CAN WE BETTER LEVERAGE NATIONAL DATA COLLECTION INITIATIVES TO SUPPORT TRANSPORTATION PLANNING IN SMALLER CITIES AND RURAL AREAS IN CANADA? A VIEW FROM NEW BRUNSWICK

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Abstract: As Canada's population ages, there will be growing calls for transportation solutions that address the challenges associated with transportation and aging, in particular, for those who are unable to drive. Effective transportation solutions require a clear understanding of travel behaviour, yet the most sophisticated transportation studies are undertaken in the largest urban centres where many alternatives to driving already exist. Smaller cities and rural areas are among the most rapidly aging in the country, yet may not have the resources to conduct studies to understand the travel needs of their residents, necessitating reliance on national datasets. National datasets, such as the Census, can be used to gain some insight into broad travel needs, but are limited in terms of specific conclusions that could be used to support transportation solutions for non-driving older adults. This paper profiles national Canadian data collection efforts in terms of their suitability and limitations to be used for transportation planning in smaller communities, with a New Brunswick focus. The paper identifies opportunities to consider new questions or wording among these national surveys that could provide an additional resource for smaller cities and rural areas to help support their transportation planning for an aging population.

1 INTRODUCTION

Statistics Canada anticipates that over 20% of the Canadian population will be over the age of 65 years by the year 2036 (Statistics Canada 2015d), and in some jurisdictions, like New Brunswick, this percentage may be nearly 30% (Statistics Canada 2015c). The vast majority of Canadians depend on the automobile to meet their transportation needs, yet the health effects of aging can make driving difficult or impossible over time. This demographic shift is of such significant national importance that numerous federal agencies, such as Statistics Canada, have devoted resources to understanding the issues and opportunities associated with an aging population. While the issues are generally well articulated at the national level, responding to the transportation needs of an aging population will require deploying solutions at the local level.

Effective transportation solutions require a clear understanding of travel behaviour, yet the most sophisticated transportation studies are undertaken in the largest urban centres where many alternatives to driving already exist. Smaller cities and rural areas, such as those in New Brunswick, are among the most rapidly aging in the country, are the most car-dependent, and yet may not have the resources to conduct studies to understand the travel needs of their residents, necessitating reliance on national datasets. Any transportation issues that manifest among an aging driving population will likely be more pronounced in smaller cities and rural communities due to higher proportions of older adults and higher

automobile dependence. Conversely, smaller cities and rural communities may also be the incubators for new ideas that address transportation issues for an aging population. The challenge is ensuring that smaller cities and rural areas have the tools to understand the issues and to mobilize in response.

2   APPROACHES FOR TRAVEL DATA FOR TRANSPORTATION PLANNING

"Transportation planning studies are designed to collect and analyze information pertaining to present and future transportation needs" (Institute of Transportation Engineers 1999), and for passenger transportation, this information can come from personal and household travel data collected through surveys. There are three main approaches to personal and household travel data collection in Canada:

- Commuting travel data associated with the census of population

- National surveys that capture travel behaviour as part of a wider study (e.g. General Social Survey on Time Use in Canada) for understanding regional and national trends

- Metropolitan surveys on travel behaviour (e.g. Transportation Tomorrow Survey, Toronto, Destination 2040, Greater Moncton) for service and infrastructure planning

Each of these approaches are explored below in terms of their relevance to rural communities and small cities.

2.1   Commuting travel data associated with the census of population

The most relevant (and accessible) national data for smaller and rural communities is the Statistics Canada "Journey to Work" data, which are open data available on the Statistics Canada website and taken from the Census of Population. "Journey to Work" is also the only transportation component of the U.S. Census (U.S. Census Bureau 2017) and reports data in a comparable way to Canadian data, a fact noted by Pucher and Buehler (2006) when looking at cycling data. The data in Figure 1 is organized by Census Agglomeration, but data are also available by Census Subdivision, which would typically include any incorporated municipality (regardless of size).

The information presented in tables like Figure 1 provides valuable insight on travel behaviour and commuting patterns, including mode choice, and is available to even the smallest communities, provided they are a recognized Census Subdivision. The challenge with these data is that they have fairly limited utility for transportation planning; the issue of seeing a Toronto to Fredericton driving commute (1300 km) is described in this footnote from the Statistics Canada data table:

"The census assumes that the commute to work originates from the usual place of residence, but this may not always be the case. Sometimes, respondents may be on a business trip and may have reported their place of work or main mode of commuting based on where they were working during the trip. Some persons maintain a residence close to work and commute to their home on weekends. Students often work after school at a location near their school. As a result, the data may show unusual commutes or unusual main modes of commuting" (Statistics Canada 2016c).

Data table

Select data categories for this table

Geography
| Fredericton |

Geography type
| Place of work |

Commuting duration (6)
| Total - Commuting duration |

Sex (3)
| Total - Sex |

[Submit]

Place of residence	Place of work	Total - Main mode of commuting[1]	Car, truck or van	Driver, alone	2 or more persons shared the ride to work	Driver, with 1 or more passengers	Passenger, 2 or more persons in the vehicle	Sustainable transportation	Public transit	Active transport	Other method
Fredericton	Fredericton	37,570	33,185	26,590	6,590	3,325	3,265	4,060	1,045	3,020	330
Saint John	Fredericton	295	250	205	45	30	20	40	10	30	0
Moncton	Fredericton	155	140	125	15	10	10	15	0	10	0
Bathurst	Fredericton	45	45	35	0	0	0	0	0	0	0
Miramichi	Fredericton	45	45	40	0	0	0	0	10	0	0
Toronto	Fredericton	25	15	15	0	0	0	0	0	0	0
Halifax	Fredericton	20	15	15	0	0	0	10	0	10	0

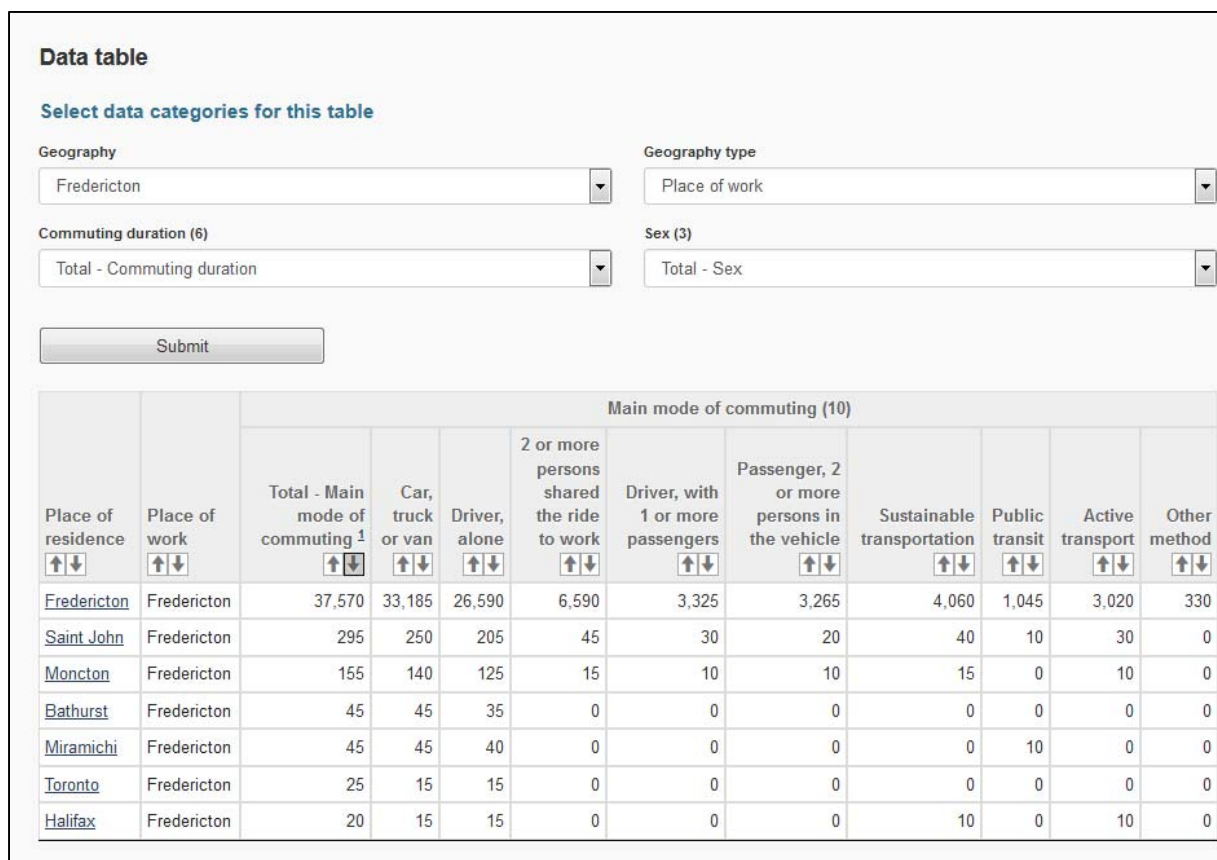*Main mode of commuting (10)*

Figure 1: Commuting data to Fredericton by place of residence (Statistics Canada 2016b)

These data are not associated with a timeframe or frequency (e.g. how many trips per day, how many days per week) or modal split for the trips taken (e.g. what percentage of the trips are taken as a driver). The caveat provided by Statistics Canada above suggests that the farther away the place of residence is from the place of work, the less likely that the data represent a "usual" daily commute. This can present further complications for interpreting data from rural areas as commuters may need to travel farther for work than in urban areas, and the distinction between what makes an "unusual" commute and a long-distance commuter is unclear.

2.2 Challenges with the 2011 National Household Survey commuting data for Rural New Brunswick

Given the small numbers associated with commuter flows from small communities, data issues (such as non-response) or errors that may be minor on a metropolitan scale can have major impacts on conclusions drawn from data from small communities. The New Brunswick experience with the 2011 National Household Survey (NHS) provides some insight into some of the challenges with this survey for understanding rural needs. The NHS was introduced as a voluntary replacement for the mandatory long-form census which previously provided information that could be used for understanding commuting behaviour. While Smith (2015) highlights that data from 1100 communities or 3% of the Canadian population were not released from the 2011 NHS due to "because of unacceptably low response rates by Statistics Canada's standards", this actually accounted for 82 New Brunswick Census Subdivisions representing 11% of the New Brunswick population (calculated from cross-referencing communities profiled in Statistics Canada (2015b) and their population from the 2011 Census). The majority of communities included in Table 1 were unincorporated rural areas accounting for 64,451 New Brunswickers, with the largest unincorporated area having 5032 people.

Table 1: Breakdown of New Brunswick communities excluded from NHS data release in 2011

Parishes (unincorporated)	61
Villages	14
Rural Community (incorporated)	3
Town	2
First Nation	2
Total number of communities where data not released (2011)	82
Total population of communities where data not released (2011)	83,794
Total population NB (2011)	751,171
% population where data not released	11%

In addition, coding errors among communities with similar names can result in commuting flow data that appears unrealistic. Commuting flow data for one New Brunswick community was found to be entirely incorrect due to assigning people working at Canadian Forces Base Gagetown (in the Town of Oromocto) to the Village of Gagetown (pop. 698), 40 km away (Hanratty 2015). The 2011 commuter flow data showed 660 commuters to the Village of Gagetown, with 410 from Oromocto; the 2016 data show only 85 total commuters destined for the Village of Gagetown and none from Oromocto (Statistics Canada 2016a). As of March 2018 the values have not been corrected online.

The return of the long-form census and mandatory completion has had positive impacts on Global Non-Response Rates (GNR) for a number of small communities in New Brunswick, as some had high GNR for the 2011 National Household Survey (Table 2), which was the source for "Journey to Work" data in 2011.

Table 2: Select New Brunswick communities and Global Non-Response to the 2011 NHS and 2016 long-form census (retrieved from community profiles from both surveys)

Community	Non-response to 2011 NHS	Non-response to 2016 long-form census
Minto	48.6%	5.8%
Chipman	48.1%	6.6%
Canning	39.4%	9.7%
Chipman Parish	40.6%	3.8%

Even though "Journey to Work" is only one aspect of travel in a community, these data may represent the only origin-destination information available at a small community level, but as evidenced from New Brunswick examples for the 2011 NHS, the data may not always be available, and when it is, it may not be correct. The improved response rate for the latest census can be expected to increase the reliability and value of this information for planning in small communities.

2.3   National surveys that include travel behaviour

The Census of Canada is the only national data source that collects and disseminates data at the community level, and the only travel behaviour characteristics presented are commuting-based. There are additional national data sources that, with appropriate analysis, can provide considerable insight into aggregate individual and household travel behaviour.

The national data source that is likely most relevant for understanding travel behaviour is the General Social Survey on Time Use. These data are available upon request from Statistics Canada or can be accessed through the Data Liberation Initiative at participating universities, such as UNB, and can be analyzed through such tools as CHASS from the University of Toronto. The data are available by province (and include samples from each province, but no territories) and by urban (CMA/CA) and rural

(non CMA/CA) areas, and include demographic variables, such as age. They are based on a 24hr time-use diary obtained through a telephone interview, which is coded to provide information on the time spent on various activities, including transportation between activities, and the type of transportation. Data from earlier surveys (Cycle 19 (2005) and Cycle 24 (2010)) go much further in depth on access to transportation than the most recent Cycle 29 (2015), asking whether respondents had a driver's license (or had to give it up) whether others depend on them for transportation, and why people do not use public transportation. Cycle 29 (2015) represented a considerable change compared to previous Cycles, with only one question on access to transportation ("How often do you have a vehicle at your disposal?") and a question on mode to commute to work in the previous week (Statistics Canada 2015a).

These data are valuable for understanding how Canadians use transportation, within the confines of overall how they spend their time, and can form the basis for modelling exercises to identify important variables influencing transportation use (see Young and Lachapelle (2017)) and earlier versions of the survey have been used explore travel behaviours of older Canadians (Newbold et al. 2005). Cycle 29 drew from a sample of 17,390, of which 1,058 were from New Brunswick. These data could be used to understand how rural older adults in New Brunswick spend time on transportation and earlier Cycles could provide insight on older adults' perspectives on transportation access and preferences. It may be possible to develop mathematical models relating demographic and socio-economic variables with travel behaviour, permitting some estimation of local needs based upon census attributes.

The Canadian Community Health Survey (CCHS) is another national survey that asks transportation questions that are relevant to an aging population. In a study of access to health care services and waiting times, participants were asked about difficulties is accessing care (e.g. specialist) and one of the options was "Transportation problems" (Statistics Canada 2013). These survey data were the basis for the compilation of 33 New Brunswick community profiles for the New Brunswick Health Council, with results that indicate the percentage of the population in that community reporting transportation problems to healthcare (New Brunswick Health Council 2018). The benefit of these data is that they do give a finer resolution to transportation issues by geography, and the entire province is covered, but the geographic boundaries are generally associated with health catchments areas rather than municipal or taxation boundaries which would expected to be the service delivery mechanisms. The challenge remains from the transportation planning perspective that "transportation problems" are not defined. The 2008-2009 Health Aging Canadian Community Health Survey has numerous questions about someone's ability to meet their own transportation needs, including how much they drive, whether they rely on others for transportation, and the data are organized by province and CMA and Non-CMA, providing another valuable dataset.

2.4 Metropolitan (urban) surveys on travel behaviour

Data collected through metropolitan or urban travel surveys explicitly focus on measuring, understanding , and forecasting transportation, and do so in a way that align with the planning and forecasting tools typically available (e.g. four-step modelling). While the Census "Journey to Work" data looks at the number of workers and where they live and work most often, an urban travel survey will look at all elements of a journey, and the one-way trips generated from Home and Non-home, and include more categories than "Work", since the goal is often to understand travel impacts on infrastructure capacity and service levels. The population census data can serve to help with the validation of model estimates.

These data can be collected at the local (metropolitan) level involving participation from municipalities, regions, transit agencies and can involve provincial governments. Canada's two largest metropolitan areas, Toronto and Montréal, for example, conduct regular (and extensive) household travel surveys. The Transportation Tomorrow Survey (TTS) is a detailed household travel survey conducted by the University of Toronto Transportation Research Institute every five years for urban transportation planning in Greater Toronto & Hamilton (GTHA) (University of Toronto 2018b). In 2011 the TTS included a random sample of 159,200 households, representing information on 8.5 million people (University of Toronto 2018a). The Réseau de transport metropolitan (RTM) in Montréal in 2013 conducted an "extensive Origin-Destination survey throughout the entire Greater Montréal Area" involving 80,000 households, "in order to adapt transportation policies and projects to the real needs of the population"

(Société de transport de Montréal 2018). By contrast, the U.S. National Household Travel Survey in 2017 relied on participation from 129,000 households (U.S. Department of Transportation 2018). Both the Toronto and Montréal travel studies have expanded their scopes to include outlying communities and regions.

Smaller metropolitan areas also collect similar household travel data, though the regularity may be more ad hoc. Hanson (2017) profiled the progression of transportation planning in New Brunswick from 1946 to 2017 and found many of the metropolitan transportation plans for New Brunswick cities did involve household travel surveys, but the plans were focused on understanding the impacts of highway infrastructure projects and typically did not cover rural or suburban areas. More recent approaches, including the Destination 2040 plan for Greater Moncton (Cities of Moncton and Dieppe, Town of Riverview) (HDR Inc. 2015), have starting moving towards modal split targets involving transit and active transportation instead of exclusively forecasting automobile usage. The challenge is that in the case of Destination 2040, 20% of the metropolitan population lives outside the boundaries of the three communities in the study area; by 2041 this is forecast to be 18% or over 37,000 people (calculated from data in HDR Inc. (2015)). These 37,000 people will likely be highly automobile dependent, and primarily living in smaller, rural communities, yet fall outside any transportation planning framework that could assist them planning for a future where access to the automobile is reduced.

3   THE CHALLENGE AND OPPORTUNITIES FOR BUILDING TOMORROW'S SOCIETY BY DEPENDING ON EXISTING DATA

The recently released "From Surfaces to Services" 20 year (2017-2037) transportation strategy from the Rural and Urban Transportation Advisory Committee of the New Brunswick Economic and Social Inclusion Corporation (ESIC, an anti-poverty Crown Corporation) is predicated on the need to address the economic and social inclusion needs of tomorrow's society by focusing on transportation today. "New Brunswick has largely achieved its previous vision for automobile-based mobility, but this mobility now makes populations dependent on the ability to own and drive a car." (RUTAC 2017). The strategy highlights the challenges with this automobile dependence for New Brunswick where it may have up to 1/3 of its population over the age of 65, with "no plan to help prepare for the number of people in this group who will look to transition from being drivers to passengers due to health effects of aging and the onset of disability". The strategy also indicates that it is unclear what agency has the responsibility to develop such a plan.

Many of the most rapidly aging areas of New Brunswick are in rural areas, many of which are outside the reach of any transportation planning and service domains. The two largest urban areas in New Brunswick, Greater Moncton and Greater Saint John have involved outlying or adjacent municipalities in their transportation plans, but "there is no obligation for coordination of transportation service planning among smaller municipalities and unincorporated areas." (RUTAC 2017). Unincorporated areas are home to 37% of the New Brunswick population (Government of New Brunswick 2017).

The existing national datasets, such as the Census, can provide insight for some rural travel behaviour, but the focus on "commuting" for understanding travel behaviour can be expected to have a decreasing relevance for an aging population, many of whom will be retired. Hanson and Hildebrand (2011) found in their sample of 60 drivers rural drivers aged 54-92 that only 6% of one-way trips were for "Work" purposes, with "Shopping" accounting for 20% and "Social Visits" for 16%. Hanson and Hildebrand's sample was primarily retired from work; therefore may not be representative of the employment status of the entire 54-92 year old population. The findings did suggest that the greatest need for transportation for older adults who do not drive will be for non-work related transportation, yet it is not possible to quantify this need from the census of population and rural communities are likely not well positioned to conduct travel studies at the same scale as urban areas. The challenge is that rural communities are or will be on the leading edge of demographic changes that will make driving a less realistic option for some over time; these communities can be the best positioned to mobilize in response to these changes, yet have the fewest resources to do so.

There would be value in extending the long-form census questions to include such trip purposes as "Journey to Shop", "Journey to Health", and "Journey for Social Visits". While these are covered to some extent in the General Social Survey and Canadian Community Health Survey, it is not at the same resolution as "Journey to Work" where origin and destination communities are identified. A rural area that is looking to develop a transportation solution for those who cannot drive to the doctor, for example, would be much better positioned to respond to this need if it had easily accessible data on the level of need. The census would provide a mechanism for that data collection, analysis and dissemination.

Looking to the future, the ubiquity of data-enabled smartphones and the "Big Data" they generate remains an opportunity for obtaining travel data in rural areas at a level not previously available. Traffic congestion data, for example, is already available for small cities and rural areas in New Brunswick on Google Maps. Furthermore, autonomous vehicles appear poised to be realistic options for non-drivers in the near future, yet more work is needed to understand the deployment implications for serving older adults in rural areas, from a policy, technology, infrastructure and user preference standpoint. "Big Data" may have a role in preparing for future technological changes, such as autonomous vehicles, that could support rural transportation needs.

4   CONCLUSIONS

Statistics Canada anticipates that over 20% of the Canadian population will be over the age of 65 years by the year 2036 (Statistics Canada 2015d), and in some jurisdictions, like New Brunswick, this percentage may be nearly 30% (Statistics Canada 2015c). Rural areas and small cities are among the most rapidly aging areas of Canada, yet in provinces like New Brunswick, they face challenges with respect to having the resources to obtain sufficient data to understand the magnitude and breadth of transportation needs posed by an aging population. Census data are the most comprehensive community data available, yet the only information transportation-related data focuses on commuting to work, which may not be relevant for understanding needs of a predominantly retired population. General Social Survey data and Canadian Community Health Survey data provide valuable insight into demographic and socio-economic factors influencing transportation use, but is not readily translated into understanding local transportation needs that can facilitate an operational response. Urban transportation studies can fill in data gaps between the Census and other surveys, but may not cover rural areas. Expanding the long-form census to include transportation-related questions beyond "Journey to Work", such as "Journey to Health", could provide valuable insight to rural and small communities as they look at addressing present and future needs in their communities. "Big Data" may also have a role to play in understanding rural transportation needs and preparing for a future than may include autonomous vehicles.

References

Government of New Brunswick. 2017. Local Government Resource Manual. edited by Local Government. Fredericton.

Hanratty, Siobhan. 2015. "Fwd: Re: Commuting flows table - interpretation issue or error?", July 20, 2015.

Hanson, T.R, and E.D Hildebrand. 2011. "Can rural older drivers meet their needs without a car? Stated adaptation responses from a GPS travel diary survey." *Transportation* 38 (6):975-992. doi: 10.1007/s11116-011-9323-3.

Hanson, Trevor R;. 2017. "Exploring the past 70 years of transportation planning tools and practices among select New Brunswick cities: are we ready for the future?" 52nd Annual Conference of the Canadian Transportation Research Forum, Winnipeg.

HDR Inc. 2015. Regional Sustainable Transportation Master Plan

Institute of Transportation Engineers. 1999. *Transportation Planning Handbook*. 2 ed: Institute of Transportation Engineers,.

New Brunswick Health Council. 2018. "Community Profiles 2017." accessed March 12. https://www.nbhc.ca/community-profiles#.WqbNcnxG1QI.

Newbold, K Bruce, Darren M Scott, Jamie EL Spinney, Pavlos Kanaroglou, and Antonio Páez. 2005. "Travel behavior within Canada's older population: a cohort analysis." *Journal of Transport Geography* 13 (4):340-351.

Pucher, John, and Ralph Buehler. 2006. "Why Canadians cycle more than Americans: a comparative analysis of bicycling trends and policies." *Transport Policy* 13 (3):265-279.

RUTAC. 2017. From Surfaces to Services: an inclusive and sustainable transportation strategy for the Province of New Brunswick. edited by Rural and Urban Transportation Advisory Committee. Fredericton: Economic and Social Inclusion Corporation,.

Smith, Wayne R. 2015. "The 2011 National Household Survey: the complete statistical story." Statistics Canada, accessed March 15. http://www.statcan.ca/eng/blog-blogue/cs-sc/2011NHSstory.

Société de transport de Montréal. 2018. "2013 origin-destination survey - Launch of the largest travel behaviour survey." accessed March 9. http://www.stm.info/en/press/press-releases/2013/2013-origin-destination-survey---launch-of-the-largest-travel-behaviour-survey.

Statistics Canada. 2013. Access to Health Care Services and Waiting Times Canadian Community Health Survey Rapid Response Questionnaire.

Statistics Canada. 2015a. "General Social Survey on Time Use, 2015." accessed March 15. http://www23.statcan.gc.ca/imdb/p3Instr.pl?Function=assembleInstr&lang=en&Item_Id=217656#qb218258.

Statistics Canada. 2015b. "NHS Census subdivisions (CSD) not released." accessed March 15. http://www12.statcan.gc.ca/nhs-enm/2011/ref/sup_CSD-SDR-eng.cfm#NB.

Statistics Canada. 2015c. "Population by age group and sex, medium-growth - historical trends (1981 to 2008) scenario (M1), July 1st — New Brunswick, 2010 to 2036 ", accessed March 15. https://www.statcan.gc.ca/pub/91-520-x/2010001/t367-eng.htm.

Statistics Canada. 2015d. "Population Projections for Canada, Provinces and Territories, Highlights." accessed March 15. https://www.statcan.gc.ca/pub/91-520-x/2010001/aftertoc-aprestdm1-eng.htm.

Statistics Canada. 2016a. 2016 Census of Population, Catalogue no. 98-400-X2016325.

Statistics Canada. 2016b. 2016 Census of Population, Statistics Canada Catalogue no. 98-400-X2016327 Government of Canada,.

Statistics Canada. 2016c. Commuting Destination (5), Main Mode of Commuting (10), Sex (3) and Age (5) for the Employed Labour Force Aged 15 Years and Over Having a Usual Place of Work, in Private Households of Canada, Provinces and Territories, Census Divisions and Census Subdivisions, 2016 Census - 25% Sample Data. edited by Statistics Canada: Government of Canada,.

U.S. Census Bureau. 2017. "2009-2013 5-Year American Community Survey Commuting Flows." accessed March 15. https://www.census.gov/data/tables/time-series/demo/commuting/commuting-flows.html.

U.S. Department of Transportation. 2018. "National Household Travel Survey." accessed March 8. http://nhts.ornl.gov/.

University of Toronto. 2018a. "2011, 2006, 1996 & 1986 Travel Survey Summaries." accessed March 9. http://dmg.utoronto.ca/transportation-tomorrow-survey/tts-demographic-and-travel-summaries/2011regional-travel-summaries.

University of Toronto. 2018b. "About TTS 2.0." University of Toronto, accessed March 9. https://tts2.ca/welcome-to-tts-2-0/.

Young, Mischa, and Ugo Lachapelle. 2017. "Transportation behaviours of the growing Canadian single-person households." *Transport Policy* 57:41-50. doi: https://doi.org/10.1016/j.tranpol.2017.03.022.