Route to Happiness:

Unravelling the Link between Transportation and Quality of Life

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Abstract

This research paper studies how mobility via modes of transport and infrastructure affect satisfaction with life and satisfaction with quality of life in the community in the United States. The National Community Livability Survey is used for the analysis. Specifically, the independent variables used are perceived quality of public transit, perceived walkability rate and number of vehicles owned in the household. Interaction terms between quality of public transit and vehicles owned and between geographic region (urban/ urban cluster/ rural) are included in the models. Linear regression and ordinal logistic regression are utilised to look at the impact for satisfaction with life and satisfaction with quality of life in the community respectively. The results show that both higher walkability rate and owning more vehicles improve satisfaction with life and quality of life. On the other hand, perceived public transit quality and the presence of public transit in rural areas significantly improve the satisfaction with quality of life in the community. Thus, initiatives to increase the walkability of areas and improve public transit accessibility can be taken.

Introduction

Public transport and walkability enable access to essential resources and services such as groceries, healthcare and education. Additionally, higher mobility allows one to engage in social interactions and to access entertainment such as retail and dining. Together, the aspects of access to essential resources and socialisation are referred to as subjective wellbeing (Makarewicz & Németh, 2017, Pfeiffer et al. , 2023). Many regions of the United States are not built for pedestrians due to low walkability, the absence of sidewalks in certain areas and lack of public transport, making the country's residents heavily reliant on vehicles (Carson et. al., 2023; Kolodinsky et. al., 2013). Consequently, if an individual does not own a vehicle, it can lead to detrimental effects on their well-being. Therefore, this research paper aims to answer the following questions:

a. *How do modes of transport impact satisfaction of life?*

b. *How do modes of transport affect one's satisfaction with quality of life in the community?*

The remaining sections of the paper will include a literature review highlighting the transport-related variables that influence life satisfaction and quality of life, the methodology including description of data from the National Community Livability Survey and models used: linear regression with interaction effects and ordered logistic regression and finally the results regarding how number of vehicles owned, public transit quality and walkability affect life satisfaction and quality of life .

Literature Review

Researchers have discussed how wellbeing is affected by public transit, car ownership and walkability. For instance, Makarewicz and Németh conducted a survey to understand how the accessibility to and use of several modes of transport affected subjective well-being in the Denver metro area (2018). They explained that subjective well-being encompasses financial security, emotional and physical health and the standard of living. The survey asked questions regarding the transportation modes available and how they travelled to frequent destinations such as the grocery store, medical care, school and jobs. Using this information, a travel behaviour variable was created to have three categories- relied on one mode (modal), relied on mostly on one mode (semimodal) and relied on several modes regularly (multimodal). Moreover, the accessibility to transport options was included in the analysis. They also included income and urban form (suburban, urban neighbourhood and urban core) in their analysis. Utilising ANOVA and bivariate correlations, they found that across income groups, those who travelled multimodally had a higher standard of living and connection to communities. However, for those multimodal respondents who belonged to the high-income group, there was no significant effect on overall subjective well-being. For all respondents, owning a vehicle was associated with higher subjective well-being unless they did not have other modes of transport. A higher positive correlation between living in an urban core area and subjective well-being was only found for those who belonged to the low-income group. Finally, it was found that those who travelled multimodally were more likely to live in the urban core regions which typically have more transit options and a greater walkability. Hence, they demonstrated the importance of including variables that measure perception of accessibility to public transit and vehicle ownership while studying factors that impact quality of life (Makarewicz & Németh, 2018). Moreover, the research illustrated that controls such as income and geographic region should be incorporated.

Certain papers looked more specifically into how walkability plays a role. Carson et al. studied how neighbourhood walkability affected social health factors such as sense of community and social interaction in the metropolitan areas of Seattle/King County and the Maryland counties near Washington D.C. and Baltimore. They created a walkability index which included parameters such as the distribution of land into residential, retail and entertainment and net residential density. Additionally, they created a self-selection variable which contained reasons why people moved to a neighbourhood- this included the ease of walking, proximity to public transit and desire for services and stores in the vicinity. Using a mixed model, they found a greater walkability significantly results in higher social interaction and a greater sense of community. On adding the self-selection variable, neighbourhood walkability did not significantly impact the sense of community but still affected social interaction.

Moreover, Pfeiffer et. al. looked into how neighbourhoods which are objectively more walkable, with transit available and parks along with people's perceptions of the factors mentioned above affect life satisfaction in Phoenix, a quintessential American suburban area (2020). While the study did establish that objectively more walkable neighbourhoods caused a slight increase in life satisfaction, when variables such as social capital and people's engagement with nature are included, the magnitude of the effect decreases. The perceptions of accessibility to transit and perceived did not have any relation to life satisfaction, when controls regarding the neighbourhood and demographics were included (Pfeiffer et. al., 2020). Although the papers found mixed results regarding walkability, it is worth exploring the walkability aspect in this paper's research since the data is on a national level as opposed to a specific suburban/ metropolitan region that was studied in the previous literature.

Finally, some of the research has utilised structural equation modelling approaches to find the relationship between mobility and life satisfaction. Kolodinsky et. al. utilised structural modelling to understand how unserved travel demand, attitudes towards the weather, the availability of amenities and the social environment can affect quality of life in the rural areas of Maine, Vermont and New Hampshire (2013). The first model included factors regarding mobility such as having a motor vehicle, knowing people who cannot get to the places they want to, being able to get to the places that they needed to and the walkability impacts unserved travel demand. The results from this model showed that access to motor vehicles had the greatest impact in reducing unserved travel demand. A second model was used to predict the number of trips made. Finally, the third model used the results from these two as part of the travel demand aspect to predict the quality of life. While the number of trips was not significant, a negative association was found between the unserved travel demand and quality of life (Kolodinsky et. al., 2013).

Similarly, Cao researched how the access to light rail transit in the Hiawatha corridor, a traditional urban area in Minnesota affected satisfaction with life through a structural equation model (2013). They also used urban and suburban control corridors located in Minneapolis in their analysis. The research found that the presence of the Hiawatha corridor affects travel satisfaction because it influences individual's perceived accessibility to transit and destinations. In turn, greater travel satisfaction leads to a greater satisfaction with life (Cao, 2013). Therefore, these papers highlighted the importance of perception of accessibility to public transit and car ownership in determining life satisfaction.

Hypotheses

Based on the findings in the literature, the independent variables chosen for the analysis include the number of vehicles owned, perceived walkability rate, perceived quality of public transit. Moreover, two interactions a) number of vehicles owned and perceived quality of public transit and b) perceived quality of public transit and geographic area were included. The hypotheses for how these variables impact satisfaction with life and satisfaction with quality of life in the community are as follows :

Satisfaction with Life

1. The presence of one or more vehicles in the household improves satisfaction with life.
2. People who live in communities with better perceived walkability will be more satisfied with their life overall.
3. People who have access to higher perceived public transit quality will be more satisfied with their life overall.
4. The presence of a vehicle in the household may reduce the effect of higher perceived public transit quality on satisfaction with life.
5. Higher perceived public transit quality in a rural area may have a greater impact on satisfaction with life than higher perceived public transit quality in an urban area.

Satisfaction with Quality of Life in the Community

1. The presence of one or more vehicles in the household is associated with higher satisfaction with quality of life.
2. People who live in communities with better perceived walkability will be more satisfied with their quality of life.
3. People who have access to higher perceived public transit quality will be more satisfied with their quality of life.

4. The presence of a vehicle in the household may reduce the effect of higher perceived public transit quality on satisfaction with quality of life.

5. Higher perceived public transit quality in a rural area may have a greater impact on satisfaction with the quality of life than higher perceived public transit quality in an urban area.

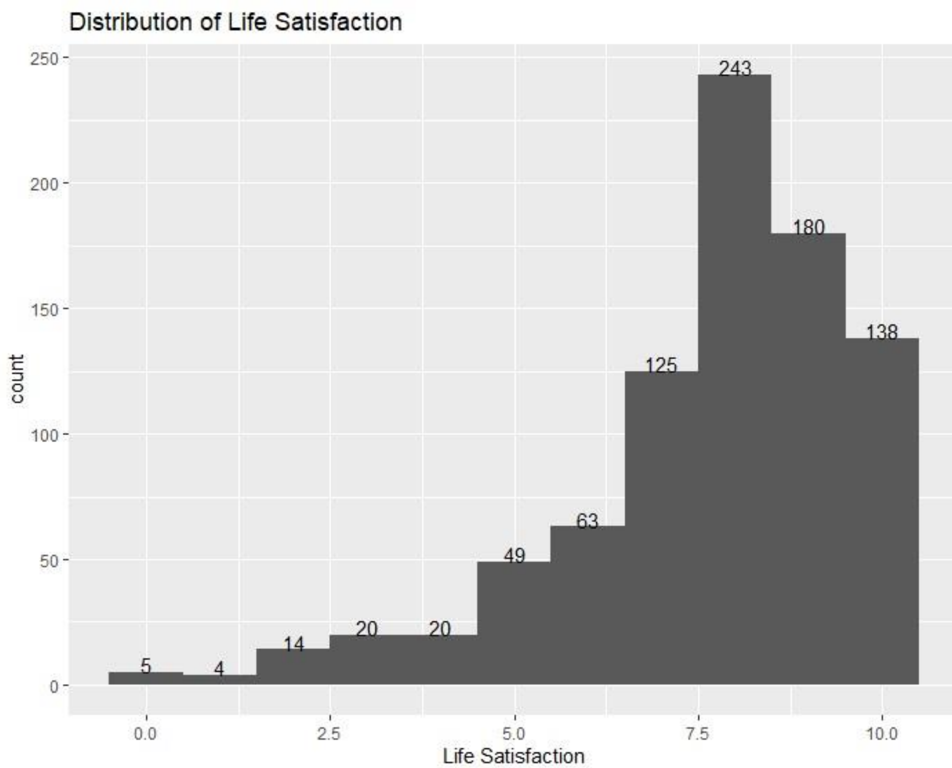
Research Design

The dataset used in this research is from the National Community Livability Survey. The survey was conducted by the Texas A&M Transportation Institute and Upper Great Plains Transportation Institute's Small Urban and Rural Transit Centre present at North Dakota State University in 2017 (Texas A&M Transport Institute, 2017). They asked questions pertaining to transportation, specifically views on public transit and aspects regarding quality of life in the community. The sample consists of 994 adults above the age of 18, who have a mailing address in one of the 50 states in USA. After cleaning the data, the sample size reduced to 861. It is a stratified random sample and is nationally representative (Mattson et al., 2021; Texas A&M Transport Institute, 2017).

I utilised two dependent variables- satisfaction with life and satisfaction with the quality of life in the community.

Figure 1

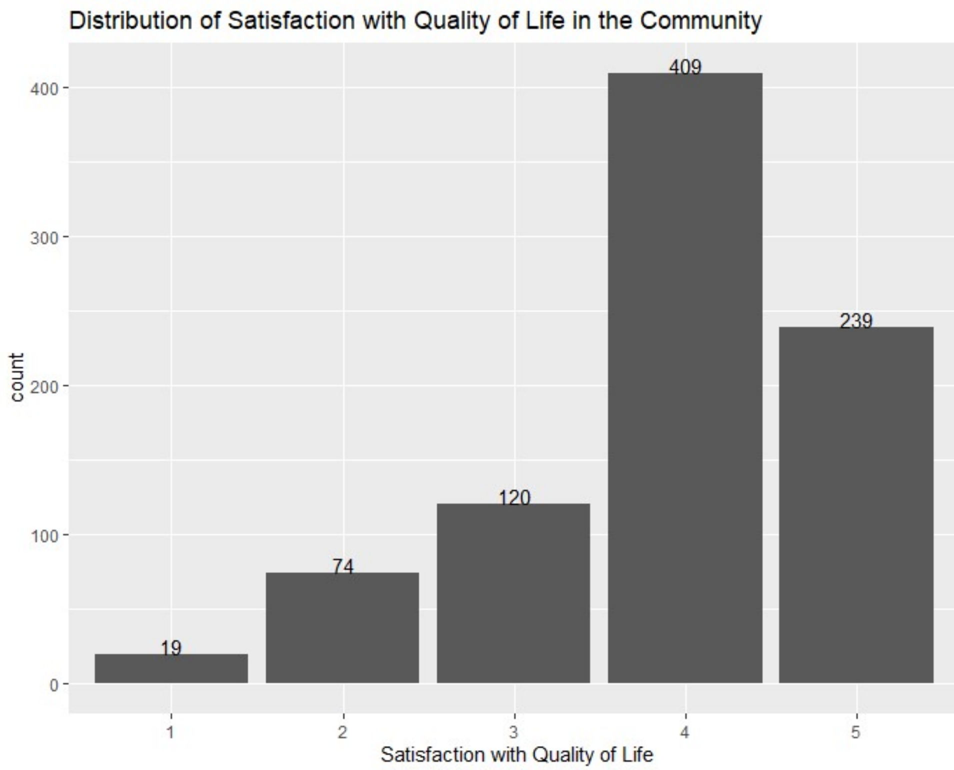
Distribution of Life Satisfaction



The question specifically asked for the satisfaction of life variable was- "All things considered, how satisfied are you with your life as a whole these days?" (Texas A&M Transport Institute, 2017). Since the variable is a scale ranging from 1-10, it is used as a numeric variable. The mean life satisfaction is 7.68 and the variance is 3.84. A linear regression with interaction effects is utilised as the satisfaction with life variable is numeric.

Figure 2

Distribution of Satisfaction with Quality of Life in the Community



The question specifically asked for the satisfaction with quality of life in the community was- “How satisfied are you with the quality-of-life in your community?” (Texas A&M Transport Institute, 2017). The scale ranges from 1-5, so it is an ordinal categorical variable. The mode for satisfaction with quality of life is 4. An ordinal logistic regression with interaction effects is utilised since quality of life is an ordinal categorical variable. A linear regression was also run since there were 5 values but the results found were slightly different. However, ordinal logistic regressions typically provide a more reliable result so it was selected as the model.

The main independent variables are number of vehicles in the household, perceived public transit quality and perceived walkability rate. The number of vehicles in the household ranges from no vehicles (0) to 3. The perceived walkability rate was based on how respondents rated the quality of walkability in their community, it ranged from 1-5 where a higher number depicted a greater quality of walkability. The number of vehicles in the household and perceived walkability rate, were utilised as factor and numeric variables in different models. The perceived public transit quality was created using 2 variables- one which asked respondents if they had public transit in their community or not and the other which asked respondents to rate the quality of public transit in their community. It ranged from 0 to 5, where 0 denoted that there was no public transit and between 1-5, a higher value depicted better quality of public transit. This was used as a factor variable in all models.

The controls included in the models are income, geographic area (rural, urban cluster and urban), age, education, race (White or person of colour), gender, since, with the exception of geographic area, previous literature has used these variables to study life satisfaction. As mentioned in the literature review section, income and geographic area play a role in affecting wellbeing (Makarewicz & Németh, 2018). Income is on scale of 1-8, where 1 denotes earning less than $15000 and 8 denotes earning $25000 or more. The dataset had zipcodes so I utilised this to create the geographic area variable. I merged the dataset with data from the zipcodeR package, since it had population numbers corresponding to zipcodes. Then I classified each observation based on the Census definition that a place with a population less than 2500 is rural, between 2500-50000 is an urban cluster and above 50000 is urban (Ratcliffe, 2022). Age is on a scale of 1-8, where most levels denote a range of 9 years;1 is 18-24 and 8 denotes 85 or older. Typically, life satisfaction and well-being do not have a linear relationship with age as it reduces till mid-40s and then rises after that; but when controlled for mortality rates, life satisfaction starts decreasing around 70 (Blanchflower & Graham, 2020). Education ranges between 1-6 where 1 is some grade school and 6 is master's, professional or doctorate degree. Gender is a binary variable in the data where 0 is female and 1 is male. Higher education has been found to positively influence life satisfaction and an interaction with gender showed this effect to be stronger for females (Zhang et. al., 2017). Although studies have shown differences in how races report life satisfaction, the dataset had a majority of respondents who were White (782 respondents) and only 79 respondents for people of all other races so this was used as a binary variable in the model (Zhang et. al., 2017; Wadsworth & Pendergast, 2021).

For both models, two interaction terms were used- number of vehicles in the household and perceived public quality transit; and geographic region and perceived public quality transit. Since one may not use public transit if they own a vehicle, the quality of public transit would not affect them. Regarding the geographic region, urban areas typically are more connected via public transit whereas rural areas are more spread out, so having better public transit in a rural area may be more effective (Kolodinsky et. al., 2013).

Analysis and Results

Linear regression on Life Satisfaction with Interaction terms

Table 1

Linear Regression on Satisfaction with Life

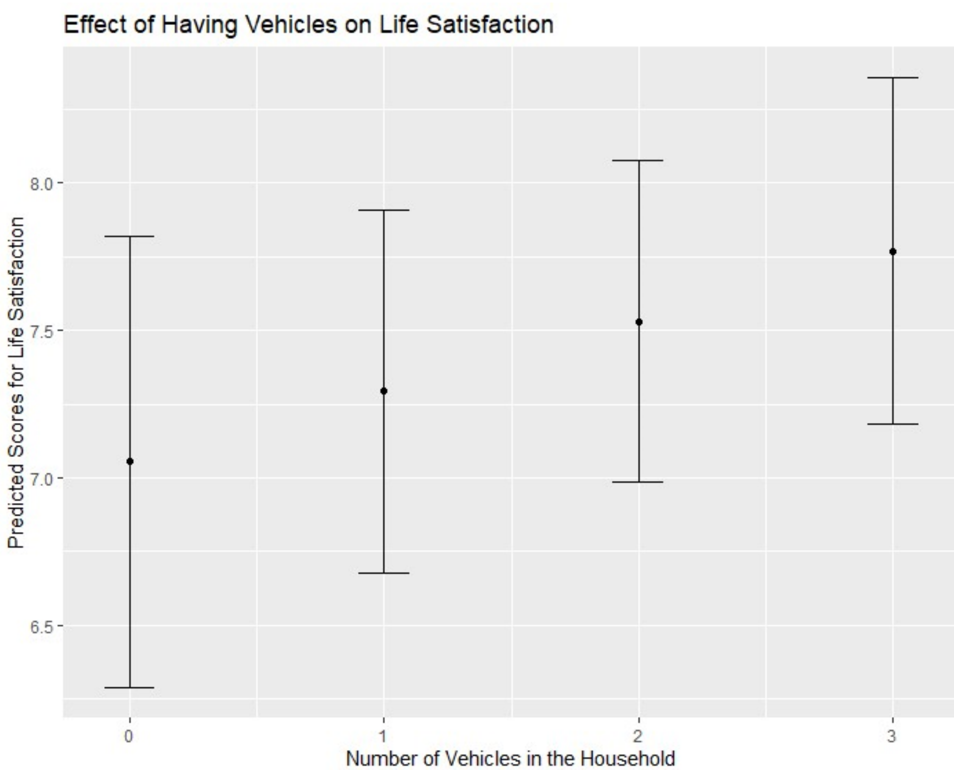
	Dependent variable:
	Satisfaction with Life
# of cars in household	0.238* (0.130)
Public Transit Quality (PTQ)-Level 1 (reference:0)	0.482 (1.043)
PTQ Level 2	-0.246 (0.749)
PTQ Level 3	-0.086 (0.750)
PTQ Level 4	0.581 (0.891)
PTQ Level 5	2.200 (1.538)
Urban Cluster (reference:Rural)	0.024 (0.215)

Urban(reference:Rural)	0.834 (1.318)
Walkability Level 2 (reference:1)	-0.060 (0.273)
Walkability Level 3	0.200 (0.254)
Walkability Level 4	0.340 (0.261)
Walkability Level 5	1.013*** (0.310)
Household Income	0.206*** (0.043)
Age	0.312*** (0.043)
Education	-0.002 (0.049)
Race (0=white,1=person of colour)	0.314 (0.224)
Gender(0=female,1=male)	-0.463*** (0.130)
# of cars in household : PTQ Level 1	0.130 (0.328)
# of cars in household : PTQ Level 2	0.270 (0.262)
# of cars in household : PTQ Level 3	-0.040 (0.204)
# of cars in household : PTQ Level 4	-0.056 (0.243)
# of cars in household : PTQ Level 5	-0.423 (0.397)
PTQ Level 1:Urban Cluster	-1.001 (0.801)
PTQ Level 2:Urban Cluster	-0.337 (0.595)
PTQ Level 3:Urban Cluster	0.141 (0.668)
PTQ Level 4:Urban Cluster	-0.079 (0.807)
PTQ Level 5:Urban Cluster	-1.224 (1.378)
PTQ Level 1:Urban	-0.854 (1.986)
PTQ Level 2:Urban	-0.449 (1.639)
PTQ Level 3:Urban	-1.374 (1.637)
PTQ Level 4:Urban	-0.950 (1.645)
PTQ Level 5:Urban	-2.642 (2.014)
Constant	4.564*** (0.461)
Observations	861
R^2	0.151
Adjusted R^2	0.119
Residual Std. Error	1.840 (df = 828)
F Statistic	4.615*** (df = 32; 828)
Note:	*p<0.1; **p<0.05; ***p<0.01

The results showed that having more vehicles and the perceived walkability at level 5 were positively associated with life satisfaction, up to 10% and 1% respectively. Both of the results are in line with the hypotheses. The effect of perceived public transit quality and its interactions with the number of vehicles and geographic region were not statistically significant. Among the controls, a higher income level, higher age group and being female were associated with greater life satisfaction, with all results being statistically significant up to 1%.

Figure 3

Effect of having Vehicles on Life Satisfaction

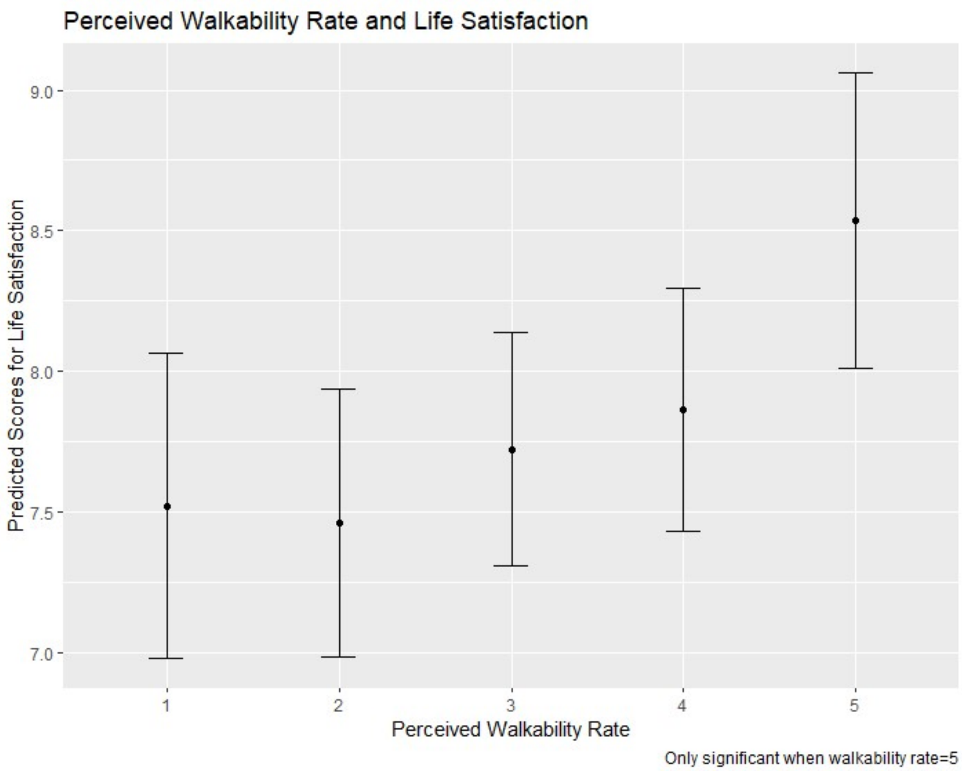


Note. Adjusted for: Walkability rate=1, public transit quality = 0, Geographic region = Rural, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

This follows a linear pattern where more vehicles in the household increase the predicted life satisfaction score. Perhaps having more vehicles is particularly useful, when the household comprises nearly as many individuals as there are vehicles. Consequently, members are not necessarily dependent on each other to travel and have their own means to do so.

Figure 4

Perceived Walkability Rate and Life Satisfaction



Note. Adjusted for: number of vehicles=1.96, public transit quality = 0, Geographic region = Rural, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

This demonstrates that the perceived walkability rate does not follow a linear trend, since the predicted score drops when walkability is rated as 2 and is much higher when it is rated as 5. Contrary to the hypothesis, a walkability rate of 2 is associated with a lower life satisfaction score than a walkability rate of 1. Since this is not statistically significant, no conclusion can be drawn.

Regardless, the perceived walkability rate at 5 being corresponding to a life satisfaction score of around 8.5 highlights the importance of improving walkability for a greater life satisfaction.

In all the graphs, the large error bars indicate that there is uncertainty and the results are not necessarily conclusive. The R-squared value is 0.15 which depicts that very little of the variance in life satisfaction is caused by the variables included in the model. The adjusted R-squared value is lower (0.12) further showing that certain variables in the model may not be required as they do not help explain life satisfaction. Another version of this regression model was evaluated keeping walkability as a numeric variable and the number of vehicles as a categorical variable (refer to Table A1 in the appendix). Since, the walkability rate when used as a factor displayed a non-linear relationship, it was incorporated as a factor to obtain accurate results. Unexpectedly, using the number of vehicles as a categorical variable showed that an increase in the number of vehicles compared to having no vehicles, decreased life satisfaction but none of the results were statistically significant so it was used as a numeric variable.

Ordinal Logistic Regression on Satisfaction with Quality of Life with Interaction Terms

Table 2

Ordinal Logistic Regression on Satisfaction with Quality of Life in the Community

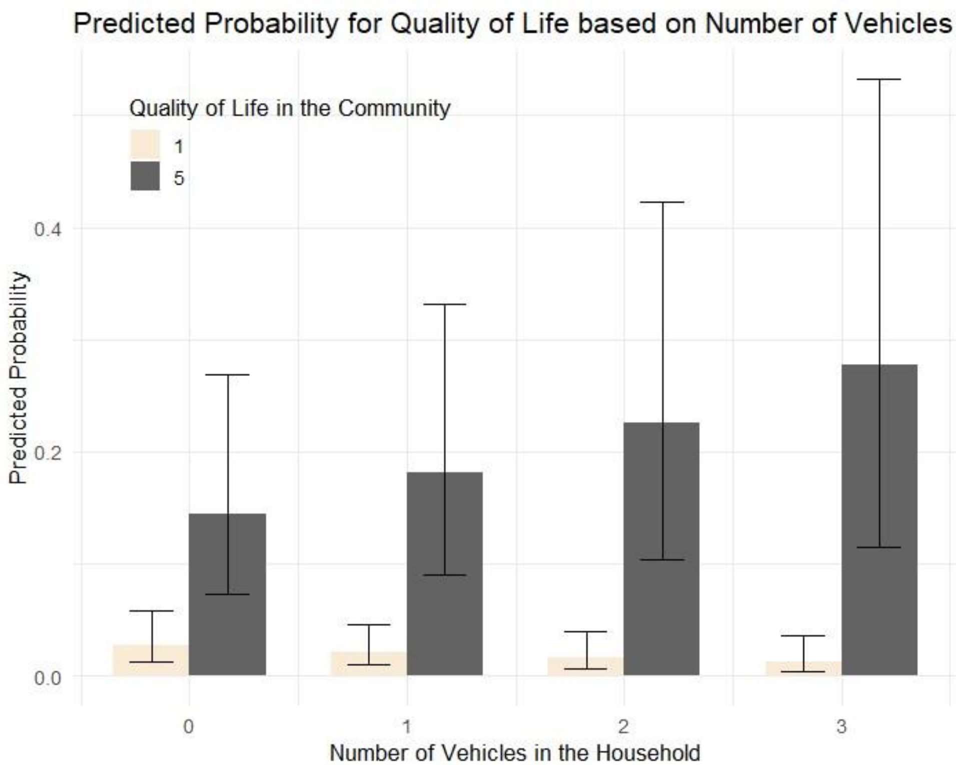
	Dependent variable:
	Satisfaction with Quality of Life in the Community
# of cars in household	0.273** (0.136)
Public Transit Quality (PTQ)-Level 1 (reference:0)	0.215 (1.137)
PTQ Level 2	1.493* (0.763)
PTQ Level 3	0.759 (0.743)
PTQ Level 4	1.879** (0.925)
PTQ Level 5	12.457*** (0.645)
Urban Cluster (reference: Rural)	0.253 (0.225)

Urban(reference: Rural)	-0.712 (1.149)
Walkability Rate	0.587*** (0.068)
Household Income	0.139*** (0.044)
Age	0.226*** (0.045)
Education	0.052 (0.051)
Race (0=white,1=person of colour)	-0.265 (0.236)
Gender(0=female,1=male)	-0.237* (0.133)
# of cars in household: PTQ Level 1	0.087 (0.353)
# of cars in household: PTQ Level 2	-0.476* (0.264)
# of cars in household: PTQ Level 3	-0.078 (0.210)
# of cars in household: PTQ Level 4	-0.347 (0.254)
# of cars in household: PTQ Level 5	-0.493 (0.441)
PTQ Level 1:Urban Cluster	-1.188 (0.852)
PTQ Level 2:Urban Cluster	-0.553 (0.612)
PTQ Level 3:Urban Cluster	-0.900 (0.655)
PTQ Level 4:Urban Cluster	-0.985 (0.835)
PTQ Level 5:Urban Cluster	-11.113*** (0.537)
PTQ Level 1:Urban	1.690 (1.944)
PTQ Level 2:Urban	-0.746 (1.457)
PTQ Level 3:Urban	0.420 (1.490)
PTQ Level 4:Urban	0.342 (1.540)
PTQ Level 5:Urban	-11.738*** (0.932)
Observations	861
AIC	2090.446
BIC	2247.46
RMSE	3.831
Note:	*p<0.1; **p<0.05; ***p<0.01

Similar to the previous model, having more vehicles and greater perceived walkability (in this model it is numeric) were positively associated with satisfaction with quality of life, up to statistical significance of 5% and 1% respectively. Perceived public transit quality was significant at level 2 (10%), level 4(5%) and level 5(1%). For these three levels, the quality of life in the community was higher in comparison to no public transit being available. It was not clear as to why the other levels were not significant. All the significant results for these three independent variables matched the hypotheses. The only significant effect in the interaction between the number of vehicles and perceived public transit quality was when the quality was 2. Geographical area on its own was not significant and the interaction effect with perceived public transit quality when it was equal to 5 was highly significant (1%) for both urban cluster and urban areas. This depicted that when there is no public transit, the geographic region does not matter. For both urban areas and urban clusters, the quality of life was lower even with the highest public transit quality in comparison to the quality of life for rural areas. These results matched the hypotheses. In this model as well, a higher household income level (1%), higher age group (1%) and being female (10%) improved the satisfaction with quality of life in the community. The significant results are also depicted with graphs but only the effects for the extremes of satisfaction with quality of life (1 and 5) have been plotted.

Figure 5

Effect of Number of Vehicles on Satisfaction with Quality of Life

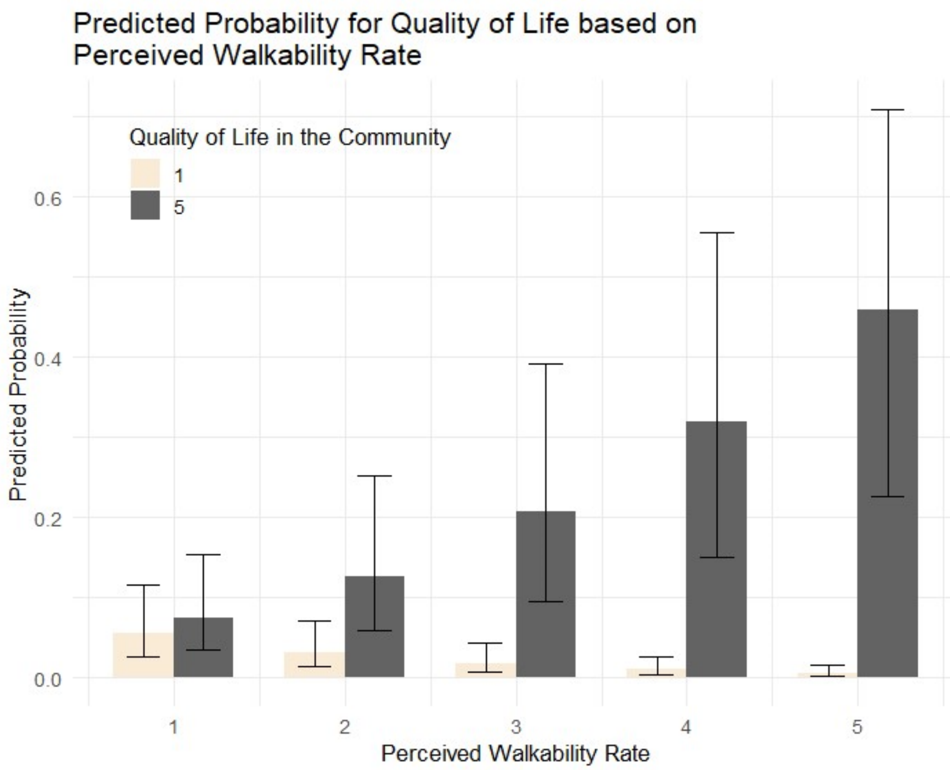


Note. Adjusted for: Walkability rate=3.17, public transit quality = 0, Geographic region = Rural, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

The number of vehicles in the household has similar effects to the walkability rate where the predicted probability for when satisfaction with quality of life is 5 increases with a greater number of vehicles owned. For all values of number of vehicles, the predicted probability for when quality of life is 5 is significant and higher than the predicted probability when quality of life is equal 1. The impact of owning a vehicle on the quality of life also exhibits the car-dependent nature of the country.

Figure 6

Effect of Perceived Walkability on Satisfaction with Quality of Life

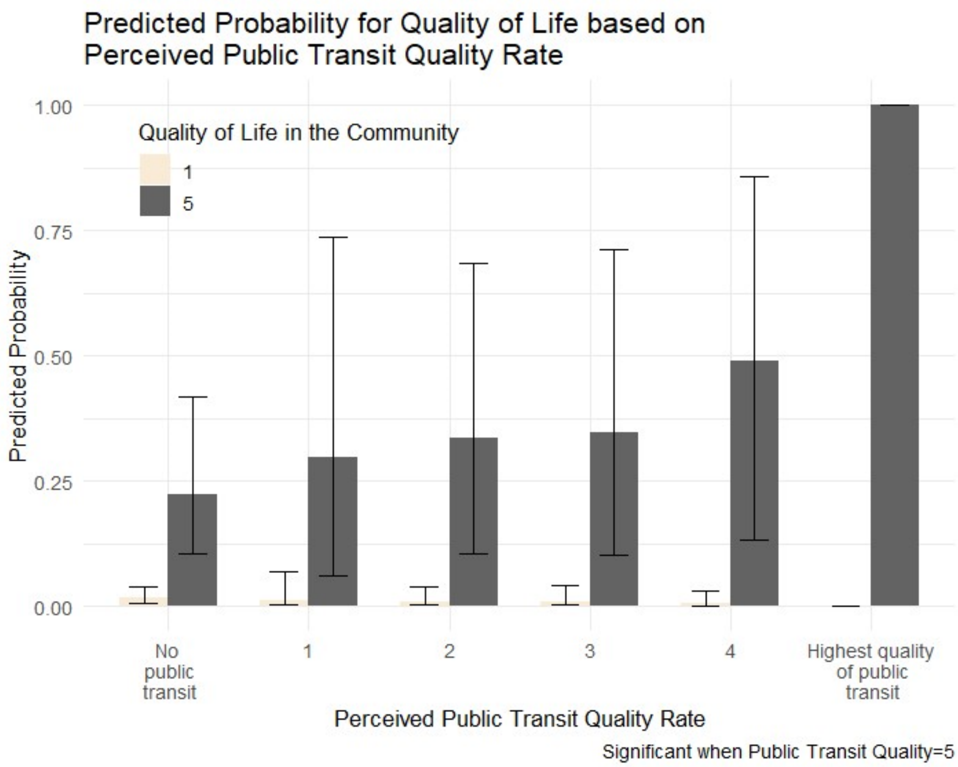


Note. Adjusted for: number of vehicles=1.96, public transit quality = 0, Geographic region = Rural, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

The graph depicts that higher perceived walkability rate improves the satisfaction with quality of life in the community. This may be because walkability makes it easier to access stores and enables more social interactions. In general, the predicted probability of those who rate the satisfaction with quality of life as 5 is greater than those who rate the quality of life as 1 at all levels. However, the predicted probability of people who rate quality of life as 5 rises as the walkability rate increases. While the predicted probability for the quality of life at 1 reduces as the walkability rate increases, the error bars overlap with the values so the effect is insignificant.

Figure 7

Effect of Public Transit Quality on Satisfaction with Quality of Life



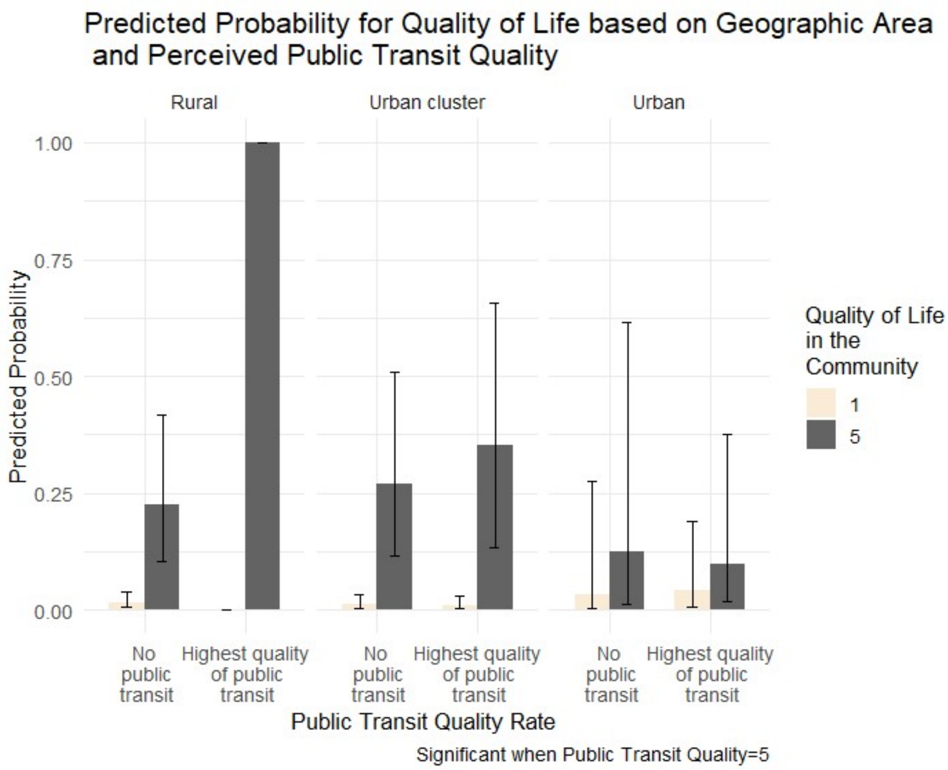
Note. Adjusted for: number of vehicles=1.96, Walkability rate=3.17, Geographic region = Rural, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

Here as well, the gap between the predicted probabilities for quality of life=1 and quality of life=5 increases at each level of public transit quality but the model results as well as the error bars show that no conclusions can be drawn except for when public transit quality is 5.

Overall, the three graphs above depict that having better walkability, more vehicles in the household and a high quality of public transit are conducive to satisfaction with quality of life in the community.

Figure 8

Effect of Public Transit Quality and Geographic Area on Satisfaction with Quality of Life



Note. Adjusted for: number of vehicles=1.96, Walkability rate=3.17, Income= 4.63, Age= 4.87, Education = 4.07, Race = 0.09, Gender = 0 (female)

Within the rural area, having no public transit lowers satisfaction with quality of life, and the same effect is seen in the urban cluster. However no significant effect of perceived public transit quality is found in the urban areas. The graph also demonstrates that having high quality of public transit affects the quality of life the most in rural areas. This is possibly because resources such as employment, grocery stores, medical care are less accessible in rural areas and the layout of infrastructure is more spread out, so public transit greatly reduces challenges in accessing various locations.

The large error bars in the models make it difficult to give definitive conclusions. A version of the ordinal logistic regression model was evaluated keeping walkability and the number of vehicles as categorical variables (refer to Table A2 in the appendix).. The walkability rate when used as a factor showed that the relationship was linear so it could be used as a numeric variable. Contradictory to the hypotheses, using the number of vehicles as a categorical variable showed that an increase in the number of vehicles compared to having no vehicles, reduced satisfaction with quality of life but the results were not statistically significant so it was used as a numeric variable. The root mean squared error for both the models was 3.83, the AIC and BIC when walkability and number of vehicles were categorical were 2096.4 and 2324.8, and the AIC and BIC when walkability and number of vehicles were numeric was 2090.4 and 2247.5, demonstrating that both models yielded similar results. Additionally, a linear regression model treating satisfaction with quality of life as numeric was run (refer to Table A2 in the appendix) but the results in terms of the direction and magnitude were not identical for all the coefficients so the ordinal logistic regression model was selected as the final model.

Conclusion

The research looked into how transportation related factors of vehicle ownership, perceived public transit quality and perceived walkability levels impacted satisfaction with life as well as quality of the life in the community. Satisfaction with life was on a 10-point scale so a linear regression was utilised whereas satisfaction with quality of life was on a 5-point scale so an ordinal logistic regression was utilised. Moreover, interaction effects of perceived public transit quality with vehicle ownership and geographic region were included in both models. An individual may not rely on public transit or be inconvenienced by temporary closures and delays if they had their own vehicle. Additionally, in the United States, urban areas typically have an infrastructure characterised by greater walkability and public transit options so the effects of different transportation options may vary depending on the whether a region is urban or rural. The results demonstrated that a greater perceived walkability rate and number of vehicles owned positively influence both life satisfaction and satisfaction with quality of life. The perceived public transit quality and the effect of the highest perceived quality of public transit in geographic regions only significantly impact the satisfaction with quality of life in the community. Additionally, having a higher income, belonging to an older age group and being female improved both life satisfaction and satisfaction with quality of life. However, there were several insignificant results or large confidence intervals which may have been due to a small sample size (n=861) and only 27 respondents not owning a vehicle.

While working with the models, I learnt the importance of displaying interaction effects in a meaningful way and the complexity of ordinal logistic regression models. Since interaction effects may be difficult to interpret from the regression table, especially if there are several terms associated with an effect, a graphical format may allow for better comprehension. While graphing the interaction effect, it is important that at least 2 levels for each variable in the interaction are plotted to observe the differences. For instance, in my graph, if I only showed the changes between urban, urban cluster and rural areas when public transit quality was 5, that would not depict the interaction effect. Moreover, since logistic regressions cannot be interpreted directly from the table, studying the predicted probabilities becomes crucial. However, in an ordinal logistic regression, based on the structure of the independent variable, there can be several predicted probabilities corresponding to each level of the dependent variable. For example, in this research, there were 5 levels in the quality of life variable and 4 unique values for the number of vehicles which resulted in 20 predicted probabilities. This makes the model complex and difficult to interpret. I learnt that in order to interpret the results, sometimes we have to narrow the focus which is why I studied only the extreme values for quality of life (at 1 and 5).

With regards to modes of transportation, the connection between owning more vehicles and experiencing higher life satisfaction and satisfaction with the quality of life, reinforces the heavy reliance on vehicles in the United States. Better walkability levels in the cities and towns may help reduce the dependence on vehicles since individuals can easily walk to destinations such as offices and schools that they frequent. Moreover, the results demonstrate that initiatives towards facilitating accessible public transit, especially in rural areas should be taken to improve wellbeing. In conclusion, enhancing mobility through public services and infrastructure is beneficial to life satisfaction and quality of life.

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Appendix A

Table A1

Comparisons for Linear Regressions with Satisfaction with Life

	Dependent variable:	
	Satisfaction with Life	
	(1-Final model used)	(2)
# of cars in household (numeric)	0.238* (0.130)	
1 car		-0.613 (0.647)
2 cars		-0.792 (0.642)
3 cars		-0.048 (0.653)
Public Transit Quality (PTQ)-Level 1 (reference:0)	0.482 (1.043)	-0.436 (1.643)
PTQ Level 2	-0.246 (0.749)	-0.364 (1.206)
PTQ Level 3	-0.086 (0.750)	-0.547 (1.157)
PTQ Level 4	0.581 (0.891)	-0.858 (1.368)
PTQ Level 5	2.200 (1.538)	1.552 (1.877)
Urban Cluster (reference: Rural)	0.024 (0.215)	0.025 (0.214)
Urban(reference: Rural)	0.834 (1.318)	1.067 (1.318)
Walkability Level 2 (reference:1)	-0.060 (0.273)	
Walkability Level 3	0.200 (0.254)	
Walkability Level 4	0.340 (0.261)	
Walkability Level 5	1.013*** (0.310)	
Walkability Rate (numeric)		0.218*** (0.063)
Household Income	0.206*** (0.043)	0.212*** (0.043)
Age	0.312*** (0.043)	0.319*** (0.043)
Education	-0.002 (0.049)	-0.001 (0.050)
Race (0=white,1=person of colour)	0.314 (0.224)	0.278 (0.227)
Gender(0=female,1=male)	-0.463*** (0.130)	-0.491*** (0.130)
# of cars in household Level 1	0.130 (0.328)	
# of cars in household: PTQ Level 2	0.270 (0.262)	
# of cars in household: PTQ Level 3	-0.040 (0.204)	
# of cars in household: PTQ Level 4	-0.056 (0.243)	
# of cars in household: PTQ Level 5	-0.423 (0.397)	
1 car: PTQ Level 1		1.205 (1.534)
2 cars: PTQ Level 1		1.247 (1.532)
3 cars: PTQ Level 1		1.340 (1.529)
1 car: PTQ Level 2		-0.034 (1.209)

2 cars: PTQ Level 2		1.049 (1.169)
3 cars: PTQ Level 2		0.798 (1.191)
1 car: PTQ Level 3		-0.171 (1.090)
2 cars: PTQ Level 3		0.911 (1.073)
3 cars: PTQ Level 3		-0.161 (1.082)
1 car: PTQ Level 4		1.027 (1.168)
2 cars: PTQ Level 4		1.623 (1.157)
3 cars: PTQ Level 4		0.674 (1.179)
1 car: PTQ Level 5		0.273 (1.312)
2 cars: PTQ Level 5		0.315 (1.352)
3 cars: PTQ Level 5		-0.300 (1.584)
PTQ Level 1:Urban Cluster	-1.001 (0.801)	-1.092 (0.802)
PTQ Level 2:Urban Cluster	-0.337 (0.595)	-0.405 (0.600)
PTQ Level 3:Urban Cluster	0.141 (0.668)	0.236 (0.670)
PTQ Level 4:Urban Cluster	-0.079 (0.807)	0.073 (0.811)
PTQ Level 5:Urban Cluster	-1.224 (1.378)	-1.343 (1.426)
PTQ Level 1:Urban	-0.854 (1.986)	-1.079 (1.982)
PTQ Level 2:Urban	-0.449 (1.639)	-0.859 (1.649)
PTQ Level 3:Urban	-1.374 (1.637)	-1.613 (1.640)
PTQ Level 4:Urban	-0.950 (1.645)	-0.827 (1.658)
PTQ Level 5:Urban	-2.642 (2.014)	-2.933 (2.080)
Constant	4.564^{***} (0.461)	5.063^{***} (0.716)
Observations	861	861
R^2	0.151	0.164
Adjusted R^2	0.119	0.122
Residual Std. Error	1.840 (df = 828)	1.836 (df = 819)
F Statistic	4.615^{***} (df = 32; 828)	3.910^{***} (df = 41; 819)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table A2

Comparisons for Ordinal Logistic and Linear Regressions with Satisfaction with Quality of Life in the Community

	Dependent variable:		
	Satisfaction with Quality of Life		Satisfaction with Quality of Life
	ordered logistic		*OLS*
	(1)	(2- Final model used)	(3)
1 car	-1.074 (0.777)		
2 cars	-0.612 (0.774)		
3 cars	-0.329 (0.783)		
# of cars in household		0.273** (0.136)	0.125** (0.063)
Public Transit Quality (PTQ)-Level 1 (reference:0)	1.743 (1.872)	0.215 (1.137)	0.046 (0.506)
PTQ Level 2	-0.320 (1.216)	1.493* (0.763)	0.678* (0.363)
PTQ Level 3	-0.006 (1.223)	0.759 (0.743)	0.521 (0.364)
PTQ Level 4	0.733 (1.475)	1.879** (0.925)	0.858** (0.433)
PTQ Level 5	10.607*** (1.122)	12.457*** (0.645)	1.169 (0.747)
Urban Cluster (reference:Rural)	0.291 (0.229)	0.253 (0.225)	0.104 (0.104)
Urban(reference:Rural)	-0.760 (1.158)	-0.712 (1.149)	-0.271 (0.640)
Walkability Level 2 (reference:1)	0.578** (0.280)		
Walkability Level 3	1.106*** (0.265)		
Walkability Level 4	1.534*** (0.277)		
Walkability Level 5	2.608*** (0.339)		
Walkability Rate		0.587*** (0.068)	0.260*** (0.030)
Household Income	0.132*** (0.045)	0.139*** (0.044)	0.069*** (0.021)
Age	0.242*** (0.046)	0.226*** (0.045)	0.108*** (0.021)
Education	0.070 (0.052)	0.052 (0.051)	0.021 (0.024)
Race (0=white,1=person of colour)	-0.285 (0.240)	-0.265 (0.236)	-0.164 (0.109)
Gender(0=female,1=male)	-0.266* (0.136)	-0.237* (0.133)	-0.093 (0.063)
1 car: PTQ Level 1	-0.291 (1.781)		
2 cars: PTQ Level 1	-2.248 (1.753)		
3 cars: PTQ Level 1	-0.043 (1.764)		
1 car: PTQ Level 2	1.796 (1.217)		
2 cars: PTQ Level 2	1.020 (1.167)		

3 cars: PTQ Level 2	0.282 (1.193)		
1 car: PTQ Level 3	0.808 (1.177)		
2 cars: PTQ Level 3	0.630 (1.161)		
3 cars: PTQ Level 3	0.531 (1.169)		
1 car: PTQ Level 4	1.109 (1.276)		
2 cars: PTQ Level 4	0.452 (1.260)		
3 cars: PTQ Level 4	0.202 (1.284)		
1 car: PTQ Level 5	0.541 (1.589)		
2 cars: PTQ Level 5	-0.004 (1.628)		
3 cars: PTQ Level 5	-1.096 (1.928)		
# of cars in household:PTQ Level 1		0.087 (0.353)	0.075 (0.160)
# of cars in household:PTQ Level 2		-0.476^{*} (0.264)	-0.213^{*} (0.127)
# of cars in household:PTQ Level 3		-0.078 (0.210)	-0.078 (0.099)
# of cars in household:PTQ Level 4		-0.347 (0.254)	-0.143 (0.118)
# of cars in household:PTQ Level 5		-0.493 (0.441)	-0.205 (0.192)
PTQ Level 1:Urban Cluster	-1.729^{**} (0.821)	-1.188 (0.852)	-0.592 (0.389)
PTQ Level 2:Urban Cluster	-0.644 (0.628)	-0.553 (0.612)	-0.236 (0.289)
PTQ Level 3:Urban Cluster	-0.912 (0.666)	-0.900 (0.655)	-0.488 (0.325)
PTQ Level 4:Urban Cluster	-1.024 (0.850)	-0.985 (0.835)	-0.483 (0.392)
PTQ Level 5:Urban Cluster	-10.211^{***}(0.686)	-11.113^{***}(0.537)	-0.559 (0.669)
PTQ Level 1:Urban	2.072 (2.070)	1.690 (1.944)	0.606 (0.964)
PTQ Level 2:Urban	-0.743 (1.483)	-0.746 (1.457)	-0.449 (0.797)
PTQ Level 3:Urban	0.500 (1.502)	0.420 (1.490)	0.124 (0.796)
PTQ Level 4:Urban	0.326 (1.572)	0.342 (1.540)	0.044 (0.798)
PTQ Level 5:Urban	-10.859^{***}(1.067)	-11.738^{***}(0.932)	-0.781 (0.978)
Constant			1.866^{***} (0.226)
Observations	861	861	861
AIC	2096.434	2090.446	
BIC	2324.823	2247.46	
RMSE	3.831	3.831	
R^2			0.185
Adjusted R^2			0.157

Residual Std. Error	0.895 (df = 831)
F Statistic	6.521*** (df = 29; 831)
Note:	*p<0.1; **p<0.05; ***p<0.01