Mode Substitution Effect of Urban Cycle Tracks: Case Study of a Downtown Street in Toronto, Canada

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INTRODUCTION

Cycling facilities (e.g., bicycle lanes or cycle tracks) may encourage individuals to switch their mode to cycling.

Existing literature has demonstrated an association between increased bicycle networks and higher rates of cycling.

The direct impact of cycling facilities on a mode substitution remains understudied.

A case study was used to better understand the impact of a cycle track in enabling a short-term mode substitution effect among current cyclists.

STUDY AREA: SHERBOURNE STREET

The City of Toronto has the largest population in the Canada at 2.65 million.

Sherbourne Street in the downtown area was selected as a case study.

In 2012, Sherbourne became the first street in Toronto to include cycle tracks that extend 2.44 km.

DATA

Travel data was collected from current cyclists using a street intercept surveys method. Surveys were conducted at two intersections during weekdays (7:30 a.m. to 9:00 a.m., and 5:00 p.m. to 6:30 p.m.) and weekends (4:30 p.m. to 6:00 p.m.) in the months of October and November 2014.

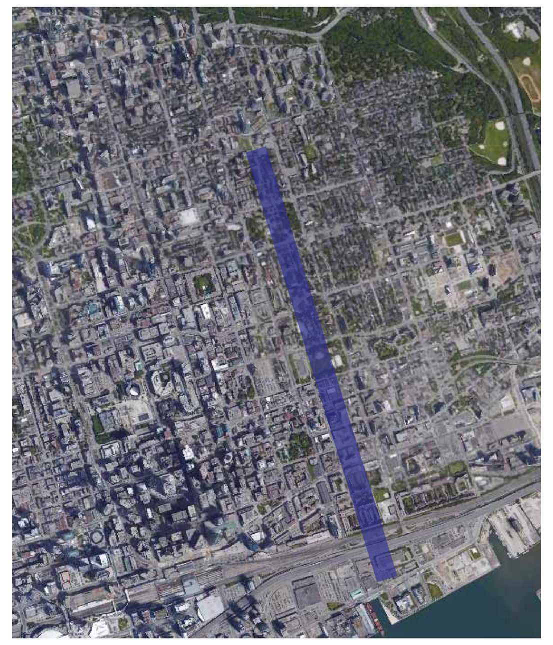
A total of n=214 cyclists participated in the study (183 week-day trips, 31 weekend trips).

ANALYTICAL APPROACH

Potential travel behaviour change (i.e., short term mode sub-stitution) was captured in the survey by a key question: "Before the redevelopment of Sherbourne Street, what travel mode would you use to get to the destination of your current trip?".

Binomial logistic regression models were estimated to exam-ine the factors associated with the following types of mode substitution
1) from all other modes (including car, and transit) to cycle,
2) from private automobile (i.e., cars) to cycle, and
3) from transit to cycle.

Figure 1: Sherbourne Street



Description of Cycle Tracks:

The street runs through four different downtown neighbor-hoods: North St. James Town, Cabbage Town, South James Town and Moss Park. It has varying densities and uses ranging from high-rise apartments to mixed use low-rise.

North and south-bound buses run along the street, connecting transit riders to the Sherbourne Subway Station to the North and the waterfront to the South.

Following its completion in 2012, the average daily cycle count rose from 995 in 2011 to 2,827 by 2014.

Table 1: Current Cyclists and Cycling Trips (n = 214)

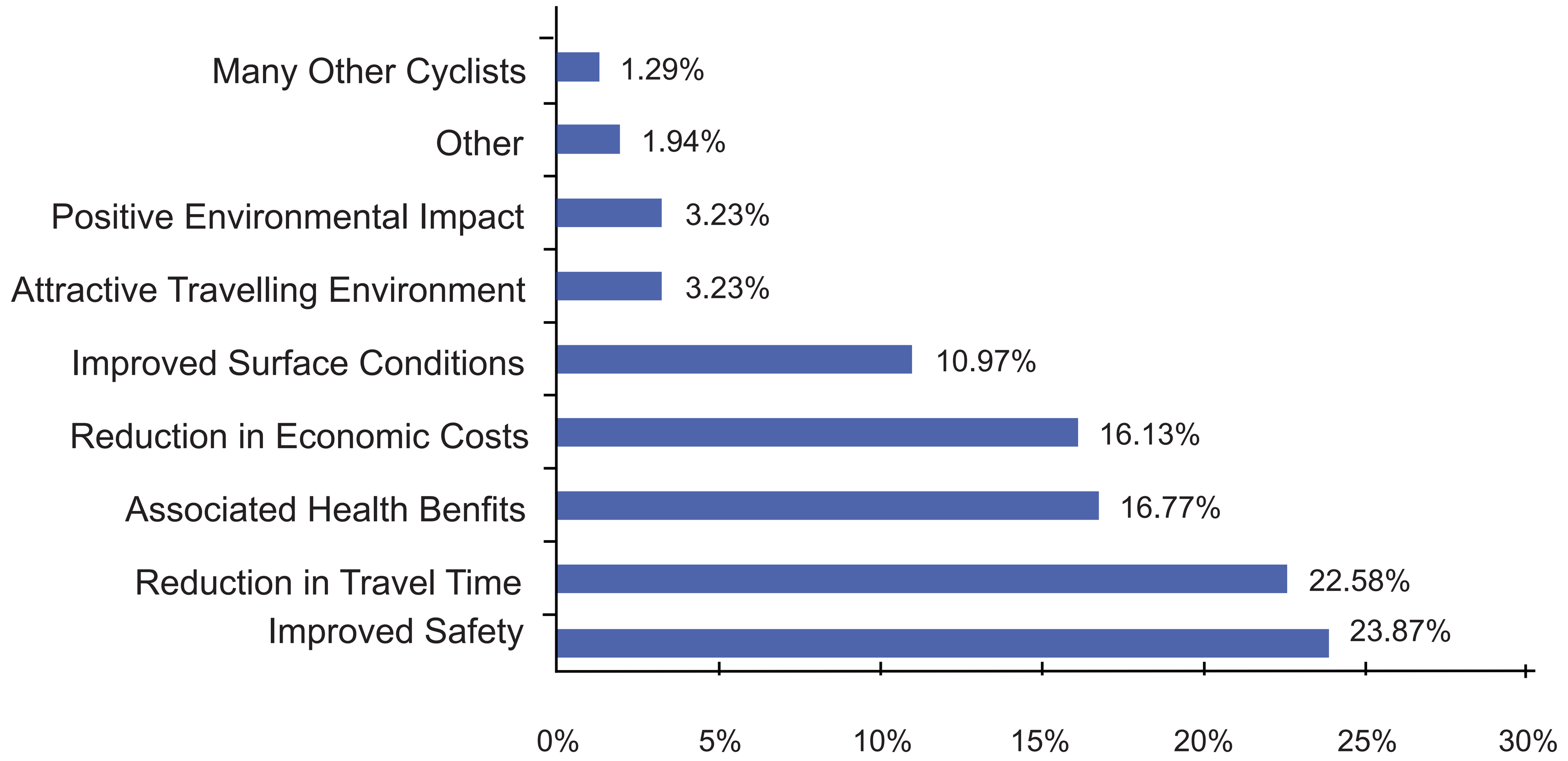
Variables	Percent
Demographics	
Gender	
Male	61.21
Female	38.79
Age:	
<40 yrs	64.95
40+	35.05
Previously used road before 2012	
Yes	37.85
No	62.15
Purpose and Travel Times	
Purpose of trip	
Commuting (work)	68.69
Commuting (school)	9.81
Social (shopping or social events)	15.89
Recreational (leisure or exercise)	4.67
Other	0.93
Total time to complete trip	
<15 mins	14.49
15+ mins	85.51
Time spent from origin to Sherbourne	
<15 mins	77.57
15+ mins	22.43
Time spent from Sherbourne to destination	
<15 mins	86.92
15 + mins	13.08
Travel Mode Substitution	
Changed to cycling after redevelopment	38.32
Cycling before redevelopment	61.68

Table 2: Binary Logistic Regression of Mode Substitution to Cycling (n = 214)

	From All Modes [1]		From Car [2]		From Transit [3]	
	Not adjusted for route substitution Coef (S. E.)	Adjusted for route substitution Coef (S. E.)	Not adjusted for route substitution Coef (S. E.)	Adjusted for route substitution Coef (S. E.)	Not adjusted for route substitution Coef (S. E.)	Adjusted for route substitution Coef (S. E.)
Gender (ref: Female)						
Male	-0.38 (0.30)	-0.19 (0.34)	-0.20 (0.50)	0.12 (0.54)	-0.54 (0.36)	-0.43 (0.38)
Age (ref : ≥ 40 yrs)						
< 40 yrs	0.36 (0.31)	0.22 (0.35)	-0.64 (0.49)	***-0.92 (0.52)***	0.20 (0.37)	0.10 (0.40)
Purpose (ref: Other)						
Commute	0.29 (0.42)	0.27 (0.47)	-0.48 (0.65)	-0.47(0.68)	0.81 (0.61)	0.78 (0.63)
Trip length (ref: >30 mins)						
< 15 mins	-0.40 (0.58)	0.07 (0.66)	0.41 (0.95)	0.86 (1.02)	**-1.74 (0.79)**	***-1.51 (0.82)***
15-30 mins	-0.55 (0.46)	-0.28 (0.51)	0.02 (0.71)	0.40 (1.23)	-0.84 (0.51)	-0.60 (0.55)
Dist from origin (ref: ≤15 mins)						
>15 mins	-0.61 (0.44)	-0.11 (0.50)	***1.14 (0.67)***	**0.85 (0.77)**	**-1.15 (0.54)**	-0.85 (0.57)
Dist from destination (ref: ≤15 mins)						
>15 mins	-0.72 (0.55)	-0.62 (0.62)	-1.40 (1.14)	-1.61 (1.23)	-0.14 (0.61)	0.19 (0.66)
Day of week (ref: weekday)						
Weekend	-0.13 (0.51)	-0.08 (0.58)	-0.60 (0.90)	-0.18 (0.94)	-0.05 (0.70)	-0.21 (0.74)
Route substitution (ref: no)						
Yes (i.e., did not use road before)		**2.40 (0.42)**		**2.36 (0.83)**		**2.04 (0.56)**
Constant	-0.11 (0.62)	**2.17 (0.79)**	***-1.62 (0.93)***	**-4.00 (1.33)**	-0.89 (0.79)	**-2.67 (0.98)**
McFadden's p^2 (adj.)	0.03 (0.00)	0.19 (0.16)	0.07 (0.01)	0.16 (0.10)	0.07 (0.03)	0.16 (0.12)
AIC	294.79	251.45	141.78	131.2	222.6	205.23

NOTE: 1: Ref: previous travel mode was bicycle; 2: Ref: previous travel mode was transit, cycle, walk or other; or other. Coefficients in **bold** are significant at α=0.05; coefficients in ***bold italics*** are significant at α=0.10.

Figure 2: Reported Reasons for Substituting Modes (n = 214)



KEY FINDINGS

Of the sample, 62% cycled before the 2012 redevelopment. However, 45% of those who previously cycled did not use Sherbourne Street.

Between 2012 and 2015, 38% of all respondents potentially switched their travel mode to cycling from:
1) Transit (55%),
2) Car (24%), and
3) Walking (13%).

There was a strong association between travel route change and mode substitution, where the likelihood of switching to cycling was 11 times higher for those who did not use the street before 2012.

Distance to Sherbourne Street was positively associated with mode substitution from car to cycle.

Total trip length was negatively associated with mode substitution from transit to cycling.

Age influenced the probability of switching from driving to cycling, where it was less likely to occur among those younger than 40 years.

The presence of cycle tracks improved cyclists' perception of safety and travel times (refer to Figure 2).

IMPLICATIONS FOR POLICY

In Toronto, cycle tracks may lead to a reduction in both public transit users and private automobile drivers, contributing to some relief from transit and automobile congestion.

Potential route substitution was the most important predictor of mode substitution in our models (Table 2), suggesting that some cyclists may add to their trip length in order to use physically separated cycling facilities.

The evidence may enable transportation and urban planning practitioners to better understand the impacts of cycle tracks on travel mode choice, and enable them to make more informed decisions regarding future active transportation facilities and polices.

The method may inform the development of evaluation tools that would help professionals to measure and monitor the success of active transportation-related infrastructure projects.

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