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Longer or more frequent walks: Examining the relationship between transit use and active transportation in Canada

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ABSTRACT

Introduction: Using public transit has been positively associated with active transportation mainly because it is typically required to access and egress stations and stops. Transit users may adopt a lifestyle that enables them to walk and bicycle more to destinations other than transit stops or stations. The relationship between public transit use and active transportation in Canada is analyzed with a focus on trip durations for trips taken.

Methods: Using a sample of the time use module of Canada's General Social Survey (2005, $n = 10{,}867$, weighted to represent 15,298,948 urban Canadians), meeting physical activity guidelines of 30 min or more of moderate physical activity through walking on survey day was assessed using a logistic regression. Using public transit during the day was the main correlate, controlling for socio demographic characteristics and survey day.

Results: Transit users (8.5%) met physical activity guidelines (Adjusted Odds Ratio: 1.66 and 2.78 respectively for bus and subway/train) by walking to public transit or to other destinations. Analysis of walk time by purpose showed that trip duration did not vary significantly between transit users and non-users once an individual walked for a specific purpose, but a higher proportion of transit users walked for each studied purpose.

Conclusion: Beyond the walks to public transit stops or stations, transit users perform more active transportation to destinations by taking more walk trips for various purposes. Developing transit infrastructure and providing proximity destinations in surrounding neighborhoods may provide health benefits beyond a reduction in travel related energy use and emissions.

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1. Introduction

Because of the important potential health benefits associated with physical activity (CSEP, 2012; USDHHS, 2008), and the limited amount of Canadians being sufficiently physically active on a regular basis, the practice of active transportation (AT), walking or cycling for the purpose of reaching destinations, has been identified as a potentially important source of physical activity (Sallis et al., 2004, 2006). In 2011, 54% of Canadians were considered active or moderately active (Statistics Canada, 2012), an increase compared to the 52% of active or moderately active Canadians in 2005 (Gilmour, 2007).

The total (direct and indirect) health care costs of physical inactivity in Canada in 2009 amounted to $6.8 billion, and represented 3.7% of overall health care costs (Janssen, 2012). The Canadian Society for Exercise Physiology (CSEP) has established a set of guidelines for the practice of physical activity (PA) (CSEP, 2012). On hundred and fifty minutes a week, or 30 min a day of brisk walking can improve adults' personal health, reduce the onset of disease, and help recover from poorer health. Coronary artery disease, stroke, hypertension, colon cancer, breast cancer (in women only), type 2 diabetes, and osteoporosis are some of the most common diseases associated with physical inactivity (Warburton et al., 2006, 2010).

An abundance of systematically reviewed research points to the relationship between the built environment and walking (TRB-IOM, 2005; Brownson et al., 2009). Environments that are denser have more destinations within walking distance and have a variety of land

uses tend to favor walking and have been empirically shown to be associated with more frequent and longer active transportation trips. Residents of single family homes in suburban areas are less likely to benefit from such environments (Turcotte, 2008b).

Transit users are also walkers because most public transit trips require a walk trip at least on one end of a transit journey (Lachapelle and Frank, 2009). Estimates for the percentage of transit users reaching PA guidelines by walking to and from transit range from 29% (Besser and Dannenberg, 2005) to 35.3% (Freeland et al., 2013) and 40% (Wener and Evans, 2007). Average total walk time to and from transit can be in the order of 12–49 min for work trips depending on transit types and need for transfer (Wasfi et al., 2013). The higher level of active transportation of public transit users has also been associated with lower rates of overweight and obesity (Brown and Werner, 2007; Ming Wen and Rissel, 2008; MacDonald et al., 2010), higher energy expenditure (Morabia et al., 2010, 2012; Rissel et al., 2012) and reduced health care costs (Edwards, 2008; Stokes et al., 2008).

Analyses are usually carried out at the level of a city or metropolitan region. Beyond transit access by active transportation, being a transit user increased the likelihood of walking to multiple other destinations both near their homes and workplace (Lachapelle et al., 2011) but no information was provided on time spent walking by purpose for individual trips. Transit service tends to be associated with denser neighborhoods with more accessible destinations and certain trip may be accessed near the home without taking transit. Once at the destination side of a trip, transit users have no other means of transportation, and are more likely to walk to nearby destinations and services (Lachapelle et al., 2011).

This paper's objective is to explore how the Canadian General Social Survey (GSS) can serve to confirm these analyses at a national level. Specifically the paper aims to assess the relationship between meeting PA guidelines through walking depending on whether a person used different modes of transit, or not. A secondary objective is to identify differences in engagement in walking for different purposes and average trip duration for users and non-users of public transit.

While a number of authors have used the GSS to assess the practice of physical activity (Spinney et al., 2009), or overall transportation for the entire population (Turcotte, 2008a, 2011) or for specific groups such as the elderly (Newbold et al., 2005; Spinney et al., 2011), none to this author's knowledge have analyzed the relationship between active transportation and public transit use. The GSS provides important qualities that can distinguish this analysis from others in its field. Namely, a nationally representative sample of urban Canadians, detailed socio-demographic characteristics, detailed information on trip purposes and on variation between weekdays and weekend days.

2. Material and methods

The analysis relies on the time use module of Statistics Canada's General Social Survey, Cycle 19 (2005, $n=$ 19,597). The GSS is a Computer Assisted Telephone Interview of a random sample of non-institutionalized persons 15 years of age or older, living in Canada's ten provinces (excluding Yukon, Northwest Territories and Nunavut). The weighted sample is representative of the entire non-excluded population of Canada (Béchard and Marchand, 2006). Random Digit Dialing (RDD) methods were used to sample participants, and telephone interviews were conducted to retrieve voluntary information. Data was gathered in 2005 between January 12 and December 13. The overall response rate was 58.6%. The public use microdata files were used for this analysis. Thus, approval from an ethical review board was not required for this analysis. All work was conducted in 2014.

This time use survey collects information on activities having taken place on the day prior to the survey call. The designated day begins at 04:00 a.m. and ends 24 h later. Participants are asked to provide a detailed list of all activities that took place during the 24-h period. Types of activities are coded into episode files (nearly 200 activity codes), location where the activity took place (including 9 modes of transportation which enable determining that an episode was a trip), start and end time, as well as duration. A person level file that includes information on socio demographic characteristics accompanies the episode file.

Because public transit is typically not available outside of larger urban centers, the analysis was restricted to participants living inside Census Metropolitan Areas (CMA) and Census Agglomeration (CA). One or more adjacent municipalities centered on a population core form a CMA and a CA. A CMA must have a total population of at least 100,000 of which 50,000 or more must live in the core. A CA must have a core population of at least 10,000 and a total population of at least 11,000 (Béchard and Marchand, 2006). The population of these 147 areas amounted in 2005 to 20,947,994, or 14,715 respondents. The final sample size ($n=$10,867) contained all relevant variables included in analysis. Missing cases ($n=$3848) were omitted because they did not report income.

2.1. Dependent variables

Using a variable on the total walking duration for active transportation, two dummy variables were created: having walked at all and having walked 30 min or more on the diary day. Episode files were also used to create variables for participation and duration of walk trips by purpose. The 20 different activity codes for walking were recoded into 8 purposes[1] (see Fig. 1) to combine similar activities with low participation rates. Upon inspection of the episode files, transit trips were not always preceded or followed by walk, bicycling, car or other transit trips. It was found that most respondents (about 90% of transit trips) bundled walk access, transit wait time, trip time and egress time together. The data therefore underreports the total amount of walking done by transit users in particular. Estimates should thus be

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[1] Travel-related activity codes (typically beginning with "Travel to/from"...) were recoded using the following classification:
1. **Work:** 30 – "Travel during work"; 90 – "paid work".
2. **Household related:** 190 – "unpaid domestic work".
3. **Children transport:** 291 – "care for household children"; 292 – "care for household adults".
4. **Purchases and services:** 390 – "shopping or obtaining services"; 492 – "personal care activities"; 990 – "Travel for media and communication activities".
5. **Restaurants:** 491 – "restaurant".
6. **Education:** 590 – "Travel related to/from school education activities".
7. **Others:** 674 – "Transporting assistance to someone other than a household member"; 691 – "civic or voluntary activity"; 692 – "religious services"; 791 – "attending sports, movies or other entertainment events or visit sites"; 793 – "other socializing (to bars, hospitals, weddings)"; 891 – "participating in active sport/outdoor activities"; 892 – "coaching activities"; 893 – "hobbies and sale or exchange of crafts"; 894 – "other leisure activities".
8. **Visit family and friends:** 792 – "Travel for Socializing (Between Residences)".