Cycling to high school in Toronto, Ontario, Canada: Exploration of school travel patterns and attitudes by gender

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1 CYCLING TO HIGH SCHOOL IN TORONTO: AN EXPLORATION OF SCHOOL TRAVEL
2 PATTERNS AND ATTITUDES BY GENDER
3

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ABSTRACT

This study reports on a survey of attitudes, behaviours, social norms and perceived control among the populations of students at three high schools in downtown Toronto. Our data describe a pattern of hesitancy to cycle on the part of female high school students, as compared to their male counterparts. The young women report less access to a bicycle, less comfort or confidence in riding, more fear associated with cycling and less ability to independently decide how they travel to school. Our study identifies two important variables that are likely associated with young women's participation in cycling to school: overall cycling mode share and ability to decide independently their travel mode. The former tracks findings for the general population, and the latter appears to be associated with the proximity of immigration, as families may bring associations of danger to independent female travellers from their countries of origin or perceive new dangers in Canada. While the former association is well established, the latter hypothesis warrants further research.

Keywords: bicycling, active school transportation, gender, children's independent mobility, adolescents

1.0 INTRODUCTION

One of the many unfortunate consequences of North American car culture has been the loss of children's independent mobility. Active school transportation (AST) – using human-powered methods of travelling to school – is recognized as an opportunity for adolescents to become more independent, while simultaneously incorporating more physical activity into their lives and contributing to safer and more sustainable communities. Most AST studies have focused on infrastructure, walking, and elementary schools, with little consideration of high school students, cycling, and the role of gender. This study helps fill that gap by exploring high school travel patterns and attitudes towards cycling, with special attention to how they differ by gender.

The increased prevalence of cars on streets has heightened parents' concerns about the dangers of children being in public space, and has coincided with growing climates of fear (1; 2; 3). As a result, parents tend to restrict children's ability to both travel alone and play outside without adult supervision. This overprotective behaviour is reducing children's opportunities for physical activity and poorly equipping them with the skills necessary to navigate the public sphere (1;4). Recent studies have found that young males are generally afforded greater mobility than young females and the chance to become independent at an earlier age (5; 6).

2.0 BACKGROUND

Gender-specific cycling patterns are not new. Medical journals in the 1890s frequently suggested that cycling was unhealthy for women, and a danger to their reproductive systems (7). In the United States, bicycles were perceived as a threat to the gendered social order which depended on constrained female travel, dress and physical activity and consequent reliance on men for physical mobility (8). In many countries to this day, there are far fewer women riding recreationally and for commuting purposes than men. Women account for approximately one-third of recreational cyclists and one-quarter of commuter cyclists in Australia and the United States (9).

Numerous studies reveal that there are distinct spatial, temporal, and functional patterns for men and women cycling. Several studies from the United States, United Kingdom, and Australia conclude that women more commonly seek out streets with lower traffic and as much separation from motorized vehicles as possible (10; 11; 12). This finding is debated, though, as other studies have reported very similar preferences for cycling facilities among men and women, which are focused on network connectivity and directness of route (13; 14). Several reports suggest that women are more likely to ride for leisure than for transport, and have less structured routines for cycling (10; 15). It is, however, important to understand the diversity and heterogeneity of the group we call "women". While it is possible to identify commonalities and some general trends, there is no single pattern that describes a woman's relationship to cycling.

An overall trend that holds true in most cases is the positive correlation of cycling mode share with female cycling rates (9; 16). In places where cycling is a normal, common activity, such as in several Western European countries, the rates of women and men cycling are similar (17; 6). The central Toronto wards demonstrate this pattern, as well (Figure 1).

FIGURE 1 Cycling mode share by ward and gender in the central city of Toronto

There are a number of theories that attempt to explain the trend of lower female participation in cycling. Some suggest it is a matter of attitude, purporting that women simply do not enjoy cycling as much as men do (6). Others suggest women's responsibilities, such as taking children to school, make cycling a less appealing mode of transportation (18). Others relate the trend to personal safety and women's tendency to be more risk averse (11; 14; 15). Most of the theories demonstrate the prevalence of constructed gender roles. They paint women in a particular light, and assign them certain characteristics. They reflect society's perpetuation of what is and is not a woman's role, and effectively deter young females from stepping outside of these assignments. In discussions of gender and mobility, what is constraint and what is choice is a complicated conversation (19).

Recognizing that women face unique constraints, the literature on gender and cycling provides a number of recommendations for encouraging more women to ride for transportation: creating higher quality road networks, making bicycles that are suited to carrying baggage and children more readily available and accessible, putting bike lanes along direct routes to common destinations, promoting cycling as convenient, safe and enjoyable, and pairing cycling education, including route planning, with opportunities to gain experience (6; 14; 15; 18). For young females, more opportunities to walk or cycle with peers may allow them to engage in the independent mobility permitted sooner to males (5).

3.0 CONCEPTUAL MODEL

The conceptual model for this study is based on the framework developed by de Bruijn et al. (2005), which combines features of the Theory of Planned Behaviour with the Theory of Triadic Influence (20). The Theory of Planned Behaviour suggests that behaviour is predicted by

intention, and that the strength of intention is predicted by attitudes, subjective norms, and perceived control (21). Attitudes refer to the positive or negative associations individuals have with certain behaviours. Subjective norms are their beliefs about what others will think of them when they engage in said behaviour. Perceived control is the product of their beliefs about whether or not they are able to perform the behaviour successfully, which also depends on actual control (21). Since the Theory of Planned Behaviour acknowledges but does not highlight the influence of the physical, cultural and social environments and biological factors on intention, the Theory of Triadic Influence is added, which focuses on these factors. The category of cultural environment refers primarily to religion and ethnicity. The social environment refers to factors such as the family structure and parenting style. The category of biological factors refers to age, gender, and also includes personality traits (20). The model below illustrates the chain of influence (Figure 2).

FIGURE 2 Conceptual model adapted from de Bruijn et al. (2005) (20)

In line with the model and broader literature, it was hypothesized that rates of cycling to school would be lower among female students than their male counterparts. It was predicted that the social and cultural environments of households and schools in North America would negatively influence females' attitudes, subjective norms, and behavioural control in the area of AST. Since behaviours adopted during adolescence may predispose future behaviours, it is especially important to understand any factors inhibiting healthy and sustainable behaviours at this early stage of life.

4.0 METHODS

This exploratory case study was designed to gain a better understanding of the complex influences on cycling for transportation at the high school level, and to identify direct and indirect facilitators of adolescents cycling to school, which can help inform and enhance bike to school programming. This paper focuses on the findings as they relate to the gender gap.

4.1 Setting

Toronto is Canada's most populous city, with a population of 2.6 million (2011). Driven by the Province of Ontario's Growth Plan for the Greater Golden Horseshoe (2006) and the limitations placed on urban sprawl in surrounding regions by the Greenbelt Plan (2005), Toronto is experiencing rapid intensification. Population forecasts for 2031 predict a total of 3.19 million residents and 1.66 million jobs (22). To date there has been no corresponding increase in the

scale of long-range transportation infrastructure investment, and investment in active transportation remains a significant gap area.

Though the physical environment is often cited as the main determinant of cycling behaviour (23; 24; 25; 26; 27), there are also other significant factors at work. From 2001 to 2006, the number of Torontonians cycling for transportation grew by more than 30 per cent (28). Cycling participation further accelerated between 2006 and 2011, a period in which trips by bicycle increased by 75 per cent while overall trip growth increased by only 8 per cent (29). Cycling has continued to grow since 2011 (30), but commuter cycling infrastructure has only very recently started to increase. It is important to note that Toronto's physical infrastructure for commuter cycling ranges from weak to non-existent, creating an unusual opportunity to observe the influence of other factors. In areas with very similar physical infrastructure and urban environment, we see substantial differences in levels of cycling.

Historically, there has also been a lack of investment in cycling to high schools (e.g. education programs, infrastructure). This age group is not yet well understood in the AST literature. Three high schools in the Toronto District School Board participated in this study. All three are located in the downtown core of Toronto in Wards 19 (Trinity-Spadina) and 27 (Toronto Centre-Rosedale) (Figure 1). Schools A and B are sited in a largely residential neighbourhood with a grid street pattern. School C is in the "heart of the city", and also has several residential neighbourhoods and apartment buildings nearby. The schools differ in the make-up and size of their student populations and in the extent of their cycling initiatives.

All three schools participate in CultureLink Settlement Services' Bike to School Project, which offers educational programs in cycling skills and road safety, support for after-school bike clubs, and includes a fleet of 40 new bicycles that are housed at School A. School A's bike club has existed for three years. They won the 'Bicycle Friendly School of the Year Award' at the 2013 Toronto Bike Awards, and host the first Bicycle Repair and Maintenance Course offered in the Toronto District School Board, as well as a special program for newcomers to Canada. Schools B and C recently finished their first year with the Bike to School Project. Prior to participating in the Project, they did not have bike clubs and had minimal to no cycling-related events or support. More than half of School A's population has moved to Canada within the last five years. One-quarter of School C's population has as well, but most students at School B have lived in Canada since birth.

4.2 Surveys, Interviews, and Focus Groups

Ethics approval was received from both the University of Toronto and the Toronto District School Board, and the principals of each school chose to have their schools participate. Parental consent forms were sent home in October 2013 with all students with a homeroom class at Schools A and C, and with two classes per grade at School B (based on discussions with the principals). The forms requested permission for students to participate in in-school surveys and/or focus groups. At School A (school population = 350), a total of 138 students completed the survey in class on November 21st, 2013. At School B (school population = 1000), 55 students completed the survey on November 26th, 2013. At School C (school population = 1000), 502 students completed the survey on December 2nd, 2013. Teachers provided the first 10 to 15 minutes of their first period class for students to complete the surveys. The survey measured trips to and from school by mode, demographic and situational factors affecting transportation choices, personal attitudes and peer perceptions of cycling, and awareness and participation in the school's bike initiatives. Since Schools B and C had very few initiatives at this time, their lists comprised mostly of initiatives in the school neighbourhood.

Five semi-structured interviews were held with teachers and staff at School A, each of whom was involved in the cycling activities at the school. The interviews helped provide an overall understanding of what cycling initiatives were held in the recent past, and what bike programming currently exists. They also provided information about perceived changes to the travel behaviour of students, and barriers to and benefits of cycling to school.

A convenience sample of students at School A who had permission from their parents to participate in focus groups was invited to take part in small group discussions held in January 2014. One of the teachers involved in the cycling program invited students she knew through classes and clubs, and provided a room in the school for the focus groups to be held. It was partially purposive in that she sought a balanced combination of cycling and non-cycling students in Grades 11 and 12 for the first group of eight, and a group of six Grade 9s for the second. (No Grade 9s at the school cycle as their primary mode of transportation). The focus groups were organized by grade to ensure that the younger students would be able to speak as much and as freely as the older students, and to see if the discussions differed greatly by grade.

4.3 Data Analysis

The data were analyzed with the goal of answering the following questions:

- How are students currently travelling to and from school, and why do they use those particular modes?
- Who is cycling? What characteristics are common to most of the cyclists?
- Do male and female high school students think differently about cycling?
- Do male and female high school students face different barriers and opportunities for cycling to school?

The student surveys were numbered, coded and entered into Excel. The totals for each answer were tallied, and the averages, medians, and modes were calculated. Using the filter function in Excel, the summary statistics were compared by different grouping characteristics, such as males versus females, high school grade level, and other attributes. The absolute numbers were converted to their percentage equivalents to more easily compare across groups in order to find where strong differences and similarities exist. The data from the Likert scale questions (about attitudes, subjective norms, and perceived control) were entered in SPSS and analyzed using the Mann-Whitney U test, a non-parametric test, to see if there exists statistically significant differences between each group. The Mann-Whitney U test is useful for comparing differences between two independent groups with ordinal data (31). The N/A responses were removed so the medians and p-values only reflect those who chose a number on the scale. The surveys were analyzed as one large sample including all students, as well as on a school by school basis.

For the interviews and focus groups, respectively, techniques from constant comparison and classical content analysis were used. The data were grouped in small units, a code was attached to each unit, the codes were grouped into categories, and then one or more themes that expressed the content of each category were developed (32).

4.4 Potential Limitations

It is important to recognize that this paper is based on a small number of case studies, and may not be representative of other high schools in Toronto, especially those with different physical environments and student populations. It should be viewed as one piece of a larger effort to increase understanding about AST.

Not all students may have completed the survey honestly. One survey was identified as containing 'joke' answers throughout, and was therefore removed, but others may have contained false responses. Additionally, the surveys were not all completed on the same date,

and all were delivered later in the semester than intended, which may result in some weather biases (likely against cycling, especially for the latest survey day in December).

5.0 RESULTS

For most of the results that follow, the findings are presented by school and by gender. Some figures, such as Figure 1, show the results of the schools' pooled data. First, the student populations are described, focusing on their cultural/ethnic backgrounds, how long they have lived in Canada, car ownership, access to a bicycle and/or a transit pass, and who the key decision-makers are regarding their transportation choices. Second, the travel patterns of the students are explored, focusing on mode share to and from school, as well as the distance between home and school, and interesting findings among the students who cycle. Lastly, the barriers to cycling to school and students' attitudes and perceptions of cycling are examined through a comparison of male and female responses.

5.1 Describing the Student Population

The overall sample of students from Toronto is very diverse. Approximately 50% of students identify as Asian. Many of those who selected more than one answer chose 'North American' as one of their two or three groups (Figure 3).

FIGURE 3 Survey respondents by culture

Close to half of the households at Schools A and C do not own a vehicle (43.80% and 44.22% respectively). The majority of households (85.19%) at School B have one or more vehicles. At School B, nearly all students have access to a bicycle (89.09%). At Schools A and C the bicycle ownership/access rate is only slightly over 50%. Many students at School A have a transit pass (41.06%), but very few at Schools B and C do (18.18% and 11.55% respectively). In every case,

more males have bicycles than females, and more females have transit passes than males (Figure 4).

FIGURE 4 Percentage of students with access to a bicycle and/or transit pass by gender

Overall, more males are deciding for themselves how to travel to school. The exception is School B, where both males and females are deciding about 65% of the time. At School A the difference is most significant: more than 80% of males decide for themselves, but only slightly over 40% of females have that same independence (Figure 5). For schools combined, 60% of females decide on their own compared to 73% of males.

FIGURE 5 Percentage of students who decide their transportation mode to school themselves, have their parent or guardian decide, or decide together by gender

The variation in independent decision-making regarding transportation was further investigated using the Mann Whitney U test, comparing males and females newly arrived in Canada (0-5 years; 6-12 years) over all schools. Recently immigrated males are most independent in their transportation decisions, significantly differing (at the 5% level) from newly immigrated females. Overall, males are more independent than females in their transport decisions, but this difference diminishes as the students live in Canada longer, and for those born in Canada, the difference is negligible.

FIGURE 6 Percentage of students independently determining how they travel to school by length of time lived in Canada and gender

5.1 School Travel Patterns

None of the high schools has a school bus system. Students either arrive by car, transit, on foot, by bike, or in a few cases, by skateboard/longboard. The results vary greatly by school. At School A, an overwhelming majority take transit to and from school (68%) as their primary mode of transportation. The next most common mode is walking (13%), followed by cycling (11%). At School B, the mode share for transit is lower (35%), and higher for walking and cycling (26% and 19%). There are several students who are driven to School B in the morning, but who walk home at the end of the day. At School C, the most popular mode is walking (47% on the way to school, 56% on the way home), followed by transit (39%) (Figure 7).

FIGURE 7 Percentage of students travelling to school by car, transit, walking, cycling, skateboarding and other as their primary mode of transportation by gender

Across all three schools, the rates of males cycling are much higher than females. The most significant gap is at School C, where the cycling mode share is the smallest. The difference is not as pronounced at School B, where the cycling mode share is greatest.

Schools B and C have very small catchment areas, with approximately 90% of students living 5 km or closer. At School C, over 40% of students live within 1 km. At School A, which has more special programs offered, about 20% of students are coming from more than 5 km away (and in some cases very far). Overall, the vast majority of students are within a bikeable distance.

Cyclists, defined here as students who ride at least once a week to school ($n = 108$) (not just those who indicated it is their primary mode), represent 16% of the overall sample, and have a number of characteristics in common. The majority of student cyclists are male and live within 4 km of their school. They are more likely to list 'fast' and 'enjoyable' as reasons for choosing their mode of transportation, to also ride recreationally, and to decide their mode of transportation on their own. For the female cyclists specifically, 77% decide on their own how to travel to school, compared to 60% of non-cycling females.

5.3 Barriers and Attitudes by Gender

Differences between male and female students were most pronounced at School A. At School A, all of the students who identify their parents as a barrier to cycling to school are females. Females also make up the majority of respondents who say they do not bike because they do not know how, or they do not know how to ride with traffic. Many more females than males reference fear, danger or safety, and a few more believe they live too far, or they are without a working bicycle.

For the three schools combined, 12% of females mention fear, danger and safety when explaining why they do not cycle, compared to only 5% of males. The reverse is true for the barrier of 'weather'. Overall, 11% of females do not ride because they do not know how, compared to only 4% of males. Additionally, 20% of males choose not to cycle because they walk instead, compared to 12% of females.

For the overall sample, the attitudinal questions with the Likert Scale that show a noticeable difference between males and females are as follows: males are more likely to agree that they feel comfortable riding a bicycle on the street in Toronto and more likely to disagree that it is too expensive to buy a bicycle. At School A the first of these differences is significant according to the Mann-Whitney U Test.

In summary, more males than females have access to a bicycle, and the reverse is true of transit pass access. More males than females decide independently how to travel to school at Schools A and C, particularly at School A, where the spread is nearly 40%. This gender difference in decision-making is significant for the pooled school data, for those most recently arrived in Canada. This difference declines over time spent in Canada, becoming negligible for those born here. At School A, where the average distance from home to school is greater, an overwhelming majority take transit to and from school (68%), while some walk (13%) or cycle (11%). At School B, where students live closer to school and are mostly born in Canada, the mode share for transit is lower (35%), and for walking and cycling they are higher (26% and 19%). Several students are driven to school in the morning, but walk home at the end of the day. At School C, where students live very close by, the most popular mode is walking (47% on the way to school, 56% on the way home), followed by transit (39%).

At Schools B and C, there are many more females taking transit to and from school than males. Across all three schools, the rates of males cycling are much higher than females. The most significant gap is at School C, where the cycling mode share is the smallest. The difference is not as pronounced at School B, where the cycling mode share is greatest.

School A has the highest proportion of recent immigrants, and Schools A and C both host students with low rates of family car ownership. At School A, the gender differences are most pronounced, and females identify their parents as a barrier to cycling to school, as well as lack of cycling ability or confidence, and females refer to fear and lack of access to a bike or excessive distance. At this school, females feel significantly less comfortable riding a bike than do males.

6.0 DISCUSSION AND CONCLUSIONS

The picture of cycling by gender and by school described above is complex and fascinating, but overall, indicates a disturbing pattern of fear and lack of access and cycling confidence among females as compared to males at the case study schools, as well as a lack of independent transportation choice among females particularly at School A. There is a striking difference in the ability to decide travel mode between females overall and females who cycle. Those who cycle are more likely to be independent decision makers than those females who do not cycle. These attitudes and perceptions of control are influenced by the physical, social, and cultural environments the students live in, and may also be affected by biological and personality traits, as described in the conceptual model. The literature on gender and cycling finds that women are more concerned about safety, comfort, and accessibility than men (15).

Some of the focus on safety may be related to females' household environments, where their culture or family structure may constrain or enhance their opportunities. It is notable that at School A, where the spread of independent decision-making between genders is very pronounced, the majority of students arrived in Canada within the past five years, and the culture of their birthplaces is likely dominant in these households. It may be that in their countries of

origin, the very real risks for women travelling independently are assumed to prevail in Canada as well, and that as learning about their new country progresses, these fears abate somewhat, as is visible in School C. Alternatively, parents may view new dangers in Canada for their daughters, due to the very different prevailing social norms from their country of origin. Again, these fears may diminish as time in Canada increases, or daughters might progressively resist these limitations. Overall, male accident rates on bicycles greatly exceed those for females, who experience similar risk of fatality on bicycles as on foot or in cars (33). Additionally, social desirability may also play a role in terms of the way students answer. The males may be more inclined to answer that they travel independently because they believe that is the norm, and females may be more inclined to say they share this decision with their parents because they believe that is expected of them. Therefore, the influence of culture on adolescent travel mode warrants further research. In particular, if adolescent travel choice is dictated, in part, by parental perception of gendered risks, evaluation of the effect of integration programs targeted at new Canadian parents on adolescent mode choice could be a worthwhile research topic.

As is evident for the population at large, gender differences in cycling mode share among these localised school populations are exaggerated when cycling mode shares are low, and disappear as mode share approaches 20%. Even in these diverse schools, female to male ratios of cycling mode shares track overall cycling mode share, with Schools B, A and C, having cycling mode shares of 18.52%, 10.95% and 4.38% respectively, and ratios of .73, .53 and .14. Coincidentally, Ward 19, home to Schools A and B, has an overall cycling mode share of 11.4% (ratio of female: male mode share being .81), while Ward 27, housing School C, with a much lower cycling mode share, has a lower cycling rate of 3.5% (with the female: male ratio being .32) (29). As cycling becomes normalized and visible, even when cycling infrastructure is absent, women appear to increasingly view cycling as an accessible form of transport (16). This makes a case for programs to increase cycling mode share overall, which should improve female cycling rates as well.

In conclusion, this study describes a pattern of hesitancy to cycle on the part of female high school students, as compared to their male counterparts. The young women report less access to a bicycle, less comfort or confidence in riding, more fear associated with cycling and less ability to independently decide how they travel to school. Our study identifies two important variables that are likely associated with young women's participation in cycling: overall cycling mode share and ability to decide independently their travel mode. The former tracks findings for the general population, and the latter might be associated with social expectations of students and the proximity of immigration, as families may bring associations of danger to independent female travellers from their countries of origin or perceive new dangers in Canada. While the former association is well established for the adult population, the latter hypothesis warrants further research.

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