Facilitators and Barriers to Winter Cycling: Case Study of a Downtown University in Toronto, Canada

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Introduction

Cycling rates decrease significantly in winter months in many North American urban regions, which is a missed opportunity for physical activity participation and adds to traffic congestion during those months of the year.

The perception that “no one cycles in the winter” is sometimes a major political and social barrier in advancing active transportation planning.

Research on winter cycling in North America is sparse; limited evidence suggests that adverse weather conditions may discourage cycling.

Is it possible to overcome some of this barrier by providing improved bicycle infrastructure and an attractive/favourable neighbourhood environment?

This research investigates this question by exploring travel behavior of current cyclists who commute to Ryerson University in Toronto, Canada. The university is a major commute destination located in downtown Toronto.

Conceptualization

Drawing on the Theory of Planned Behavior, we hypothesized that the perceived capability of cycling in the winter months may be influenced by the built environment, including access to bicycle infrastructure.

the perception of the ease or difficulty of cycling in different environments may explain seasonal variations in cycling.

Methods

Data from two transportation surveys were utilized:

Student data: StudentMoveTO survey (www.studentmoveto.ca) was conducted in Fall 2015 among students of 4 universities in Toronto.
Staff/ employee data: an employee travel survey was conducted in summer 2016 at Ryerson University.

The dataset included 279 students, staff, and faculty who commuted to Ryerson University using a bicycle, in a typical Fall/Spring day (8% of surveyed sample).

Those cyclists who self-reported a seasonal switch in travel mode were identified as ‘fall/spring cyclists’ and the rest were identified as ‘all-season cyclists’.

ANOVA and x^2 tests were conducted to test differences between seasonal and all-season cyclists, with regard to Socio-demographic and built environment characteristics, travel-related preferences, and travel experiences.

Variables that demonstrated statistical significance in bi-variate tests were then modelled with a binomial logistic regression.

Results

Public transit is the most common form of transportation for both staff (58%) and students (77%). Cycling was more popular among staff (13%) than students (5%).

Table 1: Students and staff who maintain their usual commute mode in winter months

	Student (n=2,925) %	Employees (n=1,310) %	All (n=4,235) %
Walk	90	83	88
Bicycle	31	23	27
Local transit	99	96	98
Regional transit	99	94	98
Rideshare	98	88	91
Solo driver	96	83	88

Table 2: Correlates of all-season cycling: Binomial logistic regression model

	Coef.	S.E.	OR (95% CI)	Sig.
Socio- Demographics				
Gender: female (ref: male)	-0.96	.299	0.39 (0.21 – 0.69)	**0.001**
Student (ref: faculty and staff)	0.52	.295	1.69 (0.95 – 3.03)	***0.076***
Transportation Options				
Possess a transit pass (ref: no transit pass)	-2.16	1.068	0.12 (0.01 – 0.63)	**0.043**
Travel Distance and Infrastructure				
Commute Distance	0.05	.086	1.06 (0.89 – 1.25)	0.535
Bicycle infrastructure on shortest route	0.45	.220	1.57 (1.02 – 2.44)	**0.040**
Accessibility Index	0.15	.478	1.17 (0.46 – 3.07)	0.748
Neighbourhood Design/ Land Use Characteristics near Residence				
% Residential land use	0.53	.630	1.69 (0.51 – 6.08)	0.404
Business density	0.00	.000	1.00 (1.00 – 1.00)	0.333
% Housing > 35 years	1.47	.703	4.33 (1.15 – 18.47)	**0.037**

NOTES:
Bicycle infrastructure on shortest route: Density of on-street cycling facilities (cycle tracks and painted bicycle lanes) within 500m of the shortest route.
Accessibility Index: Relative travel distance using cycling facilities, compared to the shortest path.

Figure 1: Housing age by dissemination area (DA) compared to cyclist types

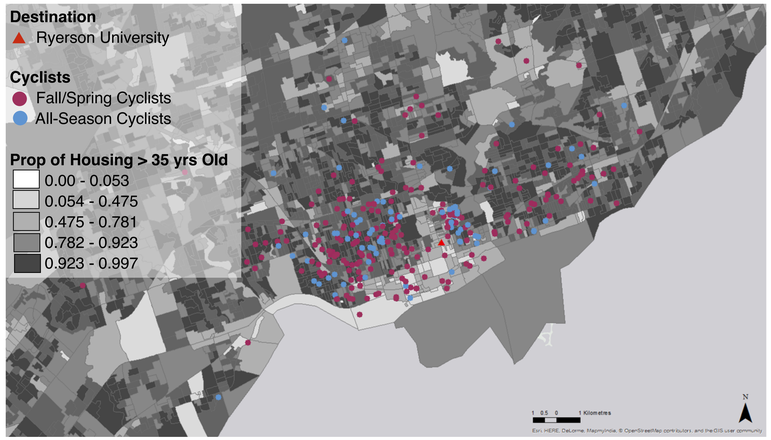
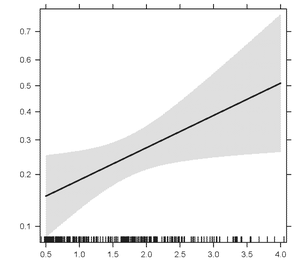
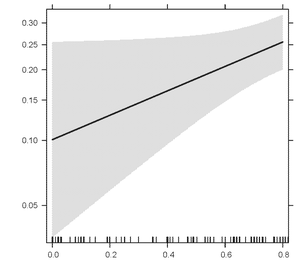


Figure 2: Marginal prob. of cycling through winter: Effect plots from logistic regression models



Bicycle Infrastructure on Shortest Route



Proportion of Housing Stock >35 Years Old

Key Findings

Only 27% of cyclists continue to commute by bicycle through winter months.

Women and transit pass holders were less likely, while students rather than staff were more likely to cycle during the winter.

The density of bicycle infrastructure within 500m of the shortest route was associated with all-season cycling. The potential of using cycle tracks or bicycle lanes where possible, at least part of the way to school, is perhaps more important than being able to travel all-the-way on a bicycle infrastructure, which sometimes come at the cost of an increased travel distance.

A cyclist living in an older and more stable neighbourhood was more likely to bicycle through winter, perhaps indicating the presence of residential self-selection.

Conclusions

The findings support current planning and policy emphasis on bicycle infrastructure. An improved bicycle network could help overcome barriers to winter cycling.

Municipal, grass roots and university-based programming focused on specific demographic groups including women may bring positive outcomes.

Policy and programs on commute mode shifts may also focus on a gradual change: i.e., from driving to public transit or cycling during warmer months. Previous research has indicated that 33% of all trips made in the Greater Toronto and Hamilton Area (GTHA) are potentially cyclable.

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