

Inclusive Mobility of Older Persons with Disabilities (OPDs) in the Klang Valley: An Analysis of Travel Frequency and Transport Mode Choice

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Abstract: *Inclusive mobility is essential for ensuring the social participation and well-being of older persons with disabilities (OPDs), particularly in urban areas with complex transport systems. However, existing studies often examine mobility dimensions separately without capturing the interaction between mobility engagement and transport service utilisation. This study addresses this gap by developing an integrated framework that links travel frequency and transport mode choice through a two-stage behavioural approach. Using primary survey data from 165 older OPDs in the Klang Valley, this study applies Ordered Logit and Multinomial Logit models to analyse travel behaviour. The results show that health constraints, particularly walking difficulties and chronic illness, significantly reduce travel frequency, while income and medical needs increase mobility engagement. Importantly, travel frequency acts as a mediating factor influencing transport mode choice, with higher mobility associated with greater use of multimodal transport. The findings contribute to the development of inclusive and service-oriented transport policies by highlighting the importance of accessibility, multimodal integration, and support mechanisms for vulnerable populations.*

Keywords: Inclusive mobility, Older persons with disabilities (OPDs), Travel behaviour, Travel frequency, Transport mode choice, Multimodal transport

1. Introduction

Inclusive mobility is a fundamental prerequisite for ensuring the social participation and well-being of older persons with disabilities (OPDs), particularly in densely populated metropolitan areas such as the Klang Valley, which depend on complex public transport systems (Wahab et al., 2016). From a service perspective, mobility reflects not only the availability of transport infrastructure, but also the accessibility, usability, and affordability of transport services for vulnerable populations. Despite the presence of national policies such as the National Transport Policy 2019–2030 and the Disability Action Plan, which emphasise universal accessibility, significant gaps remain between policy intentions and the actual mobility experiences of older OPDs.

Recent statistics from Persons with Disabilities Statistics Malaysia (DOSM, 2023) reveal a substantial mismatch between the number of registered OPDs and the estimated population based on functional difficulty measures. This discrepancy suggests potential limitations in registration systems and policy implementation, which in turn affect transport planning,

including resource allocation, infrastructure provision, and service coverage (Lucas, 2011). As a result, existing transport services may not adequately reflect the real needs of older OPDs.

At the micro level, empirical evidence further highlights the challenges faced by this group. A field study by Kamarudin (2023), using the go-along method, demonstrates that older OPDs encounter multiple barriers across the travel chain, including inaccessible pedestrian pathways, inadequate ramp facilities, limited station accessibility, and insufficient travel information. These barriers not only reduce safety and comfort, but also influence the decision of whether to travel at all. As emphasised in international literature, inclusive mobility extends beyond physical infrastructure and depends on service-related factors such as staff support, information accessibility, and system reliability (Mohapatra, 2024; Böcker et al., 2017).

Although mobility issues among OPDs have received increasing scholarly attention, empirical studies that jointly examine travel frequency and transport mode choice among older OPDs in Malaysia remain limited (Wahab et al., 2016). Existing studies tend to focus on accessibility levels, user satisfaction, or infrastructure evaluation, without capturing how individual, economic, and health-related factors interact to shape actual travel behaviour. More importantly, the relationship between mobility intensity (travel frequency) and service utilisation patterns (mode choice) remains underexplored.

This gap raises an important question: is the low utilisation of public transport among older OPDs driven solely by physical constraints, or is it also shaped by broader service-related factors such as affordability, accessibility, and dependence on support systems? This perspective aligns with international findings that highlight mobility as a multidimensional outcome influenced by health conditions, physical capability, and social support (Metz, 2000; Rosenberg et al., 2020).

In response to this gap, this study focuses on two main objectives: (i) to assess the weekly travel frequency of older OPDs in the Klang Valley, and (ii) to analyse their transport mode choices, including private, public, active, and multimodal transport options. By integrating these two dimensions, this study provides a more comprehensive understanding of mobility behaviour.

This study contributes to the literature in two key ways. First, it develops an integrated framework linking travel frequency and transport mode choice within a unified analytical model. Second, it offers empirical evidence to support the development of inclusive and service-oriented transport policies for older OPDs. Ultimately, the findings aim to inform the design of more accessible, equitable, and sustainable urban transport systems in Malaysia.

2. Literature Review

2.1 Mobility Behaviour and Theoretical Perspective

This section reviews the theoretical foundations of mobility behaviour among older persons with disabilities (OPDs), with a particular focus on travel behaviour theory and service accessibility perspectives. Understanding mobility among OPDs requires going beyond physical movement and considering how individuals interact with transport systems under various constraints.

Mobility behaviour is commonly explained through Rational Choice Theory, which assumes that individuals make travel decisions by evaluating the costs, benefits, and constraints associated with available alternatives. In the context of older OPDs, these decisions are not purely preference-based but are constrained by physical limitations, financial capacity, and the accessibility of transport services. As such, mobility choices reflect a process of constrained optimisation, where individuals select the most feasible option rather than the most preferred one.

In addition, the Worthwhile Travel Time (WTT) perspective provides an important extension to traditional travel behaviour models. Unlike conventional approaches that treat travel as a disutility, WTT suggests that travel can generate positive value, particularly when it enables access to essential services or supports social participation (Metz, 2000). For older OPDs, travel often serves a functional purpose, such as attending medical appointments or maintaining independence, making it an essential component of daily life rather than a discretionary activity.

From a service-oriented perspective, mobility is closely linked to the concept of accessibility, which encompasses not only the physical availability of transport infrastructure but also the usability, affordability, and reliability of transport services. This aligns with the broader notion of Service Accessibility, where effective mobility depends on the extent to which individuals can access and utilise transport systems in a meaningful way. For vulnerable populations such as OPDs, accessibility barriers may arise from poor infrastructure design, inadequate service integration, or lack of user-friendly information, all of which limit actual mobility outcomes despite the presence of transport services.

Integrating these theoretical perspectives, mobility behaviour among older OPDs can be understood as a multidimensional outcome shaped by the interaction between individual capabilities, economic resources, and health-related constraints. Importantly, mobility is not a single-stage decision but a dynamic process involving different behavioural dimensions. Travel frequency reflects the level of mobility engagement, while transport mode choice represents the utilisation of available transport services.

Building on this perspective, this study conceptualises mobility behaviour as a two-stage process. In the first stage, individuals determine their level of mobility engagement, reflected in travel frequency. In the second stage, they select transport modes based on their constraints and available resources. This approach allows for a more comprehensive understanding of how mobility is shaped and highlights the role of travel frequency as a mediating mechanism linking individual factors to transport service utilisation.

2.2 Determinants of Travel Frequency

Travel frequency is commonly used as an indicator of mobility engagement and reflects the extent to which individuals participate in daily activities. Previous studies have identified several key determinants of travel frequency among older persons, including individual characteristics, socioeconomic status, and health conditions.

Individual factors, such as age and gender, have been consistently found to influence mobility patterns. Increasing age is associated with declining physical ability and reduced travel participation (WHO, 2011), while gender differences may reflect variations in independence, safety perception, and travel purpose (Zhang, 2023).

Household factors also play a significant role. Income determines the ability to afford transport services and access private mobility options, while financial support mechanisms such as concession cards can reduce travel costs and improve access to public transport (Lucas, 2011). Individuals with higher income levels are generally more mobile due to greater flexibility in transport choices.

Health factors are among the most critical determinants of travel frequency. Physical limitations, such as walking difficulty and chronic illness, significantly reduce the ability to travel (Spinney et al., 2009; Luiu et al., 2020). However, health-related needs, particularly medical appointments, may increase travel demand despite these constraints. This dual role of health highlights the complexity of mobility behaviour among OPDs.

2.3 Transport Mode Choice among Older Adults

Transport mode choice reflects how individuals utilise available transport services and is influenced by a combination of individual, economic, and environmental factors. In the context of older persons, mode choice is often shaped by physical ability, accessibility of infrastructure, and the availability of support systems.

Studies have shown that older individuals tend to reduce their use of active transport modes due to declining physical capacity, while reliance on public or assisted transport increases (Schwanen et al., 2015). However, the use of public transport remains limited among OPDs due to accessibility barriers, including inadequate infrastructure and poor service design (Böcker et al., 2017).

Economic capacity also influences mode choice. Higher-income individuals are more likely to use private or multimodal transport options, while lower-income groups tend to rely on public transport due to cost considerations (Lucas, 2011). In addition, policy instruments such as concession cards can encourage public transport usage by reducing financial barriers.

Health conditions further constrain mode choice. Individuals with mobility impairments are less likely to use physically demanding modes such as walking or cycling and are more dependent on motorised or assisted transport options (Luiu et al., 2020).

2.4 Linking Travel Frequency and Mode Choice

While previous studies have examined travel frequency and mode choice separately, limited research has explored the relationship between these two dimensions within a unified framework. Travel frequency represents the intensity of mobility behaviour, while mode choice reflects the type of transport services utilised.

Individuals with higher travel frequency are more likely to require flexible and efficient transport options, leading to increased use of multimodal transport. Conversely, those with lower mobility engagement may rely on limited or no transport options. This relationship suggests that travel frequency may act as a mediating factor linking individual, economic, and health-related variables to transport mode choice.

Despite its importance, this relationship remains underexplored in the context of OPDs, particularly in developing countries such as Malaysia. Existing studies tend to focus on either accessibility or satisfaction without integrating behavioural and service usage perspectives.

2.5 Research Gap

Based on the review, three main gaps can be identified. First, there is a lack of integrated studies that simultaneously examine travel frequency and transport mode choice among older OPDs. Second, existing research often overlooks the role of health-related needs, particularly medical appointments, as a driver of mobility. Third, there is limited application of a service-oriented perspective that links mobility behaviour with transport service accessibility and utilisation.

To address these gaps, this study proposes an integrated framework that examines the determinants of travel frequency and transport mode choice within a unified analytical model. By incorporating individual, economic, and health-related factors, as well as the mediating role of travel frequency, this study contributes to a more comprehensive understanding of mobility behaviour among older OPDs.

3. Conceptual Framework and Hypotheses

3.1 Conceptual Framework

This study develops a conceptual framework to explain the mobility behaviour of older persons in the Klang Valley by integrating travel behaviour theory with a service accessibility perspective. Mobility among older individuals is not solely determined by transport availability, but is influenced by a combination of individual capabilities, economic resources, and health-related constraints.

Grounded in Rational Choice Theory, individuals are assumed to make travel decisions by evaluating costs, benefits, and constraints associated with each available alternative. In addition, the Worthwhile Travel Time (WTT) theory suggests that travel is not merely a cost, but may also provide functional and social value, particularly for older individuals who rely on travel to maintain independence and social participation. Within this context, mobility behaviour is conceptualised as a two-stage process. The first stage focuses on travel frequency, which reflects the level of mobility engagement among older persons. The second stage examines transport mode choice, representing how individuals utilise available transport services.

Based on the empirical structure of this study, three main groups of explanatory variables are identified:

- a) individual factors: These include demographic characteristics such as age and gender. Previous studies indicate that increasing age is associated with declining physical ability and reduced mobility, while gender differences reflect variations in travel independence and purpose.
- b) household factors: Income and access-related variables (e.g., concession cards) represent affordability and accessibility of transport services. Higher income increases flexibility in choosing transport modes, while financial incentives such as concession cards enhance access to public transport.
- c) health factors: Health-related variables such as chronic illness and walking difficulty represent physical limitations that restrict mobility. However, functional needs such as medical appointments may increase travel demand despite these limitations. This dual role of health has been observed in empirical findings, where healthcare needs act as a strong driver of travel behaviour among older individuals.

Based on this structure, travel frequency is treated as a mediating variable that links explanatory factors to transport mode choice. Individuals with higher travel frequency are more likely to engage in diverse and multimodal transport usage, while those with lower mobility tend to rely on limited or no transport options.

3.2 Hypotheses Development

3.2.1 Determinants of Travel Frequency

Individual characteristics are expected to influence the level of mobility among older persons. Increasing age is generally associated with declining physical capability, which reduces travel participation. In addition, gender differences may influence travel behaviour due to differences in independence, safety perception, and travel purpose.

H1: Individual factors significantly influence travel frequency.

H1a: Age is negatively associated with travel frequency.

H1b: Male older persons are more likely to have higher travel frequency than females.

Household and economic resources play a crucial role in enabling mobility. Individuals with higher income have greater access to private transport and can afford travel-related costs. Similarly, concession cards reduce financial barriers and encourage the use of transport services.

H2: Household and economic factors positively influence travel frequency.

H2a: Higher income increases travel frequency.

H2b: Ownership of concession cards increases travel frequency.

Health conditions are among the most critical determinants of mobility. Physical limitations such as walking difficulty and chronic illness reduce the ability to travel. However, healthcare needs such as doctor visits may increase travel frequency despite these constraints.

H3: Health constraints negatively influence travel frequency.

H3a: Walking difficulty reduces travel frequency.

H3b: Chronic illness reduces travel frequency.

H4: Health-related needs positively influence travel frequency.

H4a: Medical appointments increase travel frequency.

3.2.2 Determinants of Transport Mode Choice

Travel frequency plays a central role in shaping transport mode choice. Individuals with higher mobility demand are more likely to use flexible and multimodal transport options, while those with lower mobility may rely on limited transport modes.

H5: Travel frequency significantly influences transport mode choice.

Economic factors also affect transport mode selection. Higher-income individuals tend to prefer private or combined transport modes, while concession card holders are more likely to use public transport due to reduced costs.

H6: Household and economic factors influence transport mode choice.

Health limitations further constrain transport mode selection. Individuals with physical limitations are less likely to use active or physically demanding modes and tend to rely on assisted or motorised transport.

H7: Health constraints influence transport mode choice.

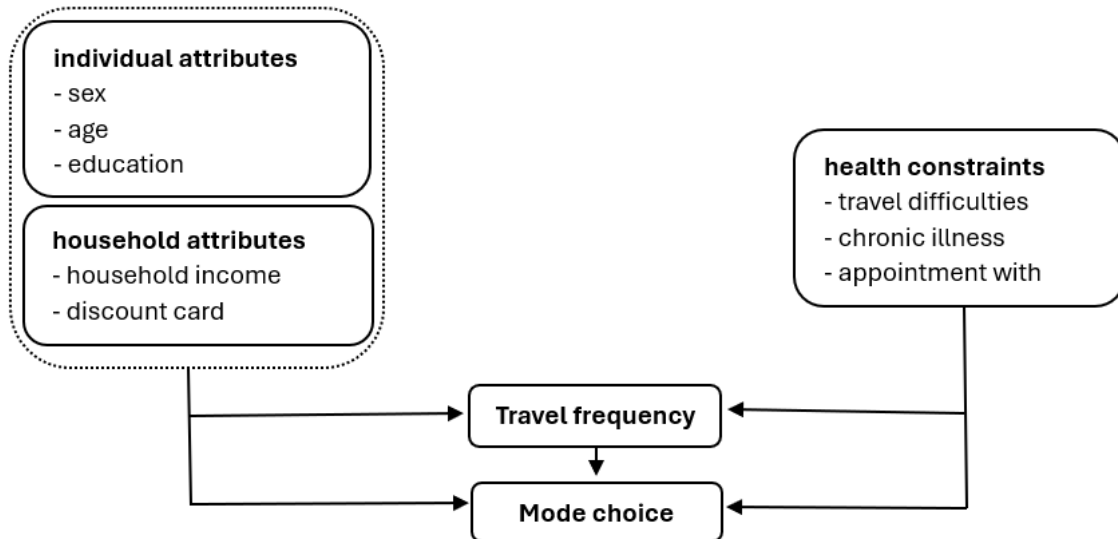


Figure 1: Conceptual Model

4. Methodology

This study adopts a quantitative research design based on primary data collected through face-to-face survey questionnaires involving 165 older persons with disabilities (OPDs) aged 60 and above in the Klang Valley. A purposive sampling technique was employed to ensure that only respondents who met the criteria of older OPDs were included. The sample size of 165 respondents satisfies the recommended minimum for multivariate regression and discrete choice models, which typically require at least 10–20 observations per parameter (Long & Freese, 2014; Peduzzi et al., 1996), thereby ensuring stable parameter estimation for both the Ordered Logit and Multinomial Logit (MNL) models.

The survey instrument consists of four main components: (i) demographic and socioeconomic characteristics, (ii) health status, (iii) transport accessibility, and (iv) weekly travel behaviour, including travel frequency and transport mode choice. These variables are aligned with the conceptual framework, which groups explanatory factors into individual characteristics, household and economic factors, and health-related constraints and needs.

The data were analysed using Stata through two sequential inferential modelling approaches corresponding to the study objectives. The first stage examines the determinants of travel frequency, while the second stage analyses transport mode choice, incorporating both direct effects of explanatory variables and the indirect effect through travel frequency.

4.1 Ordered Logit Model for Weekly Travel Frequency

For the first objective, weekly travel frequency is categorised into four ordered groups: 0 trips, 1–5 trips, 6–10 trips, and more than 11 trips. Given the ordinal nature of the dependent variable, the Ordered Logit model was selected as the appropriate analytical approach. This model

assumes proportional odds, meaning that the relationship between the log-odds of being in higher versus lower categories is consistent across all thresholds (Long, 1997).

To validate this assumption, the Brant Test was conducted. The results indicate that the proportional odds assumption was not violated, confirming the suitability of the Ordered Logit model and allowing for consistent interpretation of coefficients across categories.

The independent variables include individual characteristics (gender, age, education), household and economic factors (income, concession card ownership), and health-related factors (walking difficulty, chronic illness, and medical appointments). These variables are selected based on the conceptual framework and existing literature on mobility behaviour.

4.2 Multinomial Logit (MNL) Model for Transport Mode Choice

For the second objective, transport mode choice is analysed using a Multinomial Logit (MNL) model. The original six transport mode categories (Private Only, Public Only, Active Only, Active+Public, Private+Public, and No Transport) were consolidated into four categories: Public Only, Active+Public, Private+Public, and No Transport (reference category). The categories Private Only and Active Only were excluded due to small sample sizes, which could result in estimation issues such as perfect separation and unstable coefficients (Train, 2009).

The MNL model is appropriate as the dependent variable consists of unordered categories. It estimates the probability of selecting each transport mode based on individual characteristics, economic factors, health conditions, and transport accessibility. In addition, travel frequency is included as an explanatory variable to capture its role as a mediator influencing transport mode choice.

The model assumes the Independence of Irrelevant Alternatives (IIA), which was tested using the Hausman-McFadden Test. The results indicate no significant violation of the IIA assumption, supporting the robustness of the model specification. The application of the MNL model is consistent with existing mobility literature, where it is widely used to analyse transport mode choice behaviour among older populations and persons with disabilities (Schwanen et al., 2015; Fox et al., 2014).

5. Results

5.1 Descriptive Analysis

The descriptive analysis results presented in Table 1 provide a comprehensive overview of the demographic, socioeconomic, health conditions, transport accessibility, weekly travel frequency, and transport mode choice of 165 older persons with disabilities (OPDs) aged 60 and above in the Klang Valley. The selection of this age group is consistent with gerontological perspectives, which highlight that older OPDs experience double vulnerability, as they are affected by both ageing and disability, significantly influencing their mobility capacity (WHO, 2011).

Table 1: Descriptive Findings of OPD Respondents (N = 165)

Variable	Category	N	%
Gender	Male	74	44.8
	Female	91	55.2
Age	60–64 years	66	40.0

	65–74 years	74	44.8
	≥75 years	25	15.2
Education	None/Low	46	27.9
	Secondary	79	47.9
	Tertiary	40	24.2
Household income	< RM1,000	51	30.9
	RM1,001–4,000	68	41.2
	> RM4,000	46	27.9
Chronic illness	Yes	129	78.2
Walking difficulty	Yes	89	54.0
Concession card	Yes	46	27.9
Medical appointments	Yes	108	65.5
Weekly travel frequency	0 trips	17	10.3
	1–5 trips	82	49.7
	6–10 trips	53	32.1
	>11 trips	13	7.9
Transport mode	Private Only	45	27.3
	Public Only	16	9.7
	Active Only	10	6.1
	Active + Public	28	17.0
	Private + Public	50	30.3
	No Transport	16	9.7

Based on Table 1, from a demographic perspective, the majority of respondents fall within the 65–74 age group (44.8%), followed by 60–64 years (40.0%), while 15.2% are aged 75 and above. This distribution indicates that most respondents are in the early to mid-stages of ageing but are already experiencing physical decline that affects mobility. The gender composition shows that 55.2% of respondents are female, consistent with the demographic structure of older populations in Malaysia.

From a socioeconomic perspective, most respondents belong to the lower-middle income group, with 41.2% earning RM1,001–4,000 and 30.9% earning less than RM1,000. As highlighted by Lucas (2011), limited economic resources increase the risk of transport disadvantage, restricting access to reliable and comfortable transport options.

The health profile of respondents reflects substantial physical challenges. A large proportion (78.2%) report having chronic illnesses, while 54.0% experience walking difficulties. In addition, 65.5% report having regular medical appointments, indicating that healthcare-related travel constitutes a significant component of mobility among older OPDs. This finding aligns with Böcker et al. (2017), who emphasise the importance of health-related travel among individuals with functional limitations.

In terms of transport accessibility, only 27.9% of respondents possess a concession card, suggesting that financial support mechanisms are not fully utilised within this group. This may limit access to affordable transport services despite policy provisions.

Weekly travel frequency indicates that most respondents remain moderately active, with 49.7% making 1–5 trips and 32.1% making 6–10 trips per week. However, 10.3% do not travel at all,

highlighting a vulnerable subgroup with potentially severe mobility constraints. As noted by Kajzer-Bonk (2020), mobility among older OPDs is shaped by the complexity of the travel chain, where each stage of the journey may present barriers.

Regarding transport mode choice, the most commonly used mode is Private + Public (30.3%), followed by Private Only (27.3%). This suggests that multimodal travel plays an important role in accommodating the diverse mobility needs of older OPDs. In contrast, the use of Public Only remains relatively low (9.7%), indicating potential barriers related to accessibility, comfort, or service reliability. Notably, 9.7% of respondents do not use any transport mode, reflecting severe mobility limitations within a segment of the population.

Overall, the descriptive findings suggest that mobility among older OPDs is shaped by the interaction of health constraints, economic capacity, and healthcare-related needs. These insights provide a critical foundation for the subsequent inferential analysis, particularly in understanding how these factors influence travel frequency and transport mode choice within the proposed framework.

5.2 Ordered Logit Model Analysis (Travel Frequency)

The Ordered Logit model was employed to examine the determinants of weekly travel frequency among older persons with disabilities (OPDs) in the Klang Valley. Given the ordinal nature of the dependent variable (0 trips, 1–5 trips, 6–10 trips, and >11 trips), this model provides an appropriate framework for analysing variations in mobility intensity.

The estimation results indicate a log-likelihood value of -214.36 and a Pseudo R² of 0.23, suggesting a satisfactory model fit and reasonable explanatory power for behavioural data of this nature. These values indicate that the model is able to capture a meaningful proportion of variation in travel frequency among older OPDs, particularly when considering the complexity of mobility behaviour influenced by multiple constraints.

In addition, the Ordered Logit model was preferred over the Ordered Probit specification based on model fit considerations and interpretability. Although both models are suitable for ordinal outcomes, the Ordered Logit model provides more intuitive interpretation through odds ratios and demonstrated slightly better goodness-of-fit in this study. This supports its use as a more appropriate specification for analysing mobility intensity in the given context.

Overall, the results indicate that several factors significantly influence travel frequency, including individual characteristics, household economic conditions, and health-related constraints and needs. The model demonstrates strong explanatory power in identifying key drivers of mobility behaviour among older OPDs.

Table 2: Ordered Logit Model Results (Travel Frequency)

Variable	OR	p-value	Marginal effect			
			(0) 0 trips	(1) 1–5 trips	(2) 6–10 trips	(3) >11 trips
Individual factors						
Male (ref. female)	1.48	0.006**	-0.030**	-0.060**	0.070**	0.020*
Age 65–74 (ref. 60–64)	0.62	0.003**	0.045***	0.100***	-0.110***	-0.035***
Age ≥75 (ref. 60–64)	0.39	0.001***	0.070***	0.150***	-0.180***	-0.040***
Tertiary education (ref. none/low)	0.78	0.210	0.020	0.050	-0.040	-0.030

Household factors						
Income RM1,001–4,000 (ref. <RM1,000)	2.10	0.001***	-0.080***	-0.180***	0.200***	0.060***
Income >RM4,000 (ref. <RM1,000)	1.72	0.031*	-0.050*	-0.110*	0.100*	0.060*
Concession card (ref. yes)	1.28	0.150	-0.020	-0.040	0.040	0.020
Health factors						
Walking difficulty (ref. yes)	0.55	0.001***	0.060***	0.130***	-0.150***	-0.040***
Chronic illness (ref. yes)	0.48	0.004**	0.080**	0.160**	-0.180**	-0.060**
Medical appointments (ref. yes)	1.62	0.010**	-0.040**	-0.100**	0.090*	0.050**

5.2.1 Individual factors

From the perspective of individual characteristics, gender and age show significant effects on travel frequency. Male respondents are more likely to engage in higher levels of travel compared to females (OR = 1.48, $p = 0.006$). The marginal effects further indicate that males have a lower probability of being in the non-travelling and low-frequency categories, and a higher probability of being in moderate to high travel categories. This finding supports H1b and is consistent with Zhang (2023), who found that older men tend to maintain higher levels of mobility and are more likely to travel for out-of-home activities.

Age emerges as one of the strongest determinants of mobility. Respondents aged 65–74 (OR = 0.62, $p = 0.003$) and those aged 75 and above (OR = 0.39, $p < 0.001$) show a significant decline in travel frequency compared to the reference group (60–64 years). Marginal effects confirm that older age groups are more likely to be in lower travel frequency categories and less likely to engage in frequent travel. This finding supports H1a and aligns with established ageing literature, which highlights the decline in physical capacity and increased dependency associated with advancing age (WHO, 2011; Courtin & Knapp, 2017).

Education, however, does not show a statistically significant relationship with travel frequency (OR = 0.78, $p = 0.210$), suggesting that in the context of older OPDs, mobility is less influenced by human capital factors and more strongly shaped by physical and structural constraints.

5.2.2 Household factors

Household income is found to be a key enabling factor for mobility. Respondents with monthly household income between RM1,001–4,000 (OR = 2.10, $p < 0.001$) and above RM4,000 (OR = 1.72, $p = 0.031$) are significantly more likely to travel frequently compared to those earning less than RM1,000. Marginal effects indicate a substantial reduction in the probability of being in lower travel categories and an increase in higher-frequency travel categories.

These findings support H2a and are consistent with the resource-based perspective of mobility, which suggests that higher income enhances access to transport options, reduces financial constraints, and increases participation in out-of-home activities (Lucas, 2011).

In contrast, the possession of a concession card shows a positive but statistically insignificant relationship with travel frequency (OR = 1.28, $p = 0.150$). This suggests that financial incentives alone may not be sufficient to increase mobility without corresponding improvements in physical accessibility and service quality.

5.2.3 Health factors

Health-related factors demonstrate the strongest influence on travel frequency. Respondents with walking difficulties are significantly less likely to travel frequently (OR = 0.55, $p < 0.001$), while those with chronic illnesses also show reduced mobility (OR = 0.48, $p = 0.004$). Marginal effects confirm that these groups are more likely to remain in lower travel frequency categories. These findings support H3a and H3b, and are consistent with previous studies highlighting physical limitations as a major barrier to mobility among older adults (Spinney et al., 2009; Luiu et al., 2020).

Interestingly, medical appointments exhibit a positive and significant effect on travel frequency (OR = 1.62, $p = 0.010$). Respondents with regular healthcare needs are more likely to travel frequently, as reflected in increased probabilities of being in moderate and high travel categories. This finding supports H4a and reinforces the notion that healthcare needs act as a compulsory driver of mobility, as also observed by Kim and Ulfarsson (2019).

5.3 Multinomial Logit Model Analysis (Transport Mode Choice)

The Multinomial Logit (MNL) model was employed to examine the determinants of transport mode choice among older persons with disabilities (OPDs), with No Transport specified as the reference category. The model produces a log-likelihood value of -198.72 and a Pseudo R^2 of 0.28, indicating a good model fit and strong explanatory power for discrete choice behaviour.

The likelihood ratio test is statistically significant (LR $\chi^2 = 162.45$, $p < 0.001$), confirming that the set of explanatory variables jointly contributes to explaining variation in transport mode choice. In addition, the Hausman-McFadden test suggests that the Independence of Irrelevant Alternatives (IIA) assumption is not violated, supporting the validity of the MNL specification.

The MNL model was selected over alternative specifications due to its suitability for modelling unordered categorical outcomes and its superior model fit compared to simpler binary or ordered models. Unlike the Ordered Logit model used for travel frequency, transport mode choice does not follow a natural ordering, thus justifying the use of MNL as the most appropriate modelling approach in this context.

Importantly, travel frequency is incorporated as a mediating variable, capturing the transition from mobility engagement to transport service utilisation. This allows the model to reflect behavioural dynamics more accurately, where individuals with higher mobility levels are more likely to utilise flexible and multimodal transport options.

Table 3: Multinomial Logit Model Results (Reference Category = No Transport)

Variable	Public Only	Active + Public	Private + Public
	RRR	RRR	RRR
Individual factors			
Male (ref. female)	0.48*	0.42**	0.95
Age 65–74 (ref. 60–64)	0.90	0.85	0.95
Age ≥ 75 (ref. 60–64)	3.10**	2.00*	1.10
Tertiary education (ref. none/low)	0.85	0.92	1.10
Household factors			
Income RM1,001–4,000 (ref. <RM1,000)	0.60**	1.10	1.80**
Income >RM4,000 (ref. <RM1,000)	0.80	1.30	2.20**
Concession card (ref. yes)	2.50**	3.10***	1.85

Health factors			
Walking difficulty (ref. yes)	1.95*	1.35	1.60
Chronic illness (ref. yes)	0.60*	0.70	0.85
Medical appointments (ref. yes)	2.20**	1.30	1.05
Mobility behaviour			
Travel frequency	1.35**	1.48***	1.72***

5.3.1 Individual factors

Based on Table 3, individual characteristics exhibit differentiated effects on transport mode choice among older persons with disabilities (OPDs), particularly in relation to gender and age.

Gender shows a significant influence on the likelihood of selecting public and multimodal transport options. Male respondents are less likely to choose Public Only (RRR = 0.48, $p < 0.1$) and Active + Public modes (RRR = 0.42, $p < 0.01$) compared to female respondents, while no significant effect is observed for Private + Public (RRR = 0.95). This suggests that female older OPDs are more dependent on public and multimodal transport, potentially due to lower access to private mobility options and greater reliance on structured transport services.

Age presents a contrasting pattern. Respondents aged 65–74 do not show significant differences across transport modes. However, those aged 75 and above demonstrate a significantly higher likelihood of using Public Only (RRR = 3.10, $p < 0.01$) and Active + Public modes (RRR = 2.00, $p < 0.1$) compared to the reference group (60–64 years). This indicates that advancing age increases dependence on public transport, likely due to declining physical capacity and reduced ability to drive or rely on independent mobility.

In contrast, education level does not show a statistically significant relationship with transport mode choice across all categories (RRR = 0.85–1.10), suggesting that for older OPDs, mobility decisions are more strongly influenced by physical and structural constraints rather than human capital factors.

5.3.2 Household factors

Income emerges as a key determinant of transport mode choice. Respondents with higher income levels are significantly more likely to use Private + Public modes (RRR = 1.80 and 2.20). This suggests that greater financial capacity allows individuals to combine private and public transport, increasing flexibility and convenience in travel.

This finding supports H6 and aligns with the resource-based mobility perspective, where economic capacity enhances access to diverse transport options (Lucas, 2011). Conceptually, this relationship can be interpreted as: Higher income → greater access to private vehicles → increased use of Private + Public combinations

In addition, concession card ownership shows a strong positive effect on the use of Public Only (RRR = 2.50) and Active + Public (RRR = 3.10) modes. This indicates that financial incentives play a significant role in encouraging public transport usage. The strongest effect is observed in multimodal travel (Active + Public), suggesting that reduced cost improves the feasibility of combining walking and public transport.

5.3.3 Health factors

Health conditions significantly shape transport mode choice. Respondents with walking difficulties are more likely to rely on Public Only modes (RRR = 1.95), reflecting reduced ability to engage in physically demanding or multimodal travel.

Similarly, chronic illness is associated with a lower likelihood of using Public Only and Active + Public modes, indicating that unstable health conditions reduce the feasibility of travel requiring physical effort or multiple transfers. These findings support H4 and are consistent with previous studies showing that physical limitations are a major barrier to active and multimodal transport (Spinney et al., 2009; Luiu et al., 2020).

Conceptually, this relationship can be summarised as: Health impairment → reduced ability to use Active + Public modes. In contrast to health constraints, medical appointments show a strong positive effect on Public Only usage (RRR = 2.20). This indicates that healthcare-related needs act as a compulsory driver of travel behaviour, even among individuals with physical limitations.

This finding reinforces the dual role of health identified earlier: while physical limitations restrict mobility, healthcare needs simultaneously increase travel demand. This aligns with Kim and Ulfarsson (2019), who emphasise that healthcare access is a primary motivator for travel among older adults.

6. Discussion

The findings of this study demonstrate that mobility behaviour among older persons with disabilities (OPDs) in the Klang Valley is shaped by a complex interaction of individual characteristics, economic capacity, health constraints, and functional needs. By integrating travel frequency and transport mode choice within a unified framework, this study provides a more comprehensive understanding of mobility as both a behavioural and service-related outcome.

From a theoretical perspective, the results are consistent with Rational Choice Theory, where individuals make mobility decisions based on the trade-off between constraints and benefits. For older OPDs, mobility is not purely a matter of preference, but a constrained choice influenced by physical ability, financial resources, and accessibility of transport services. In addition, the findings support the Worthwhile Travel Time (WTT) perspective (Metz, 2000), which suggests that travel retains functional value, particularly when it enables access to essential services such as healthcare.

The results from the Ordered Logit model confirm that health constraints are the most significant factors limiting mobility. Walking difficulties and chronic illnesses substantially reduce travel frequency, supporting H3a and H3b. This finding reinforces existing literature indicating that physical limitations are the primary barriers to mobility among older adults (Spinney et al., 2009; Luiu et al., 2020). However, the positive effect of medical appointments (H4a) highlights the dual role of health, where mobility is simultaneously constrained and compelled. This reflects a shift from voluntary mobility towards needs-driven mobility, where travel is undertaken out of necessity rather than choice.

Economic capacity also plays a crucial role in shaping mobility behaviour. Higher income significantly increases travel frequency (H2a) and enables the use of more flexible transport options, particularly Private + Public combinations (H6). This supports the resource-based perspective of mobility (Lucas, 2011), which emphasises that financial resources enhance access to transport services and reduce mobility constraints. In contrast, the limited impact of concession cards on travel frequency suggests that financial incentives alone are insufficient to improve mobility without corresponding improvements in service accessibility and infrastructure.

The findings from the Multinomial Logit model further highlight how health and economic factors shape transport mode choice. Individuals with physical limitations are less likely to engage in active and multimodal transport, supporting H4. Instead, they tend to rely on more accessible and less physically demanding options, particularly public transport. Conversely, higher-income individuals demonstrate greater flexibility in combining private and public modes, reflecting their ability to overcome service limitations through additional resources.

A key contribution of this study is the identification of travel frequency as a mediating variable linking individual, economic, and health-related factors to transport mode choice. The results confirm that individuals with higher mobility engagement are more likely to utilise multimodal transport services, supporting H5. This highlights the importance of considering mobility intensity when analysing transport behaviour, as it captures the transition from mobility capability to service utilisation.

From a service management perspective, the findings suggest that mobility should be understood not only in terms of physical movement, but also as access to and utilisation of transport services. The low reliance on public transport, despite policy support and concession schemes, indicates that existing services may not adequately meet the needs of older OPDs. Barriers such as poor accessibility, inadequate infrastructure, and limited service integration reduce the usability of transport systems for this group.

In the Malaysian context, these findings have important policy implications. The National Transport Policy 2019–2030 emphasises inclusive and accessible transport systems, yet the results indicate a gap between policy aspirations and actual user experience. In particular, challenges related to first- and last-mile connectivity, pedestrian infrastructure, and service reliability remain critical barriers for older OPDs. Similarly, the Disability Action Plan calls for accessible transport infrastructure, but its implementation appears to be uneven.

At the global level, this study contributes to the achievement of Sustainable Development Goal (SDG) 11, which aims to create inclusive, safe, and accessible cities. The findings highlight that achieving inclusive mobility requires more than infrastructure provision; it requires an integrated approach that combines physical accessibility, service quality, affordability, and user-centred design.

Overall, this study demonstrates that mobility among older OPDs is a multidimensional issue that requires coordinated interventions across transport planning, healthcare access, and social support systems. Improving mobility outcomes for this group is not only a matter of transport policy, but also a critical component of promoting social inclusion, independence, and quality of life.

7. Future Directions

Future research on mobility among older persons with disabilities (OPDs) should further explore heterogeneity in individual capabilities and constraints. While this study highlights the significant roles of health conditions, income, and mobility needs, future studies should consider more detailed differentiation across types of disabilities, severity levels, and functional limitations. In particular, variations in mobility behaviour between individuals with mild versus severe mobility impairments, as well as those with multiple chronic conditions, remain underexplored. Additionally, future research may incorporate psychosocial dimensions such as perceived safety, travel confidence, and social support, which could provide deeper insights into mobility decision-making beyond observable characteristics.

Second, methodological advancements are necessary to enhance the robustness and generalisability of findings. This study employs cross-sectional data, which limits the ability to capture dynamic changes in mobility behaviour over time. Future research should adopt longitudinal designs to examine how mobility patterns evolve with ageing, health deterioration, or changes in socioeconomic status. Furthermore, integrating mixed-method approaches—such as qualitative interviews or go-along observations—would provide richer contextual understanding of barriers across the travel chain. Expanding the geographical scope beyond the Klang Valley to include rural and semi-urban areas would also allow for comparative analysis of spatial inequalities in mobility access.

Finally, future studies should further develop the behavioural modelling framework by examining additional mechanisms linking mobility engagement and transport service utilisation. While this study identifies travel frequency as a mediating factor, future research could explore more complex modelling approaches, including structural equation modelling or dynamic discrete choice models, to capture feedback effects and interdependencies between mobility decisions. In addition, incorporating service quality indicators—such as reliability, comfort, and accessibility of transport systems—would strengthen the service-oriented perspective of mobility analysis. Such extensions would contribute to a more comprehensive understanding of inclusive mobility and support the development of targeted, user-centred transport policies for ageing and vulnerable populations.

8. Limitations

This study has several limitations that should be acknowledged. First, the use of purposive sampling may limit the generalisability of the findings beyond the study population. Although the sampling approach ensures that only relevant respondents are included, it may not fully represent the broader population of older persons with disabilities (OPDs) in Malaysia.

Second, the study relies on self-reported data, which may introduce response bias, particularly in relation to travel frequency and health conditions. Respondents may underreport or overreport their actual mobility behaviour due to recall limitations or subjective perceptions.

Third, certain transport mode categories, such as Private Only and Active Only, were excluded from the inferential analysis due to small sample sizes. While this step was necessary to ensure model stability, it may limit the comprehensiveness of the analysis in capturing the full spectrum of mobility behaviour.

Finally, the study focuses on an urban setting, specifically the Klang Valley. As such, the findings may not be directly generalisable to rural or less developed areas, where transport infrastructure, accessibility, and mobility patterns differ significantly.

9. Conclusion

This study provides a comprehensive analysis of mobility behaviour among older persons with disabilities (OPDs) in the Klang Valley by integrating travel frequency and transport mode choice within a unified analytical framework. The findings demonstrate that mobility is shaped by the interaction of individual characteristics, economic capacity, health constraints, and functional needs.

Health-related factors, particularly walking difficulties and chronic illness, emerge as the most significant barriers to mobility, reducing the likelihood of frequent travel. At the same time, healthcare needs—captured through medical appointments—act as a key driver of mobility, indicating that travel among older OPDs is largely necessity-driven rather than discretionary. Economic capacity further enhances mobility by increasing travel frequency and enabling access to more flexible and multimodal transport options, particularly combinations of Private + Public modes.

A key contribution of this study lies in identifying travel frequency as a mediating variable linking explanatory factors to transport mode choice. This integrated perspective advances existing mobility research by demonstrating that mobility engagement directly influences how individuals utilise transport services, offering a more holistic understanding of travel behaviour among vulnerable populations.

From a policy perspective, the findings highlight the need for a shift towards user-centred and service-oriented transport systems. Improving physical accessibility—particularly pedestrian infrastructure and first- and last-mile connectivity—remains critical. In addition, enhancing multimodal integration and complementing financial support mechanisms such as concession cards with improvements in service quality, reliability, and usability are essential to ensure meaningful mobility access.

In the Malaysian context, these findings are highly relevant to policy frameworks such as the National Transport Policy 2019–2030 and the broader agenda of Sustainable Development Goal (SDG) 11. However, the results indicate that gaps persist between policy aspirations and actual mobility experiences. Addressing these gaps is crucial for achieving inclusive, equitable, and sustainable urban mobility systems.

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Conflict of Interest Statement

The author declares that this research was conducted in the absence of any commercial, financial, or personal relationships that could be construed as a potential conflict of interest. The study was carried out solely for academic purposes, and no external parties influenced the study design, data collection, analysis, interpretation, or manuscript preparation.

References

- Ahmad, N., Noor, N. M., & Ibrahim, F. (2019). Mobility challenges among women with disabilities in urban Malaysia. *Journal of Social Issues in Southeast Asia*, 34(2), 221–240.
- Andersen, R. M. (1995). Revisiting the Behavioral Model and access to medical care: Does it matter? *Journal of Health and Social Behavior*, 36(1), 1–10.
- Böcker, L., Amen, P. V., & Helbich, M. (2017). Elderly travel frequencies and transport mode choices in Greater Rotterdam, the Netherlands. *Journal of Transport Geography*, 59, 1–9.
- Böcker, L., Dijst, M., & Prillwitz, J. (2017). Transport related social exclusion in later life. *Journal of Transport Geography*, 59, 102–111. <https://doi.org/10.1016/j.jtrangeo.2017.01.016>
- Cebolla, J. F., López, O. R., & Prieto, R. G. (2021). Economic incentives and public transport use among vulnerable groups. *Transport Policy*, 106, 99–110.
- Courtin, E., & Knapp, M. (2017). Social isolation, loneliness and health in old age: A scoping review. *Health & Social Care in the Community*, 25(3), 799–812.
- De Ruiter, L., Zandieh, R., & Ettema, D. (2025). Accessibility and transit use among persons with reduced mobility. *Transportation Research Part A*, 175, 103–118.
- Department of Statistics Malaysia. (2023). *Persons with Disabilities (PWD) Statistics 2023*. Putrajaya: DOSM.
- Fox, J., Daly, A., Hess, S., & Miller, E. (2014). Temporal transferability of models of mode-destination choice for the Greater Toronto and Hamilton Area. *Journal of Transport and Land Use*, 7(2), 41-62.
- Jabatan Kebajikan Masyarakat. (2016). *Pelan Tindakan Orang Kurang Upaya 2016–2022*. Kuala Lumpur: JKM.
- Kajzer-Bonk, M. (2020). Mobility patterns of older adults with functional limitations: A travel chain perspective. *Journal of Transport & Health*, 16, 100–119.
- Kamarudin, S. (2023). Everyday mobility barriers of older persons with disabilities in urban Malaysia: A go-along study. *Malaysian Journal of Society and Space*, 19(1), 45–60.
- Kim, S., & Ulfarsson, G. (2019). Travel behavior of older adults: The role of health, mobility aids and medical trips. *Transportation Research Part F: Traffic Psychology and Behaviour*, 60, 465–475.
- Lucas, K. (2011). Transport and social exclusion: Where are we now? *Transport Policy*, 20, 105–113.
- Luiu, C., Tight, M., & Burrow, M. (2020). Factors preventing older people's use of public transport: A systematic review. *Transport Reviews*, 40(4), 1–27.
- Ministry of Transport Malaysia. (2019). *Dasar Pengangkutan Negara 2019–2030*. Putrajaya: MOT.

- Mohapatra, S. (2024). Barriers to mobility for elderly persons with disabilities: A global perspective. *International Journal of Disability Studies*, 21(2), 114–130.
- Pineda, V. S., Khayesi, M., & Fernández-Morales, F. (2018). Public transport accessibility for persons with disabilities: A global comparative study. *International Journal of Transportation Science and Technology*, 7(4), 283–298.
- Rosenberg, E. S., Dufort, E. M., Udo, T., Wilberschied, L. A., Kumar, J., Tesoriero, J., ... & Zucker, H. A. (2020). Association of treatment with hydroxychloroquine or azithromycin with in-hospital mortality in patients with COVID-19 in New York State. *Jama*, 323(24), 2493-2502.
- Schwanen, T., Lucas, K., Akyelken, N., Solsona, D. C., Carrasco, J. A., & Neutens, T. (2015). Rethinking the links between social exclusion and transport disadvantage through the lens of social capital. *Transportation Research Part A: Policy and Practice*, 74, 123-135.
- Shakespeare, T. (2006). *The Social Model of Disability: An outdated ideology?* London: Routledge.
- Spinney, J., Scott, D., & Newbold, K. (2009). Transport mobility benefits and quality of life: A conceptual framework for older people. *Journal of Transport Geography*, 17(5), 333–340.
- Train, K. (2009). *Discrete Choice Methods with Simulation* (2nd ed.). Cambridge University Press.
- United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. New York: United Nations.
- Van den Bosch, M., Jensen, A., & Rantakokko, M. (2020). Health appointments as a driver of mobility among older adults with functional limitations. *Health & Place*, 63, 102329.
- World Health Organization. (2011). *World Report on Disability*. Geneva: WHO.
- Zhang, Y. (2023). Gender differences in senior mobility: An empirical assessment of travel frequency and purpose. *Transportation Research Part A: Policy and Practice*, 174, 103728.