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COVID-19: Are you satisfied with traveling during the pandemic?

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ABSTRACT

The outbreak of COVID-19 and preventive measures to limit the spread of the virus has significantly impacted our daily activities. This study aims to investigate the effect of daily activity engagement including travel activity and sociodemographic characteristics on travel satisfaction during COVID-19. This study develops a latent segmentation-based ordered logit (LSOL) model using data from the 2020 COVID-19 Survey for Assessing Travel Impact (COST), for the Kelowna region of British Columbia, Canada. The LSOL model accommodates the ordinal nature of the satisfaction level and captures heterogeneity by allocating individuals into discrete latent segments. The model results suggest that the two-segment LSOL model fits the data best. Segment one is more likely to be younger and older high-income workers; whereas, segment two includes middle-aged lower-income, unemployed individuals. The model results suggest that daily activity engagement and sociodemographic attributes significantly affect travel satisfaction. For example, participation in travel for routine shopping, recreational activity, and household errands has a positive effect on travel satisfaction. The use of transportation modes like bike/walk depicted a higher probability to yield travel satisfaction. The model confirms the existence of significant heterogeneity. For instance, travel for work showed a negative relationship in segment one; whereas, a positive relationship is found in segment two. Access to higher household vehicle yield lower satisfaction in segment one; in contrast, a positive relationship is found in segment two. The findings of this study provide important insights towards maintaining the health and well-being of the population during this and any future pandemic crisis.

1. Introduction

The COVID-19 (i.e. coronavirus) outbreak was deemed a pandemic by the World Health Organization (WHO) on March 11, 2020, affecting most countries across the globe. At present (i.e. on December 17th, 2020), more than 72,556,900 people have been infected and more than 1,637,100 have died from the virus around the world (WHO World Health Organization, 2020). The COVID-19 pandemic has caused unprecedented actions to be adopted by many countries to avoid the spread of the virus. These measures include the closing of schools, restaurants, shops, prohibiting large gatherings, and imposing work-from-home. In addition, travel restrictions were imposed, and the concept of social distancing was introduced to limit the spread. Many countries (e.g., China, Italy, Spain) have enforced social distancing by imposing lockdowns, limiting non-essential travel, whereas, countries such as UK, US, Netherlands adopted less binding social distancing measures. This pandemic has not only affected human health and life but also impacted the daily activity participation and perception towards travel. For example, an increase in work from home

(Leger, 2020), e-learning, and a reduction in public activities and events significantly reduced the travel demand (De Vos, 2020). However, a sudden surge in online shopping was noticed, avoiding physical interaction during in-store purchases and travel (Fatmi, 2020). The unique scenarios introduced by the novel coronavirus pandemic have caused significant changes in the way people perform their everyday tasks. However, it is unclear how people perceive their daily activity engagement and travel related to it in this new normal and to what extent various socio-economic segments of the population have adopted these unprecedented situations. As people's daily activity engagement is a strong instrumental to achieve goals in their lives which bring social sustainability and indirectly affect their well-being, and from both research and policy perspectives it is important to assess how people perceive their travel after accepting these externally induced changes in their daily activity pattern. This study aims to investigate travel satisfaction (referred to as traveler's experience) of people while participating in daily activities and travel associated with it during this pandemic after accepting the new norms of travel restriction and social distancing.

The present study aims to investigate how daily activity engagement including out-of-home activities, travel characteristics, and sociodemographic attributes affects one's travel satisfaction during the early days of travel restrictions and social distancing. Daily out-of-home activities include in-store routine shopping, household errands, work, and others. Moreover, travel characteristics include modes of travel and companionship during travel. This study develops a hybrid latent segmentation-based ordered logit (LSOL) model utilizing the data from the 2020 COVID-19 Survey for Assessing Travel Impact (COST). This modeling technique is capable in addressing the ordered nature of the travel satisfaction level and captures unobserved heterogeneity based on the sociodemographic characteristic of an individual by allocating them into discrete latent segments. Findings from this study provide insights into people's perception of daily out-of-home activity engagement, and travel characteristics associated with it during the early days of COVID-19 travel restrictions and develop strategies to maintain well-being during any pandemic crisis or unprecedented scenarios.

2. Literature review

Travel satisfaction is one of the most important elements related to the link between travel and well-being. Travel satisfaction can be used to capture an individual's true preference for travel choice (Ye and Titheridge, 2017). In the context of travel behavior, travel satisfaction is based on feelings travelers experience, and how they evaluate their trip (De Vos et al., 2016). It consists of two dimensions; i.e. affective (referred to emotional experience during a trip) and a cognitive dimension (referred to the overall evaluation of a trip) (Ettema et al., 2011). Previous studies confirm that travel satisfaction is highly correlated with the preferred mode choice (De Vos, 2018). Recently, empirical evidence has investigated the relationship between travel characteristics (e.g. mode, duration, purpose) and travel satisfaction (De Vos et al., 2016, 2015; Mao et al., 2016; Zhu and Fan, 2018a), and found a significant association between the two. Travel satisfaction or experience during travel may have a spill-over effect on the activity at the destination, changing the traveler's perception towards it.

In travel activity engagement specifically, moods and emotions are associated with travel satisfaction. Participation in daily activity or daily routine plays an important role in travel demand. Daily travel allows people to participate in out-of-home activities such as shopping, visiting relatives, or going to work. However, the type of activity at the destination affects travel satisfaction. For instance, activities where individuals experience a high level of happiness while conducting them (e.g. leisure or recreational) are associated with a higher level of travel satisfaction (Zeid, 2009). On the other hand, commute travel (e.g. school or work) is less likable as compared to leisure-based travel (Ory and Mokhtarian, 2005), showing a negative association with travel satisfaction. Traveling to and from work is often linked with the lowest mood levels and is considered as the least appreciated activity of the day (Lancée et al., 2017). However, sudden changes in people's lives due to events like the COVID-19 pandemic can trigger the change in travel patterns (Müggenburg et al., 2015; Schoenduwe et al., 2015). As a result of preventive measures like social distancing and travel restrictions, people's daily activity patterns changed, reducing the out-of-home activities, therefore, reducing the opportunity to travel. For instance, due to travel restriction and social distancing commuters stopped traveling, significantly reducing the travel demand (Pawar et al., 2020). Recently, (Beck and Hensher, 2020) confirm that a significant decrease has been noticed in all kinds of travel (e.g. work or school-related, general shopping, social or recreational, personal business) during the spread of COVID-19. A similar trend was noticed during the outbreak of SARS and there was a significant reduction in leisure-based travel demand due to internal motivations (e.g., risk perception) and external enforced measures (e.g., travel restrictions,

imposing of stay-at-home) (Wen et al., 2005). On contrary, a higher frequency of travel related to routine shopping was noticed during the early days of the COVID-19 outbreak (Fatmi, 2020). However, (Friman et al., 2017) found that critical or unexpected incidences during travel can change mood immediately, indirectly impacting travel satisfaction. Hence it is essential to understand how these reductions in activity participation and travel due to COVID-19 restrictions have impacted one's travel satisfaction.

Travel mode choice is another critical factor to achieve higher levels of travel satisfaction, as people often tend to choose familiar modes of travel that gave them the highest travel satisfaction based on their experiences in previous travel. Prior literature confirms that travelers using a bike or walk as a mode of transport are associated with a higher level of travel satisfaction as compared to public transport users (Ye and Titheridge, 2019). However, personal characteristics can also affect travel mode choice. For instance, people try to self-select themselves into neighborhoods that allow them to travel as much as possible with their preferred mode choice (De Vos et al., 2016). For example, car-loving individuals prefer living in suburban neighborhoods as it tends to offer greater car accessibility (De Vos and Witlox, 2016), and of course, they will be satisfied with their travel. Whereas, people living in urban neighborhoods prefer transportation modes like a bike or walk due to traffic congestion, dense, and mixed land use. However, this outbreak of the virus has impacted people's travel mode choice and attitude towards it. For instance, people may avoid public transport as it makes it easier to get in contact with other passengers (Troko et al., 2011), and have a negative attitude towards it due to the fear that they might become infected with the virus while using it. As a result, people owning a car might be more inclined to travel by car, as it allows them to maintain distance from other travelers. Also, people might adopt more walking or cycling for short-distance travel as it becomes a source of recreation and it's easier to avoid social contact while using these active modes of travel (De Vos, 2020), allowing them to positively evaluate their travel. Recently, one of the studies depicts that private car is the dominant mode of transport in terms of which mode a respondent would feel most comfortable followed by walk/bike and taxi in this COVID-19 period (Beck and Hensher, 2020). Besides the travel mode, companionship also affects travel satisfaction. For example, traveling alone results in a lower level of travel satisfaction as compared to traveling with a companion (De Vos, 2019a). One of the main reasons for a higher level of satisfaction while having a companion is the fact that travelers know the other passenger, creating an opportunity for social interaction. In addition, (Zhu and Fan, 2018b) suggest that traveling with children is associated with positive emotions like happiness, whereas among negative emotions, traveling with parents is the least stressful. However, during this pandemic driving with a concept of social distancing, without a companion can lead to negative emotions like stress and adversely affect the travel experience.

Travel satisfaction should not be only regarded as an outcome of travel characteristics. It also depends upon the presence of travel-related skills and travel options available, allowing individuals to participate in an activity with a preferred mode choice. For instance, having access to transport modes like owning a car, owning a bike, or living close to the public transport network allows people to travel by their preferred mode while participating in an out-of-home activity. Moreover, individual's travel decisions are highly associated with their preference of mode and purpose of travel. For example, frequent participation in leisure-based travel is one of the primary reasons for car ownership (Lanzendorf, 2002), and it is evident that driving license ownership is a prerequisite for car ownership (Ciari and Balmer, 2007). As the access to these transport modes (e.g., household vehicles) provides an ability to travel in the desired way, indirectly associating individuals with a higher level of travel satisfaction. However, it is unclear how having access to these transportation resources affects the road user's travel experience during this pandemic.

3. Contribution of this study

This study contributes to the very limited literature available that explores how the COVID-19 outbreak and related measures affect people's perception of daily activity patterns. This study explores the relationship between travel satisfaction and daily activity attributes (including travel activity). Travel activity attributes include mode of travel, the purpose of travel, and companionship during travel. Methodologically, one of the key features of this study is to capture unobserved heterogeneity among individuals by developing a latent segmentation based ordered logit (LSOL) model, addressing the ordinal nature of the level of travel satisfaction. The level of travel satisfaction experienced by an individual might vary by their sociodemographic characteristics such as age, income, education, employment, and occupation. Such heterogeneity is accommodated within the model by allocating individuals into discrete latent segments based on their sociodemographic characteristics. A wide array of hypotheses is tested to explore the effect of daily activity engagement and other travel attributes on travel satisfaction during the early travel restriction period.

4. Modeling approach

This paper develops an LSOL model to investigate the effect of daily activity on travel satisfaction. One of the advantages of this modeling technique is to relax the homogeneity assumption of the standard ordered logit model by allocating individuals into discrete latent segments. Assuming that individual i is assigned to segment s having travel satisfaction level j. Where, j is represented using an ordinal scale of 0 (dissatisfied), 1 (satisfied), and 2 (very satisfied). The continuous latent propensity function can be written as:

$$Y_{is}^* = \beta_s Z_i + \varepsilon_{js} \tag{1}$$

where, Y_{is}^* is the latent propensity, Z_i is the individual's attributes (e.g. daily travel attributes, activity participation attributes, sociodemographic characteristics), β_s is the coefficient parameter to be estimated, and ε_{js} is the random error term assumed to follow an identical and independent standard logit distribution.

Latent propensity Y_{is}^* corresponds to the actual travel satisfaction Y_i through a threshold parameter θ in the following form:

$$Y_i = j \ if \ \theta_{j-1,s} < Y_i^* < \theta_{js} \tag{2}$$

where $\theta_{0s} = -\infty$ and $\theta_{js} = \infty$. The probability of individual i having travel satisfaction level j can be written as:

$$P_i(j|s) = \wedge(\theta_{js} - \beta_s Z_i) - \wedge(\theta_{j-1,s} - \beta_s Z_i) \tag{3}$$

where $\wedge(.)$ is the standard logistic cumulative distribution function. Further, the allocation of individual i into discrete latent segment s is probabilistically determined by formulating a latent segment allocation model within the LSOL framework. The model follows a standard multinomial logit form. Hence, the utility function of the segment allocation component can be written as:

$$U_{is}^* = \gamma_s X_i + \omega_{js} \tag{4}$$

where, X_i are the observed attributes determining the allocation of individuals into segment s, γ_s is the coefficient parameter to be estimated, ω_{js} is the random error term. ω_{js} is assumed to be identically and independently distributed with Type 1 extreme value.

The probability of individual i being assigned to segment s can be written in the following logit form:

$$P_{is} = \frac{\exp(\gamma_s X_i)}{\sum_{s=1}^{S} \exp(\gamma_s X_i)} \tag{5}$$

The unconditional probability function can be expressed as:

$$P_i(j) = \sum_{s=1}^{S} (P_i(j)|s)(P_{is}) \tag{6}$$

The log-likelihood function is given below:

$$LL = \sum_{n=1}^{N} ln \sum_{s=1}^{S} (P_i(j)|s)(P_{is}) \tag{7}$$

where N is the total number of observations. The model estimates segment-specific parameters β_s for s segments, and segment membership parameter γ_s for s-1 segments. Moreover, a traditional ordered logit model is developed for comparison purposes. The goodness-of-fit measures considered in this study are Adjusted R^2, Chi-square, and Bayesian Information Criteria (BIC) values.

5. Data used in the empirical application

The data used in the study was obtained from the 2020 COVID-19 Survey for Assessing Travel Impact (COST) survey. It was a web-based survey, which was deployed from March 24th to May 9th, 2020, and collected information about the individual's response towards this pandemic. The survey collected data related to daily activity participation, long-distance travel, and sociodemographic information Daily activity component includes in-home and out-of-home activities performed on the previous weekday. In the case of out-of-home activity, respondents were asked to report their daily activity participation, day of travel, frequency of travel, mode of travel, and companionship during travel. Respondents were also asked to rate their travel satisfaction on a Likert scale ranging from very dissatisfied to very satisfied, which was further disaggregated and the distribution of level of travel satisfaction is as follows: 31.4% dissatisfied; 40.7% satisfied; and 27.9% very satisfied. Due to the small distribution of very dissatisfied category of travel satisfaction level among the sample retained after cleaning the data for missing values, it was aggregated with dissatisfied category of travel satisfaction level. Moreover, for in-home activities, respondents provided information about the duration and frequency of activity performed. To capture alterations in daily in-home activities due to the outbreak compared to a regular non-pandemic day, duration, and change in frequency of activity were asked in the survey. A similar approach was incorporated for the out-of-home activity to capture the alterations in daily travel activity, tracking their change in frequency, mode, and companion during travel. The survey also captured information about individual's long-distance travel tracking their purpose and mode of travel and how COVID-19 has impacted their long-distance travel. The survey collected socio-economic information such as age, gender, employment, education, household income, household size, dwelling type, vehicle ownership, among others. After data collection, it was cleaned and validated for the Kelowna region of British Columbia, Canada. The Kelowna region consists of the City of Kelowna, West Kelowna, Vernon, Lake Country, and Peachland. To validate, data were compared with the Canadian census and an iterative proportional fitting technique was adopted (Lomax and Norman, 2016). The validated sample size is 202, however, due to multiple engagements in out-of-home travel activity in a day total response of 226 was retained for travel satisfaction. Detailed survey information can be found elsewhere (Fatmi, 2020). Table 1 shows the variables used in this model and descriptive statistics for each.

6. Discussion of results

This section explains the parameter estimation results of the model. To build this model a variety of socio-economic characteristics, daily activity attributes including travel activity, and in-home activity attributes are considered. The latent segmentation component of the LSOL model captures heterogeneity by assigning each individual into a discrete latent segment s. The model process begins with testing the model for multiple segments s (e.g. 2,3…) and an appropriate number of segments is determined based on lower BIC values. Results suggest

Table 1
Descriptive statistics of the variables used in this model.

Variable	Description	Mean/ Distribution	SD
Socio-demographic characteristics			
Gender	Dummy, if an individual is a female = 1, 0 otherwise	57.96%	–
Age	Dummy, if an individual's age in between 25 and 59 = 1, 0 otherwise	57.07%	–
Employment	Dummy, if an individual is not employed = 1, 0 otherwise	27.87%	–
Income	Dummy, if annual household income is less than $100,000 = 1, 0 otherwise	82.30%	–
Occupation	Dummy, if an individual has arts or sports or sales or agricultural-related occupation	28.76%	–
Dwelling type	Dummy, if dwelling type of an individual is owned = 1, 0 otherwise	76.99%	–
Household size	Dummy, if the number of individuals in a household is less than or equal to 3 = 1, 0 otherwise	65.48%	–
Household vehicle	Number of vehicles in a household	3.17	1.20
Daily activity attributes			
Travel for work	Dummy, if an individual made only work-related travel in a day = 1, 0 otherwise	22.56%	–
Travel for household errands	Dummy, if individual traveled for household errands in a day = 1, 0 otherwise	13.71	–
Travel for routine shopping by car	Dummy, if individual traveled for routine shopping by car in a day = 1, 0 otherwise	30.97%	–
Travel for recreational activity by car	Dummy, if individual traveled for recreational activity by car in a day = 1, 0 otherwise	7.07%	–
Travel by walk/ bike	Dummy, if individual traveled by walk or bicycle in a day = 1, 0 otherwise	11.50%	–
Companion during work-related travel	Dummy, if individual traveled with a companion for work in a day = 1, 0 otherwise	11.32%	–
Leisure-based activity	Duration of leisure-based activity performed by an individual in a day in minutes	212.03	146.26

Note: SD = Standard deviation.

that the model has a BIC value of 529.097 for two segments. Whereas, for three segments BIC value of 549.663 was reported. As a lower BIC value indicates a better fit, the final LSOL model assumes two segments. A traditional ordered logit model was developed to compare the statistical performance of latent segmentation based ordered logit model (LSOL) based on goodness-of-fit measures. The two models are compared in terms of overall statistical fit, using the likelihood ratio test (Anderson and Hernandez, 2017; Fountas and Anastasopoulos, 2017; Hao et al., 2016). The test statistic χ^2 is chi-squared distributed with degrees of freedom equal to the difference in the number of parameters between the unrestricted and restricted models. The test results suggest that LSOL is statistically superior model with chi-square statistic of 66.942 whereas, computed χ^2 is 108.094 with 17 as the difference in the degree of freedom between restricted and unrestricted model. In addition, a higher adjusted R^2 value of 0.165 than that of the ordered logit model (0.018) was reported suggesting LSOL outperforms the traditional ordered logit model in terms of goodness-of-fit measures. Moreover, traditional ordered logit model could not be included in the study due to discrepancies in the hypothesis confirmation as it does not captures unobserved heterogeneity (Fatmi and Habib, 2019) along with reasonable statistical significance. Therefore, the LSOL model with two segments is considered for further discussion in the study.

6.1. Model results of latent segmentation allocation component

This model identifies segments based on the sociodemographic characteristics of an individual (Table 2). Sociodemographic characteristics like age, income, employment, and occupation are considered to allocate individuals into latent segments. The model results show a negative coefficient value for the middle-aged population, indicating a higher probability of younger or older individuals belonging to segment 1. The negative coefficient of income suggests that individuals who belong to segment 1 live in a household having an annual income of more than $100,000 before taxes. Similarly, the negative coefficient of employment reveals that the population which is more likely to be employed belongs to segment 1. Lastly, the positive coefficient of occupation suggests that an individual's occupation is arts, sports, sales, or agricultural related. In contrast, individuals allocated in segment 2 can be identified as middle-aged people living in a household with a total annual income of less than $100,000 and are less likely to be working outside the home. Moreover, they can be identified as people having occupations related to health, natural and applied science, or the government sector.

6.2. Parameter estimation results of the model

6.2.1. Daily activity attributes

Among daily activity attributes, the result in Table 2 reveals inter-segment heterogeneity. For example, individuals participating in work-related travel are less likely to have a higher level of travel satisfaction in segment 1. This finding contributes to the understanding that work-related travel is often associated with negative emotions adversely affecting travel satisfaction (Mokhtarian et al., 2015; Morris and Guerra, 2015). Moreover, travel restrictions and social distancing measures due to COVID-19 also has a spillover effect on travel

Table 2
Parameter estimation results.

Variables	Segment 1 Coefficient (t-stat)	Segment 2 Coefficient (t-stat)
Latent segment allocation component		
Segment allocation probability	0.646	0.354
Constant	3.177 (3.81)	Reference
Age (25 to 59 years old)	−2.480 (−4.00)	Reference
Income < $100,000	−1.751 (−2.53)	Reference
Not Employed	−1.757 (−2.98)	Reference
Occupation	2.689 (3.70)	Reference
Parameter estimation results		
Daily activity attributes		
Travel for work	−1.848 (−2.45)	2.075 (2.00)
Companion during work-related travel	3.565 (2.07)	–
Travel for household errands	–	3.667 (1.98)
Travel for routine shopping by car	1.234 (2.12)	–
Travel for recreational activity by car	2.036 (1.47)	–
Travel by walk or bike	2.530 (4.63)	1.360 (1.15)
Duration of leisure-based activity	−0.002 (−1.24)	−0.003 (−1.89)
Sociodemographic characteristics		
Gender: female	0.583 (1.35)	−2.058 (−2.66)
Household size ≤ 3	1.706 (2.44)	−0.535 (−0.85)
Dwelling type: owned	1.487 (2.56)	–
Number of household vehicles	−0.453 (−2.49)	0.581 (2.39)
Threshold parameters		
Threshold 1	0(–)	0(–)
Threshold 2	3.511 (5.05)	0.750 (2.22)
Goodness-of-fit measures		
Log-likelihood at convergence	−185.951	
Log-likelihood at constant	−219.423	
Number of observations	226	
Adjusted R^2	0.152	
BIC value	529.097	

Note: t-stat = t-statistics.

satisfaction, making travel more stressful. In contrast, travel for work showed a positive relationship with travel satisfaction in segment 2. Since people who are not working outside their home no longer have a lot of destinations to travel to and might take this as an "opportunity to travel" and experience positive emotions which results in a higher level of travel satisfaction. In addition, reduced travel demands due to COVID-19 measures resulted in less traffic congestion making trips less stressful. Interestingly, variables indicating companion during work-related travel showed a positive relationship with travel satisfaction. This finding aligns with the previous understanding that travels made with a companion (allowing social interaction during travel) is associated with a higher level of travel satisfaction as compared to travel made alone (De Vos, 2019b; Mokhtarian et al., 2015). Moreover, travel for household errands and routine shopping depicted a higher likelihood of travel satisfaction. As the activity at the destination has a strong correlation with travel satisfaction (De Vos, 2019b), this finding reaffirms an understanding that participating in activities such as shopping yields a positive emotion among individuals due to social engagement linked with it and has a positive effect on travel satisfaction.

Travel for recreational purposes by car has revealed similar results showing a positive relationship with travel satisfaction, as anticipated. Interestingly, apart from the nature of the activity, this finding could be due to the people's positive attitude towards travel by car (Zhu and Fan, 2018b) and an understanding that cars can avoid physical contact protecting them from getting exposed to other travelers. Among travel modes, individuals making travel by walk or bike are more likely to be associated with a higher level of travel satisfaction in both segments. This finding suggests that travel made by walk or bike results in an experience of positive emotions (De Vos et al., 2016) and is highly correlated with travel satisfaction, but also considered as a form of recreational activity and thereby allowing individuals to get exposed to positive emotions, and enjoyable environment, and the beautiful surroundings (Mokhtarian and Salomon, 2001). As mentioned earlier, researchers have focused on exploring the relationship between in-home activity (i.e. activity at origin/destination) and travel satisfaction. Among in-home activity, the duration of leisure-based activity depicted a negative relationship with travel satisfaction in both the segments. Result confirms that out-of-home activities (e.g., playing, visiting friends) are perceived more positively as compared to in-home activities (e.g., watching television), as out-of-home activities are often coupled with social interaction (Archer et al., 2013; Ravulaparthy et al., 2013; Spinney et al., 2009). Moreover, due to measures like social distancing because of this pandemic reduction in socially engaged lifestyle is obvious, hence negatively affecting travel satisfaction of an individual.

6.2.2. Sociodemographic characteristics

Apart from daily activity engagement this study also incorporates the effect of sociodemographic characteristics on travel satisfaction. Among sociodemographic characteristics, variable indicating females and household size ≤3 revealed similar inter-segment heterogeneity and are positively linked with travel satisfaction in segment 1. This finding might be due to the spillover effect of living in high-income households and working outside of the home as an employee. These two domains of life allow individuals to have higher motility and encourage activity participation. For instance, activity at destination i.e. work can be considered as rewarding, and socially engaging bringing positive emotions during travel and allowing them to have a higher level of travel satisfaction. On the other hand, individuals in segment 2 showed a negative relationship. Low income and not working outside the home for pay might be a confounding factor for this relationship. Results show that people living in owned dwellings have a higher level of travel satisfaction. The popularity of owned dwelling among older and younger individuals could allow better access to the most common activities, making them more socially engaged, and proximity to close-

by destinations allows individuals to use their preferred mode choice, indirectly linking them with a higher level of travel satisfaction. Access to preferred transport modes is positively linked with travel satisfaction, however, inter-segment heterogeneity is captured as the variable indicating the number of household vehicles showed a negative relationship in segment 1. It can be argued that motility i.e. the ability to travel in the desired way with preferred mode choice is associated with access to transport resources (e.g., owning a car) but, with travel barriers or travel restrictions, it can get affected. Regardless of having access to these transport resources travel restrictions can result in limited to no use of preferred travel mode choice, hence, negatively influencing travel satisfaction. In contrast, a positive relationship was observed in segment 2. This result depicts that low-income unemployed individuals highly appreciate access to vehicles which empowers them to choose their preferred mode and seeks opportunity to travel which allows them to experience positive emotions linking them with a higher level of travel satisfaction (De Vos, 2018; Morris, 2011).

7. Conclusion

This study exclusively considers the effect of daily activity engagement and sociodemographic characteristics on travel satisfaction. The study utilizes data from the 2020 COVID-19 Survey for Assessing Travel Impact (COST) for residents of Kelowna, British Columbia, Canada. To investigate this relationship a latent segmentation-based ordered logit (LSOL) model was developed in this study. One of the key features of this modeling technique is its ability to address the ordinal nature of travel satisfaction as well as capturing the heterogeneity among individuals. In this study, a model with two segments is estimated based on BIC measures. Individuals are allocated into discrete latent segments based on their sociodemographic characteristics. Segment 1 includes younger or older individuals living in a high-income household and is most likely to be working outside of the home as an employee, whereas segment 2 includes middle-aged people residing in a low-income household and not working outside of the home as an employee. In addition, goodness-of-fit measures suggest that the LSOL model outperforms the traditional ordered logit model.

The parameter estimation results confirm the influence of daily activity engagement and sociodemographic characteristics on travel satisfaction. For example, model results reveal the existence of inter-segment heterogeneity as a variable indicating participation in work-related travel showed a negative association with travel satisfaction in segment 1, whereas, for segment 2 results were contrary. It can be expected that in times of social distancing and travel restrictions travel demand will be low due to the shift in the working environment (i.e. work from home), however, if any travel is made people might consider it as an opportunity to travel and engage socially, allowing them to have a higher association with travel satisfaction. Moreover, travel for routine shopping and household errands showed a positive relationship with a higher level of travel satisfaction as expected. Interestingly, individuals participating in recreational activity by car have a higher level of travel satisfaction which might be due to the understanding that recreational activities bring out positive emotions like joy and happiness, and cars are associated positively with travel satisfaction as they avoid physical contact with other travelers. As expected, individuals participating in travel by walk or bike showed a higher likelihood of travel satisfaction, allowing people to maintain higher well-being levels. Also, the variable indicating companionship during work-related travel is positively linked with travel satisfaction, indicating the importance of social interaction during travel overshadowing the spill-over effect of social distancing and travel restrictions due to the COVID-19 pandemic.

In addition, this research analyzes the effect of sociodemographic characteristics on travel satisfaction. Among sociodemographic characteristics, females are more likely to be positively linked with travel

satisfaction in segment 1 indicating the importance of daily activity engagement due to work and the spillover effect of higher household income. Findings suggest that living in an owned dwelling is positively linked with travel satisfaction as it allows better access to different built environment attributes. Interestingly, variable indicating household vehicles revealed inter-segment heterogeneity. The results indicate that access to these transport resources allows individuals to travel by their preferred mode but in certain circumstances where travel restrictions and social distancing are new norms, motility gets affected limiting individual's option of mode choice and negatively influencing their travel satisfaction.

Nevertheless, this study has some limitations. Longitudinal data capturing how travel experience changes over time, and how people have adopted COVID-19 measures in their daily life can provide better insights into this relationship. As this study focuses on travelers' experience just after the imposition of travel restrictions, it will be interesting to see how COVID-19 mitigation strategies associated with travel restrictions, social distancing, lockdowns, and so forth have affected travel satisfaction during different timeframes. Future studies must consider the impact of the built environment on activity engagement, and travel satisfaction during such unprecedented scenarios. Finally, results show the need to adopt intervention strategies where policies make public transport safer as it is commonly used by people not having access to the car or have a physical disability. In addition, due to social distancing cars became a dominant mode of transport, hence, policymakers must develop intervention strategies to shift this dominance and make other modes of transport more accessible and safer. Moreover, policymakers and planners should encourage access to public green spaces where residents can experience positive emotions while cycling, walking, or participating in any recreational activity, allowing them to maintain well-being during this pandemic crisis.

Authors contributions

The authors confirm contribution to the paper as follows: study conception and design: S. Khaddar, and M. Fatmi; data collection: M. Fatmi; analysis and interpretation of results: S. Khaddar, and M. Fatmi; draft manuscript preparation: S. Khaddar, and M. Fatmi. All authors reviewed the results and approved the final version of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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