Influence of Tolerable, Perceived, and Actual Travel Time on Trip Satisfaction among Canadian Older Adults

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Abstract:

Older adults tend to use public transit more as they age and their driving cessation increase. Whilst satisfaction with their public transit trips impact their well-being. This paper investigates how objective (i.e., actual and experienced) and subjective (i.e., tolerable) measures of travel time by public transit influence trip satisfaction among older adults in Canada. We use data from the 2023 Aging in Place Survey, a bilingual online survey collected in March 2023 in Toronto, Montréal, and Vancouver metro regions. We measure the influence of actual, experienced, and tolerable travel time on public transit service satisfaction through a series of ordered probit models, while accounting for sociodemographic and perceptions of public transit in each region. Our findings indicate that public transit trip satisfaction is influenced by both perceived and tolerable travel times but not impacted by actual travel time. In addition, our findings show that more positive perceptions of the public transit system in a region leads to higher satisfaction levels with a trip. As increasing satisfaction with public transit use among older adults is linked to encouraging continuous usage, the findings from this paper can be of interest to practitioners and policymakers aiming to contribute to healthy ageing.

Keywords: travel time, tolerable travel time, perceptions of transit, trip satisfaction, older adults

1 INTRODUCTION

Public transport systems can help older adults maintain their independence (*1*), allowing them to remain connected to their communities despite increases in driving cessation rates with age. Recent research has shown that older adults tend to use public transit more as they age (*2*), while their levels of satisfaction with public transit in their regions tend to be lower compared to other modes (*3*). The relationship between the impacts of travel satisfaction and well-being is well documented in the transport literature (*4; 5*), increasing travel satisfaction among older adults can help in improving their quality of life (*6*).

One factor usually associated with trip satisfaction is travel time (*7; 8*). Longer travel times are typically found to have a negative effect on user mood and satisfaction levels (*9; 10*). However, these effects are likely to be varied across the population as people have heterogeneous perceptions of what is felt as a tolerable travel time, which is characterized as the maximum threshold acceptable for a given trip (*11; 12*). Older adults tend to value their travel time more highly than younger generations (*13*), which might influence how long they are willing to travel by a mode of transport and the time thresholds to which they will still be satisfied with their trip.

The literature on the interactions between perceived (i.e., self-reported) and tolerable travel times and trip satisfaction is still limited, notably regarding older adults. Current research tends to focus on the relationship between ideal (i.e., desired) travel times and trip satisfaction, which usually finds that people experiencing longer travel times than ideal are likely to report lower levels of trip satisfaction (*7; 14*). However, as ideal, and tolerable travel times tend to differ significantly (*15; 16*), the influence of tolerable travel times on trip satisfaction can reveal new insights into the factors influencing trip satisfaction and how to encourage public transit use among older adults. Moreover, given that people tend to perceive longer travel times than actual travel times during their trip (*17*), the interactions between actual, perceived, and tolerable travel times is another aspect demanding attention in travel satisfaction research.

Considering these gaps, this paper aims to (i) understand the influence of tolerable, experienced, and actual travel times on public transit trip satisfaction among older adult population. With the aim of improving transit planning and operations, (ii) we also explore the influence of these three travel time measures on satisfaction with time-related components of a public transit trip (i.e.,

on-board and waiting times). To the best of our knowledge, no paper has previously investigated the interaction of these three measures of time on trip satisfaction for older adults.

2 LITERATURE REVIEW

People are expected to experience a positive utility from travel given a widespread desire for non-zero travel times (*18*). In this context, tolerable travel time (also known as acceptable travel time) was conceptualized based on a function of the utility of time (*15*), where it reflects the maximum time threshold acceptable for a given travel (*19*). At this threshold, people would still obtain both derived (i.e., ability to reach destination) and intrinsic (i.e., satisfaction) utility from their travel (*15*) even if not at an optimal level.

Tolerable travel time is found to be influenced by an individual's definition of what is perceived as ideal travel time (*20*), which is the point at which intrinsic utility (or satisfaction) is optimized (*11*). Travellers with higher commute times than desired (i.e., ideal) are reported to have lower satisfaction levels when compared to those commuting with their ideal travel times (*7; 14*). Even though mean tolerated travel times change across contexts, they usually fall within the range of 30 to 40 minutes. Ideal commute times can change based on trip purpose, trip conditions, activities conducted during the trip, and period of the day when the trip happened (*21*). Zhao, Tyler and Lan (*20)* studied the role of ideal and tolerable travel times on (experienced) commute travel times. They find a dynamic relationship between all variables indicating that commute travel times both influence and are influenced by subjective notions of time.

Most of the current research explores what is perceived as ideal travel time (*7; 14; 21-23*), while few studies have explored the concept of tolerable travel time (*15; 16; 19*). To date, only one study has explored tolerable travel times in relation to trip satisfaction. Humagain and Singleton (*11)* investigated the effects of commute satisfaction at hypothetical travel times on tolerable travel times. They indicate that tolerable travel times are influenced by both (perceived) commute travel times, mode choice, and individual satisfaction levels. In our paper, we further this literature by unravelling the interactions between tolerable travel times to both actual (i.e., objective measure) and perceived (i.e., self-reported) travel times as well as its influence on public transit trip satisfaction among older adults.

3 METHODS

3.1 Data collection

This research uses a bilingual online survey conducted from February to March 2023 by the Transportation Research at McGill (TRAM) group titled “The Aging in Place Survey”. The survey focuses on the travel needs and experiences of Older Adults (aged 65 or older) across six metropolitan regions in Canada (Toronto, Montréal, Vancouver, Halifax, Victoria, and Saskatoon). For this study, we concentrate on data obtained from the three biggest metro regions, Toronto, Montréal, and Vancouver. As proposed by Dillman, Smyth and Christian (*24)*, multiple recruitment strategies were employed in the Aging in Place Survey to ensure that a large and representative sample is collected, such as the distribution of flyers at senior and community centers, mailing recruitment fliers in areas with high concentration of older adults, social media advertising, distributing a link to the survey among senior center mailing lists and newsletters, newspaper and radio interviews, and recruitment through a marketing company specialized in public opinion surveys (Léger). After the data collection was completed, a 9-step cleaning process was applied. The exclusion criteria included filtering out those who answered the survey too quickly, those who provided an invalid home or destination location and those who were associated with multiple IP or email addresses. This cleaning process led to a sample of 3,013 complete and valid responses. For more detailed information on the data collection and cleaning procedures see Alousi-Jones et al. (*25)*. In our study, we analyze those who used public transit at least once in the past year, leading to a sample of 731 responses.

3.2 Measures of travel time

3.2.1 Tolerable travel time

In the general perceptions about public transit section of the survey, respondents were asked on what they perceive as a tolerable travel time by transit. The question was worded as follows “In your opinion, what would be a reasonable travel time to reach your desired destinations from your home by public transit in your region?” Respondents selected from a dropdown list ranging from *10 minutes or less* to *1 hour or longer* with 5-minute increments between options. Their answers reflect a time threshold on what is deemed as an acceptable travel time by transit.

3.2.2 Perceived travel time

In the travel diary section of the survey, respondents were asked to report on their last trip originated at their home location by different modes including public transit. The collected information includes trip destination, trip purpose, date of the trip, period of the day, modes used, trip satisfaction, and travel time. For those using public transit they were asked to report on their travel time through the following question "Thinking about this last trip using public transit, approximately how long did it take you to get to your destination from your home?" Their answers ranged from *10 minutes or less* to *1 hour or longer* with 5-minute increments between both options. Consequently, our measure of perceived travel time is based on a self-reported measure reflecting the respondent's experienced trip duration.

3.2.3 Actual travel time

Actual travel times are calculated based on the origin-destination pairing specified by the respondents and the date and time of the day they traveled. Respondents specified the origin and destination of their most recent public transit trip by typing their postal codes or placing a pin on a map. Postal codes were converted into latitude and longitude coordinates using an addon on Google Sheets. To calculate travel time, we use a Google API Distance Matrix for which a future travel date is needed. For each respondent, a new travel date was defined as one week from the day the survey was collected to match the day of the week when the trip took place. Epoch time was then calculated using this date and the time of day when the trip took place. The latitude and longitude information and the Epoch time were imputed into the Google API Distance matrix to calculate the actual travel time by public transit. The calculations are based on the route with the shortest travel time, which is the one most likely taken by the respondent.

3.3 Measures of trip satisfaction

Respondents rated their satisfaction with overall and element-specific components of their trip. In this study, we focus our analysis on overall trip satisfaction as well as time-related elements of the trip, namely on-board and waiting times. These variables were assessed by the following statements: "Overall, I was satisfied with my experience on public transit during this trip", "I was satisfied with the length of time I spent on public transit", and "The waiting time at the stop/station was reasonable". Responses were recorded on a four-point Likert Scale ranging from

strongly disagree to *strongly agree*, neutral not included. To simplify reporting and discussion of findings, this scale is converted to *very dissatisfied-very satisfied* in the manuscript.

Even though satisfaction with access to transit (i.e., time to reach transit station/stop) is a time-related component of the trip and measured in the survey, its evaluation is out of the scope of this research as it would diverge from the focus on transit operations within this paper. Nonetheless, it should be explored in future research given its moderate to strong correlation with overall trip satisfaction as reported in the Results section.

3.4 Ordered probit modeling

To explore the influence of different perceptions of time on trip satisfaction and satisfaction with time-related elements (i.e., on-board and waiting times), we define an ordered probit model for each dependent variable of interest. We select this technique because it has been found to reduce Type I and II errors (i.e., detecting non-existing effects or failing to detect existing ones) when Likert Scales are applied when compared to converting them to metric scales (*26*). Another reason is the increasing use of such technique in the transport satisfaction field (*27-29*). Finally, an advantage is that albeit the test of parallel assumptions can be applied to ordered probit modelling (*30*), it is not required to meet this assumption (*31*).

The basic form of the model is introduced in Eq. 1, where X is the main dependent variable, Φ is the cumulative probability function for a standard normal distribution, β_k are the estimated parameters, and z_k are the explanatory variables. γ_i reflect the intercepts, which relate to the cumulative probabilities of each category *i* (*30*) and do not relate to the explanatory variables.

$$P(X \leq i) = \Phi\left(\gamma_i + \sum_k \beta_k z_k\right) \quad \textbf{(1)}$$

The models were estimated in R using the *polr* function from the *MASS* package. Marginal effects were determined with the *ocME* function from the *erer* package while statistical significance levels were defined with the *coeftest* function from the *lmtest* package. Besides metrics of tolerable, perceived, and actual travel times, variables related to sociodemographic and trip characteristics as well as perceptions of transit were incorporated as explanatory variables in the models. Descriptive statistics can be found in Table 1 (sociodemographic

variables), Table 2 (trip characteristics), and Figure 2 (perceptions of transit and trip satisfaction). Many iterations of the model containing different combinations of variables were run to analyze the data and to test the stability and accuracy of the final model.

4 RESULTS

4.1 Descriptive statistics

Table 1 reports on the sociodemographic and regional characteristics of respondents in the sample. The mean age in the sample is 71.9 years old, with a standard deviation of 5.1 years, indicating a stronger representation of younger older adults. Most respondents (50.8%) reported living in households with yearly incomes of $ 59,999 CAD or less, thus classifying them as low income. Most respondents identified as women (60.5%). Around a quarter of respondents identified with having a temporary or permanent disability affecting their ability to move around. Respondents from other genders were removed from the sample given their small sample size. Most people surveyed reported being from the Montréal region (50.5%), which can be explained by the comparative easiness of disseminating the survey locally when compared to other regions.

Table 1 – Summary statistics of sociodemographic variables

Sociodemographic characteristics	Distribution (N = 731)
Gender	
Women	442 (60.5%)
Man	289 (39.5%)
Age	
Mean age in years (Std. Deviation)	71.9 (5.1)
Income	
Low income (less than $60k)	371 (50.8%)
Middle income ($60 - $120k)	259 (35.4%)
High income (over $120k)	101 (13.8%)
Reported Disability	
Yes	177 (24.2%)
No	554 (75.8%)
Region	
Greater Montréal	369 (50.5%)
Greater Toronto	217 (29.7%)
Greater Vancouver	145 (19.8%)

Table 2 reports on the characteristics of the respondent's last trip by public transit. In the survey, respondents were asked to identify their main mode as the mode they travelled the furthest

distance with during their trip. Most defined the metro/subway/SkyTrain (47.2%) or buses (39.9%) as their main mode. Groceries/shopping (41.7%), work/volunteering (32.7%), and recreation (21.9%), including visiting friends and family, were the most frequent destinations. Most trips happened during off-peak periods (60.9%) which reflect an already known behavioral pattern among older adults (*32*). The time period informed by respondents was classified into AM peak, PM peak or off-peak based on the classification provided by the Société de Transport de Montréal on their Origin-Destination Survey (*33*). Over half of respondents stated having to make at least one transfer to reach their destination, which has been shown to negatively influence trip satisfaction (*34*).

Table 2 – Summary statistics of trip characteristics

Trip characteristics	Distribution (N = 731)
Main Mode	
Bus	292 (39.9%)
Metro/Subway/SkyTrain	345 (47.2%)
Commuter Train	27 (3.7%)
Tramway/Streetcar	67 (9.2%)
Trip Purpose	
Groceries/Shopping	305 (41.7%)
Work/Volunteering	239 (32.7%)
Recreation	160 (21.9%)
Medical Appointments	21 (2.9%)
Other	6 (0.8%)
Time Period	
AM Peak	104 (14.2%)
Off-Peak	445 (60.9%)
PM Peak	65 (8.9%)
Weekend	117 (16%)
Number of Transfers	
0	358 (49%)
1	257 (35.2%)
2	105 (14.4%)
3+	11 (1.5%)
Travel Time	
Mean tolerable travel time in minutes (Std. Deviation)	33 (11)
Mean perceived travel time in minutes (Std. Deviation)	33 (15)
Mean actual travel time in minutes (Std. Deviation)	34 (20)

Based on what respondents reported as being a tolerable travel time to reach their desired destination by transit, we find a mean travel time of 33 minutes, with an 11-minute standard deviation. This variation in responses can be due to differences in region sizes, the expansiveness and connectivity of the different transit networks, as well as the destinations considered by respondents. Nonetheless, as shown in Figure 1, most respondents gravitate towards a tolerable travel time of 30 minutes for trips by transit across all metropolitan regions.

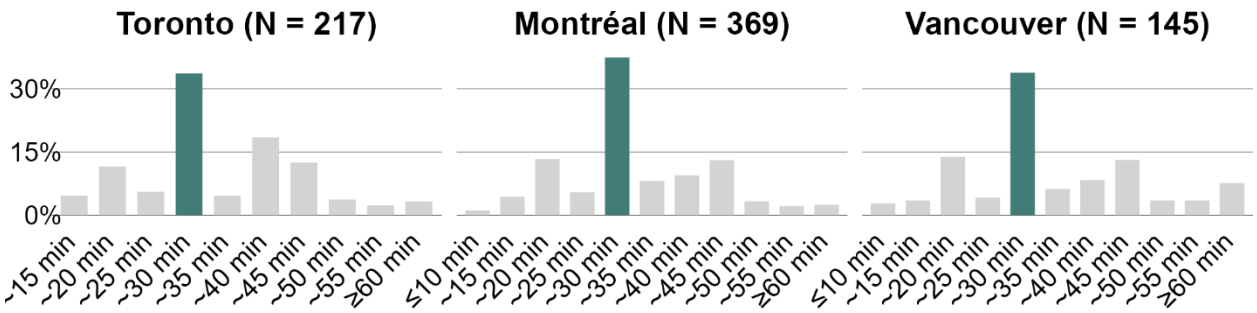


Figure 1 - Histogram of reported tolerable travel times by region

Regarding their last trip, the mean perceived travel time was also of 33 minutes, with a standard deviation of 15 minutes. Based on our calculations of their most likely actual travel time using Google's Distance matrix API, we get a mean travel time of 34 minutes, with a standard deviation of 20 minutes. No significant differences are found among the two means at the sample level, ($t(730) = -1.72$, $p = 0.08$). We further explore and unveil differences in perception of travel time among different satisfaction groups in Section 4.2.

Figure 2 shows the perception of transit services at the system level among older Canadians and their satisfaction with their last trip and time-related elements. In terms of perceptions of transit, most respondents perceived transit in their regions to be reliable (85%). In this paper, we select to report only on perceptions of reliability as we found it to be moderately to strongly correlated to other perceptions of transit service in their respective regions, such as comfort ($r(730) = 0.53$, $p < 0.05$), convenience ($r(730) = 0.58$, $p < 0.05$), and cost ($r(730) = 0.38$, $p < 0.05$). In the sample, 83% of survey respondents who used public transit were satisfied with the transit services provided in their regions.

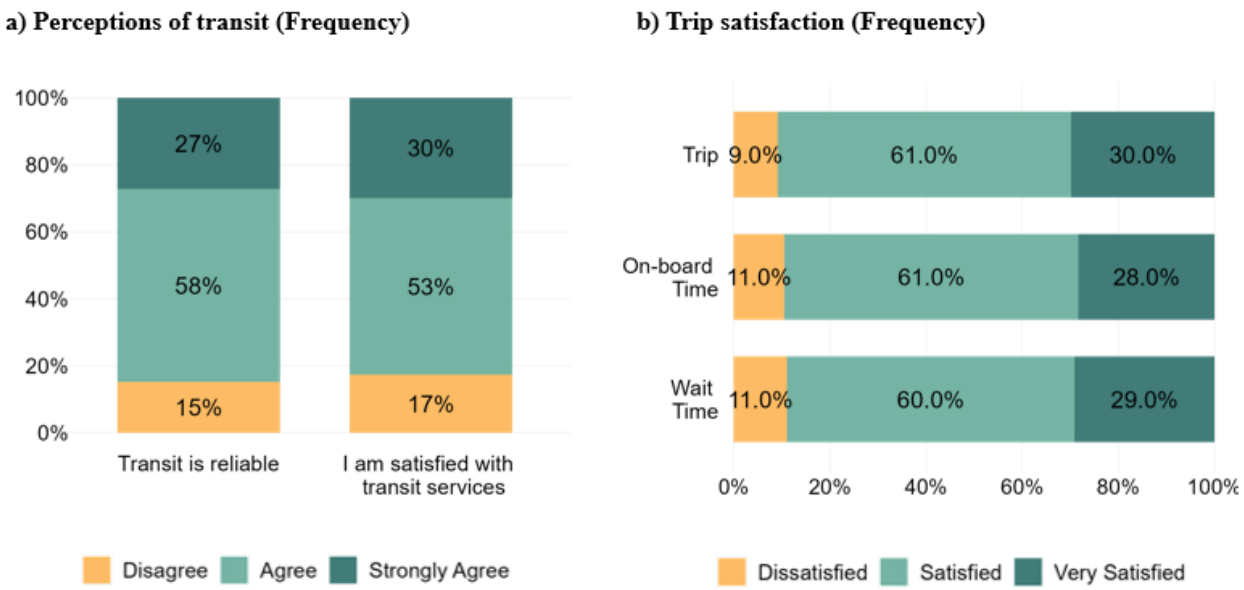


Figure 2 – Frequency distribution of respondents' perceptions of transit in their region and satisfaction with their last trip by transit

In reporting satisfaction variables, we merge the very dissatisfied with the dissatisfied category due to the small number of very dissatisfied respondents (less than 2%). Moreover, by merging these categories, the requirements of the test of parallel assumptions were met for all satisfaction variables of interest as by the results of the Brant test. Similar levels of satisfaction are found across the three variables. Around 91% of respondents are satisfied at some level with their trip while 89% are satisfied with the time spent on-board or waiting at stops/stations. Trip satisfaction is strongly correlated with satisfaction levels with access times ($r(730) = 0.65$, $p < 0.05$), on-board ($r(730) = 0.79$, $p < 0.05$) and waiting ($r(730) = 0.60$, $p < 0.05$). Thus, further highlighting the need to understand what influence satisfaction with these specific components of the trip.

4.2 Interactions between measures of travel time at various trip satisfaction levels

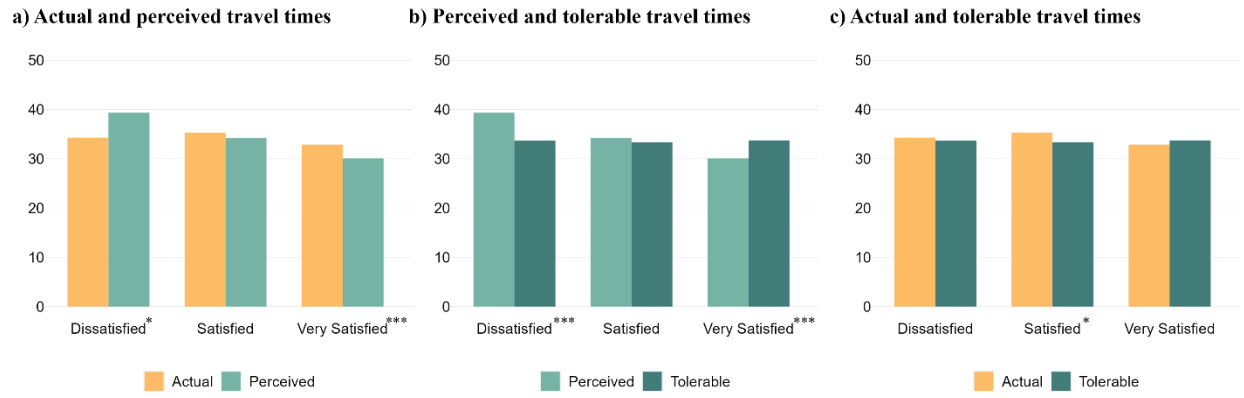
4.2.1 Differences within measures of travel time

A one-way ANOVA was performed to determine the existence of differences between the groups of transit users who were dissatisfied, satisfied and very satisfied with their last trip regarding perceived, tolerable and actual travel times. There was no statistically significant difference in mean actual ($p = 0.526$) and tolerable ($p = 0.962$) travel times between all groups. However, the test revealed a statistically significant difference for perceived travel time ($F(3, 727) = [9.05]$, $p < 0.01$). Tukey's HSD Test for multiple comparisons found that means were significantly different

across all three satisfaction groups. In this sense, even though, at the mean level, actual and tolerable times do not differ, those who are dissatisfied perceived longer travel times compared to other groups. Similarly, satisfied riders perceived higher travel times compared to very satisfied ones. These findings signal a relationship between perceptions of travel time and satisfaction levels.

4.2.2 Differences between measures of travel time

We further explore these relationships in Figure 3, which illustrates pair-wise t-tests comparing measures of travel time at the satisfaction group level. We find that dissatisfied riders perceive higher travel times compared to their actual and tolerable travel times. On the other hand, very satisfied riders perceive lower travel times compared to their actual and tolerable travel times. No statistically significant differences are found for satisfied riders. Even though we cannot pinpoint the underlying psychological reasons, these findings indicate a dissonance between perceived times and actual and tolerable travel times leading to distinct satisfaction levels. When comparing actual and tolerable travel times, significant differences are found only for the group of satisfied riders.



T-test significance levels: * p<0.05 ** p<0.01 *** p<0.001

Figure 3 – Measures of travel time and trip satisfaction

4.3 Modeling the relationship between satisfaction and measures of travel time

Table 3 includes the models developed to understand the relationship between satisfaction variables (i.e., trip satisfaction, on-board time, and waiting time) and perceptions of time (i.e., tolerable, perceived, and actual travel times), while accounting for sociodemographic and trip characteristics as well as perceptions of transit. Even though previously reported to characterize the sample, trip purpose and age were dropped from all models as they were found to be non-

significant across all model iterations. Estimates are reported in terms of odds ratio, which indicate the change in the odds of a respondent being in a higher category for every unit increase in each predictor variable, while all others remain constant. Given the interpretative challenges of odds ratios, we report the marginal effects for each category in Table 4. The marginal effects indicate the probability change of a respondent being in each category given a one unit increase in the predictor variable and all else remaining equal.

Tolerable travel time was found to have a statistically significant influence on satisfaction with their trip and on-board and waiting times. An increase by one minute in tolerable travel time would lead to an increase in the likelihood of the respondent being in the satisfied with time-based components of their trip. Meanwhile, an increase in perceived travel time has the opposite effect. Perceived travel time was found to have a statistically significant negative effect with all three satisfaction variables. Contrarily, actual travel time did not influence trip satisfaction significantly for any of the studied satisfaction variables, implying that trip satisfaction (and the intrinsic utility of time) is not based on objective measures of time and is more impacted by subjective sensibilities. However, we caution that despite our efforts to match the information inputted in Google's Distance Matrix API to reality, there still may be reporting biases at play limiting the effects of this variable on satisfaction.

Regarding trip characteristics, metro and train users were more likely to be very satisfied with their trip and the time-based elements of their trip when compared to the baseline of bus users. Having used the metro as the main mode meant an increase of 13% in the probability of being very satisfied with the trip while defining the train as their main mode increased this likelihood by 31%. While similar probabilities are found for satisfaction with on-board time, they are higher for waiting times. Those with the metro as their main mode were 21% more likely to be satisfied with their waiting times and those who had a commuter train as their main mode were 41% more likely compared to bus users. These findings highlight the influence of rail transit services on user satisfaction among older adults, as it is known to be more reliable. On the same note, it emphasizes the need for increased service frequency at off-peak times given that 61% of the sample conducted their trip at off-peak periods. Having a tramway or streetcar as their main mode did not have a significant impact on satisfaction compared to buses.

The number of transfers during the trip was found to have a positive and statistically significant effect on satisfaction with waiting times. The marginal effects show that an increase in the number of transfers by one would indicate a decrease in the probability of the respondent being very satisfied with their waiting time by 4%. Similarly, those who had their last trip by transit during a weekend day were also less likely to be satisfied with their waiting time. The marginal effects indicate a decrease of 10% in the likelihood of being very satisfied.

General perceptions of transit had the largest effects on the probability of a respondent being satisfied with both the trip and its time-related components. Those who perceive transit as reliable were found to have a 13% increase in the probability of being very satisfied with transit. A similar marginal effect was found for the other two variables. Those already satisfied with transit services in their region were more likely to be classified as very satisfied. The marginal effects indicate that an increase in one unit in satisfaction with transit services in their region signifies a 20% increase in the likelihood of the respondent being very satisfied with their trip. The marginal effects for this category were 17% for satisfaction with on-board time and 15% for waiting times. These findings denote that satisfaction with transit services has a positive and potentially recursive influence on trip satisfaction. In other words, those already satisfied with the overall system are more likely to be satisfied with their following trips.

Those who reported having a permanent or temporary disability affecting their mobility levels were less likely to be satisfied with their trip. This was the most significant factor explaining lower trip satisfaction levels. Those with mobility issues were 11% less likely to be very satisfied and 4% more likely to be dissatisfied with their trip. In consequence, it indicates the need for universal accessibility within the various stages of a transit trip so that older adults with limited mobility are satisfied. Our models indicated a regional effect on trip satisfaction as being from Vancouver had a positive influence on the models. Finally, we did not find a significant influence of socio-demographic variables (i.e., gender and income) on trip satisfaction.

Table 3 – Results of the ordered logit models

Predictors	**Trip Satisfaction**		**Satisfaction with On-Board Time**		**Satisfaction with Waiting Time**	
	Odds Ratios	*CI*	*Odds Ratios*	*CI*	*Odds Ratios*	*CI*
Intercept						
Dissatisfied | Satisfied	3.58 ***	1.80 – 7.11	2.56 **	1.30 – 5.03	3.40 ***	1.74 – 6.63
Satisfied | Very Satisfied	43.40 ***	20.75 – 90.79	27.84 ***	13.63 – 56.83	30.59 ***	15.12 – 61.89
Travel time						
Tolerable Travel Time	1.01·	1.00 – 1.02	1.01 *	1.00 – 1.02	1.01 **	1.00 – 1.02
Perceived Travel Time	0.98 ***	0.97 – 0.99	0.98 ***	0.97 – 0.98	0.98 ***	0.97 – 0.99
Actual Travel Time	1	1.00 – 1.01	1	0.99 – 1.01	1	1.00 – 1.01
Main mode						
Metro/Subway/SkyTrain	1.52 ***	1.24 – 1.86	1.51 ***	1.24 – 1.85	1.94 ***	1.59 – 2.38
Commuter Train	2.34 **	1.36 – 4.05	2.27 **	1.34 – 3.87	3.01 ***	1.78 – 5.11
Tramway/Streetcar	0.81	0.57 – 1.16	0.87	0.61 – 1.23	1.31	0.93 – 1.84
Trip characteristics						
Number of Transfers	0.96	0.82 – 1.12	0.92	0.79 – 1.07	0.87·	0.75 – 1.01
Time Period [Off-Peak]	0.82	0.62 – 1.08	0.93	0.71 – 1.22	0.88	0.67 – 1.14
Time Period [PM Peak]	1.01	0.68 – 1.51	1.26	0.85 – 1.85	1.08	0.74 – 1.59
Time Period [Weekend]	0.79	0.56 – 1.10	1	0.72 – 1.40	0.71 *	0.51 – 0.98
Perception of transit services						
Reliable	1.51 ***	1.28 – 1.78	1.50 ***	1.27 – 1.76	1.47 ***	1.26 – 1.73
Overall Satisfied	1.95 ***	1.66 – 2.29	1.76 ***	1.50 – 2.06	1.61 ***	1.39 – 1.88
Socio-demographic char.						
Gender	0.98	0.81 – 1.18	0.95	0.79 – 1.14	1.08	0.90 – 1.29
Yearly Income [Less 60k]	0.95	0.78 – 1.16	0.94	0.77 – 1.14	0.92	0.76 – 1.12
Yearly Income [Over 120k]	0.98	0.73 – 1.31	1.09	0.82 – 1.46	0.92	0.69 – 1.22
Reported Disability	0.66 ***	0.53 – 0.83	0.74 **	0.59 – 0.92	0.79 *	0.64 – 0.97
Region						
Greater Toronto	0.85	0.67 – 1.06	0.96	0.77 – 1.20	1	0.80 – 1.24
Greater Vancouver	1.39 **	1.08 – 1.79	1.53 ***	1.19 – 1.96	1.43 **	1.12 – 1.83
Observations	731		731		731	
	0.397		0.377		0.322	

*Significance levels · < 0.1 * p<0.05 ** p<0.01 *** p<0.001*

Table 4 – Marginal effects

Predictor	Trip Satisfaction			On-board Time			Waiting Time		
	Dissatisfied	Satisfied	Very Satisfied	Dissatisfied	Satisfied	Very Satisfied	Dissatisfied	Satisfied	Very Satisfied
Tolerable Travel Time	**0.002**	**0.004**	**-0.006**	**0.003**	**0.005**	**-0.008**	**0.002**	**0.004**	**-0.006**
Perceived Travel Time	**-0.001**	**-0.002**	**0.002**	**-0.001**	**-0.002**	**0.003**	**-0.002**	**-0.002**	**0.004**
Actual Travel Time	0	-0.001	0.001	0	0	0	0	-0.001	0.001
Metro/Subway/SkyTrain	**-0.034**	**-0.094**	**0.128**	**-0.044**	**-0.081**	**0.125**	**-0.084**	**-0.127**	**0.211**
Commuter Train	**-0.036**	**-0.278**	**0.314**	**-0.047**	**-0.251**	**0.298**	**-0.065**	**-0.347**	**0.413**
Tramway/Streetcar	0.02	0.04	-0.059	0.016	0.024	-0.04	-0.029	-0.062	0.091
Number of Transfers	0.003	0.009	-0.013	0.009	0.016	-0.025	**0.018**	**0.027**	**-0.045**
Time Period [Off-Peak]	0.016	0.046	-0.062	0.007	0.014	-0.021	0.016	0.025	-0.041
Time Period [PM Peak]	-0.001	-0.003	0.004	-0.021	-0.052	0.073	-0.01	-0.016	0.026
Time Period [Weekend]	0.023	0.046	-0.069	0	-0.001	0.001	**0.053**	**0.048**	**-0.1**
Reliable	**-0.034**	**-0.093**	**0.127**	**-0.043**	**-0.078**	**0.121**	**-0.049**	**-0.073**	**0.123**
Overall Satisfied	**-0.055**	**-0.15**	**0.205**	**-0.06**	**-0.109**	**0.169**	**-0.061**	**-0.091**	**0.151**
Gender	0.002	0.004	-0.006	0.006	0.01	-0.015	-0.009	-0.014	0.024
Yearly Income [Less 60k]	0.004	0.011	-0.015	0.007	0.013	-0.019	0.011	0.016	-0.026
Yearly Income [Over 120k]	0.002	0.005	-0.007	-0.009	-0.018	0.027	0.011	0.015	-0.026
Reported Disability	**0.041**	**0.074**	**-0.115**	**0.037**	**0.049**	**-0.085**	**0.033**	**0.039**	**-0.072**
Greater Toronto	0.015	0.035	-0.05	0.005	0.008	-0.013	0	0	-0.001
Greater Vancouver	**-0.023**	**-0.085**	**0.108**	**-0.037**	**-0.102**	**0.139**	**-0.039**	**-0.082**	**0.121**

Significant values in bold

5 DISCUSSIONS AND CONCLUSION

This paper focused on understanding the effects of different measures of travel time (i.e., tolerable, perceived, and actual) on trip satisfaction and satisfaction with time-related components of a trip (i.e., on-board and waiting times). We analyse data referring to Canadian older adults who answered the 2023 Aging in Place Survey. In the analysis, we explore the differences among the measures of travel time at various satisfaction levels. Then, we derive an ordered probit model for each of the variables of interest to measure their effect on satisfaction.

5.1 Interactions between tolerable, perceived, and actual travel times

When it comes to actual and tolerable travel times, we found no statistically significant mean differences across satisfaction groups (i.e., dissatisfied, satisfied, very satisfied) for all three satisfaction variables analyzed. Nonetheless, notions of mean perceived travel time were significantly different across clusters at the group level. When mean actual and perceived travel times were compared within the same group level, differences were statistically significant for both dissatisfied and very satisfied transit users. The same trend was found when comparing perceived and tolerable travel times. Dissatisfied riders tend to report higher mean perceived travel times, on average, compared to what they denote as tolerable travel time. Very satisfied riders, on the other hand, tend to perceive lower ones. No significant difference is found among satisfied riders. These differences indicate the presence of a dissonance in the perception of time as previously found in the literature (*17*).

There were no significant mean differences for reported tolerable travel times across satisfaction clusters for all three satisfaction variables. Tolerable travel times reported by older adults across Canada fall within the ranges previously found in the literature (*15; 16; 19*). Across the three metropolitan regions studied, older adults define a 30-minute trip as their threshold, which can be used as a guideline for transit agencies to plan their services.

5.2 Influence of measures of travel time on trip satisfaction

The results in our model indicate that trip satisfaction is not only influenced by perceived travel times but also by tolerable travel times. While an increase in tolerable travel time increases the probability of a rider being satisfied, increases in perceived travel times have the opposite effect. In this sense, people are likely to compare their perceived travel time not only to what they

consider as ideal (*7; 14*) but to what they consider as tolerable in defining their satisfaction levels.

We find no indication that actual travel times (i.e., an objective measure of travel time) influence trip satisfaction. Considering previous findings, this could indicate that subjective measures of time are more relevant to the understanding of satisfaction. This empirical finding could be used to justify the methodological choice of using self-reported travel times on travel satisfaction research. Nonetheless, researchers can still further investigate the influence of objective measures of time through different methods, such as GPS-based measures of travel time. In policy, transit agencies should manage user expectations by providing good predictions of travel time.

5.3 Influence of trip characteristics and perceptions of transit on trip satisfaction

Along with the main transit mode defined for the trip, perceptions of the reliability of the network and overall satisfaction with transit services were the variables that most explained changes in satisfaction among older adults. In this sense, indicating that previous experiences with transit are a key component to the level of satisfaction experienced in future trips as from previous research (*9*). Given the strong relationship between travel satisfaction and loyal behavior (*35-37*), fostering positive perceptions of transit become relevant to encouraging continuous transit usage. Besides, positive perceptions of transit throughout a person's life can influence their likelihood to use transit at later stages in life (*38; 39*). Consequently, providing service that is perceived as reliable and convenient (even at off-peak times) and fostering positive user experiences should be a major consideration for transit agencies.

5.4 Study limitations and future research

A few limitations to this study should be noted. First, even though this paper gives insight into the extent to which experienced travel times influence trip satisfaction, we do not explore what factors could lead to older adults experiencing shorter travel times. We do not look at the effects of travel time on people from mid-sized and small cities, which could be influenced by different aspects of their trip given differences in transit expansiveness and network characteristics. Further research could explore factors influencing satisfaction with access time given its strong correlation with trip satisfaction.

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