0.388	−0.167***	0.057
Travel characteristics								
Walking (>30 minutes)	0.139***	0.054	0.026***	0.010				
Familiarity to access	−0.152**	0.078	−0.028**	0.014				
Constant	−1.25***	0.45			0.735***	1.44		
Log likelihood	−512.171				−143.146			
Wald Chi-Squared	186.44				71.78			

Note: Ref: non-step-free route.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.