

Increasing Cycling for Transportation in Canadian Communities: Understanding What Works

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Abstract

This article looks at the different factors that contributed to an increase in utilitarian cycling between 1996 and 2015 in ten communities of various sizes and locations across Canada. Interviews with engineers, planners, activists, politicians and academics were conducted to assess which factors were more important in changing cycling practice in ten case study areas which witnessed very large increases in their cycling commuting mode shares between the censuses of 1996 and 2011. The results show that although the story varies from case to case, some factors had more impact on cycling behaviour than others. Factors beyond the control of local actors, such as cultural, demographic and economic changes, have contributed significantly to an increase in utilitarian cycling in all case studies. In addition to these macro-trends, locally-adopted measures have also been effective: the development of pro-cycling policies and programs, as well as the expansion of cycling infrastructure, seem to have heavily influenced cycling in several communities. In some case study areas, the activities and advocacy of cycling groups have been very influential. In a few cases, such as two small mountain communities, a specific event triggered the increase in cycling in the area. More often, however, it was a combination of government-controlled factors and larger macro-trends that created an environment favourable to cycling for transportation in the study municipalities.

Keywords

Utilitarian cycling; Commuter cycling; Cycling for transportation; Factors increasing cycling; Canadian communities; Transportation policy and planning.

1. Introduction

The virtues of cycling are undeniable. Its numerous positive effects impact not only cyclists themselves, but also cities, their inhabitants and the environment in general. From health benefits such as a diminution of the risks of developing diseases like diabetes or cardio-vascular illnesses, to positive environmental impacts like a reduction of traffic congestion and greenhouse gas emissions, there are plenty of advantages for all levels of governments to encourage cycling amongst the population (Agence de la santé et des services sociaux de Montréal, 2006).

Canada has long been considered a paradise for nature explorers and outdoor sporting enthusiasts, but some of its cities have more recently begun to achieve enviable reputations when it comes to active transport. For instance, Montreal is considered one of the most cycling-friendly cities in North America, and for the past seven years it has figured in the top 20 of Copenhagenize's Index for Bicycle-Friendly Cities worldwide (Copenhagenize Design Co., 2018). In Western Canada, the city of Calgary's multi-use pathway system is a point of pride for its residents, and Vancouver has distinguished itself by achieving a 50% modal share by active or public transportation (City of Calgary, 2016b, City of Vancouver, 2017). Since the mid-1990s, cycling as a form of urban transportation has become more and more popular and many cities in the country have witnessed an important increase in their level of cycling (Tumlin, 2012). The city of Montreal, for example, has seen its number of daily riders increase by 57% between 2008 and 2013 (Vélo Québec, 2016).

Many factors can affect the level of cycling in cities. These include strategies, plans, policies, projects and other initiatives put forward by municipalities, community groups and

institutions, as well as changes in less controllable macro-trends such as demographics, the economy, and culture.

Using a qualitative approach, this study explored the factors that contributed to an increase in cycling for transportation in 10 Canadian communities and neighbourhoods that registered rapid increases in commuter cycling since 1996. This research does not look into biking for recreational or competitive purposes. Findings are based on interviews with local experts and therefore rely on their opinions, experience, and knowledge. The interview results were analyzed, compared and classified by the researchers afterwards in order to reach cross-case conclusions. The study therefore has an irreducible subjective element, which must be taken into consideration when assessing the study's results. We believe municipalities and other cycling stakeholders will benefit from the results of this study by seeing how other communities have managed to boost utilitarian cycling within their borders.

2. Literature review

Factors that can affect the prevalence of commuter and utilitarian cycling have been widely discussed in the academic literature. For instance, according to one study, “urban planning, congestion, safety and perception of safety, pollution, petrol, pricing” can affect cycling (Stewart, Kwame Anokye, & Pokhrel, 2015). Other studies found that factors as diverse as rising costs of car ownership, safer cycling environment, investments and improvements in cycling infrastructure, interventions promoting cycling within communities, climate, topography and public advocacy, can also influence cycling practice in some contexts (Pucher & Buehler, 2006; Pucher, Garrard, & Greaves, 2011; Yang, Sahlqvist, McMinn, Griffin, & Ogilvie, 2010). Other factors include the design, location, connectivity, quantity and quality of the infrastructure network built by municipalities (Tumlin, 2012; National Association of City Transportation Officials [NACTO], 2014).

Transportation policies and investments can also play a leading role in the increase of cycling in a specific municipality or neighbourhood, and even the organisation within a city's urban and transportation planning departments can have an impact on cycling practice (Koglin, 2015, Lanzendorf & Busch-Geertsema, 2014; Meng, Koh, Wong, & Zhong, 2014; Nielsen, Skov-Petersen, & Agervig, 2013). Factors relating to urban design and land use, such as changes in population and job density, can also impact the practice of cycling in a specific area (Ewing & Cervero, 2010; Faghih-Imani, Eluru, El-Geneidy, Rabbat, & Haq, 2014).

Many studies focus on commuter cycling specifically; most conclude that new or improved infrastructure positively affects commuter cycling (Buehler, 2012; Handy & Xing, 2011; Sanders, 2013; Winters, Davidson, Kao, & Teschke, 2011). Distance to cycling infrastructure, either at the origin or during the whole path, is negatively correlated with propensity to cycle (Cervero, Sarmiento, Jacoby, Gomez, & Neiman, 2009; Handy & Xing, 2011; Zahari et al., 2016). Street density and design can also influence cycling in general as well as commuter cycling, while trip distance is negatively correlated to bicycle commuting (Cervero et al., 2009; Fraser & Lock, 2011; Heinen, Matt, & Wee, 2013; Moudon et al., 2005; Piatkowski & Marshall, 2015; Saelens, Sallis, & Frank, 2003; Sears, Flynn, Aultman-Hall, & Dana, 2012; Vandenbulcke et al., 2011; Zahari et al., 2016). Li, Wang, Yang, & Ding (2017) also concluded that trip purpose, as well as city area size and the increase in electric bikes, were deemed influential on bicycle mode share in the context of China. Vandenbulcke et al. (2011) came to

similar conclusions regarding the impact of town size on commuter cycling (Nehme, Pérez, Ranjit, Amick III, & Kohl II, 2016). Other studies found that population density (Nehme et al., 2016), as well as attitudes and perceptions, were also influential (Dill & Carr, 2003; Heinen, van Wee, & Maat, 2010; Schwanen & Mokhtarian, 2005). A study by Yang, Wang, Lu, & Li (2010) looking specifically at personal factors affecting bike commuting in Nanjing, China, revealed that “trip distance and perceived benefits had significant effects on bicycle usage,” and that safety and comfort were not perceived as important for commuters as rapidity and convenience. Other studies revealed that convenience (Piatkowski & Marshall, 2015) and perceived safety were also positively influencing the level of cycling for transportation (Fernández-Heredia, Monzón & Jara-Díaz, 2014; Sener, Eluru, & Bhat, 2013; Winters et al., 2011). “[I]ndividualised marketing of environmentally friendly modes of transportation” can also lead to modest increases in cycling levels (Yang, Sahlqvist, et al., 2010). A study conducted in Cambridge, UK, concluded that the implementation of active and public transportation infrastructure as well as supportive medias and social environments can encourage people to cycle and lead to an increase in commuter cycling (Panter, Heinen, Mackett, & Ogilvie, 2016).

Socioeconomic status and automobile availability also influence cycling practice (Heesch, Giles-Corti, & Turrell, 2014; Li et al., 2017; Ma, Dill, & Mohr, 2014; Sahlqvist & Heesch, 2012; Winters, Brauer, Setton, & Teschke, 2010; Yang, Wang, et al, 2010). These findings are similar to results from Cervero et al. (2009) and from Zahari et al. (2010), which also found that having more cars reduces the likeliness of a household to cycle, and that gender, age, education and employment status also impact cycling practice. Many studies had similar results (da Silva Bandeira et al., 2017; Heinen et al., 2013; Nehme et al. 2016; Titze, Strongegger, Janschitz, & Oja, 2008).

Uncontrollable factors such as climate (precipitation, temperatures, wind), relief and seasonal conditions (limited daylight hours) can act as barriers and have a negative impact on cycling for transportation (Sears et al., 2012; Spencer, Watts, Vivanco, & Flynn, 2013; Vandenbulcke et al., 2011). A municipality’s high rates of cycling can also have a positive effect on a neighbouring town or municipality, creating a mass effect that encourages people to cycle more (Vandenbulcke et al., 2011).

Most of the studies cited above have used quantitative approaches, such as cross-sectional analyses based on statistical correlations between independent variables and cycling outcomes, to draw conclusions about factors that impact cycling (Heinen et al., 2010; Piatkowski & Marshall, 2015). Few studies have studied the impact of changing factors on cycling practice over time and few are focused on commuter and utilitarian cycling in Canada (Caulfield, 2014; Zahabi, Chang, Miranda-Moreno, & Patterson, 2016). While several studies use one or more case studies, few have relied specifically on qualitative data taken from interviews as part of their methodology and data collection approach. This study aims at addressing these gaps in order to provide new information on the topic through the use of a more qualitative approach based on case studies in Canadian cities. This approach allows us not only to pinpoint key factors contributing to an increased cycling modal share from a broad range of categories that would be difficult to study in a quantitative manner, but to reflect on how various factors interact in a given place over a given period of time.

3. Methodology

The purpose of our study was to explore the key factors that could explain the increase in commuter and utilitarian cycling in Canadian communities where cycling boomed after 1996 (when the census first collected data on the commuting mode of travel). To accomplish this goal, we relied on a comparative multiple-case study method, which allowed us to assess both qualitative and quantitative data relating to significantly varied cases. Based on the collected data, we were able to take out main variables which helped us structure our analysis and create some analytic generalizations and conclusions (Yin, 2014).

We identified ten case study areas for detailed investigation. Because some of the factors that affect cycling work at the municipal level (such as active transportation plans or city-wide educational programs) while others work at the neighbourhood level (such as local infrastructure improvements or gentrification), we endeavoured to identify case study areas where increases in cycling were evident at both the neighbourhood and city-wide (municipal) level. As a first step, we used the bike modal share data from 1996-2006 censuses and the 2011 National Household Survey (NHS)¹ to develop a list of 23 candidate study areas in metropolitan areas across Canada where commuter cycling had shown strong increases over the study period. We also looked at eight smaller, independent towns outside metropolitan areas. This led us to a total of 31 potential sites.

Our final selection of case study areas was influenced by our desire to reflect different urban contexts (inner city, older suburbs, newer suburbs) and to include study areas from different regions of the country. Also, we chose to include not only neighbourhoods in larger urban contexts but also independent smaller towns outside the larger conurbations (where the town as a whole was the unit of study rather than a specific target neighbourhood). The final list of 10 case study areas is shown in Section 4, along with short descriptions and cycling modal share figures.

For each case study, between five and nine semi-structured interviews were conducted with key informants such as urban planners, elected officials, policy makers, engineers, cycling advocates, and academics. The interviewees were selected for their expertise, knowledge and their involvement in the field of cycling in the municipality. In total, 72 interviews were conducted, either by phone or in person, between November 2015 and September 2016. The list of interviewees can be found on Appendix A. The duration of the interviews varied from 45 minutes to 3 hours, with an average of 90 minutes. Interviews were recorded for transcription purposes.

The interviews explored respondents' perspectives on the factors that could explain the observed increase in cycling for transportation purposes in the case study neighbourhoods and municipalities. Because the study was focused on explaining the change in bike modal share over time, the interviews concentrated on changes in the factors identified in the literature as having an impact on utilitarian cycling. Factors that do not tend to change from decade to decade, such as the weather or topography, were given less attention. While the case studies were chosen in part based on their increased bike modal share for commuting, we asked interviewees to answer questions about the importance of factors that might affect utilitarian cycling levels in general, not just commuter cycling. Questions about the influence of various factors were posed for both the neighbourhood and municipal levels, with the factors grouped into several categories, i.e., governance, planning and policy, infrastructure, parking, cycling programs, ride experience,

¹ Because of doubts over the reliability of the 2011 NHS, we favoured potential study areas that showed consistent increases in bike modal share over the four census periods rather than ones that uncharacteristically spiked in 2011.

competition with other modes, urban form, bike availability, demographics, culture, and economics. Interviewees were asked to assess the importance of each factor individually, and towards the end of the interviews, to reflect on the most important factors overall, including macro-trends like economic and cultural forces as well as locally-controlled policies, programs and investments.

Following the interviews, transcripts were analyzed and coded using the qualitative data analysis software NVivo. Similar answers from different interviewees were grouped together in order to assess the frequency and perceived importance of the different factors. The interviewees' answers were also analysed to detect any correlations between narratives and other elements such as the size of a city, or whether a given factor tended to have an impact on a local or city-wide level.

In addition to the opinion interviews, the case study researchers consulted governmental publications, surveys and other official documents, as well as online websites and relevant data (e.g., on demographic change from the Canadian census). These sources were used to develop the factual context for each case study, such as the provisions of a local cycling plan, cycling investment levels, amounts of cycling infrastructure added, changes in urban form, changes in age distribution or immigration levels, or additions to the stock of bike parking spaces. The analysis part and results of this study rely almost exclusively on the qualitative data gathered during the interviews, with quantitative data being used only as a complement or in case of necessary missing information. The case study researchers used a common template and writing guide to create a detailed picture of the factors contributing to the increased cycling in each of their study areas after 1996. The current authors then compared the results among the case studies and created a synthesis across all ten case studies, the subject of the present paper.

4. Study Areas

Of the ten study areas, eight are neighbourhoods in larger urban areas and two are smaller settlements not included in a larger conurbation. Of the urban neighbourhoods, four are located in higher density precincts in or close to the urban core, three in medium-density, older suburbs and one in a lower-density, newer suburb. Three case study areas are in British Columbia, two are in Alberta, one is in Manitoba, two are in Ontario, one is in Quebec, and one is in Nova Scotia.

Table 1 provides the modal share data for the 10 case study areas. For the eight urban neighbourhoods, both the neighbourhood and municipal level data are given. For the separate towns, only the municipal level data is given. Because several case study neighbourhoods are in urban areas that underwent amalgamation between 1996 and 2011 (Halifax, Montreal, Ottawa, and Toronto), the modal shares for both the 1996 and the 2011 boundaries were considered. The amalgamations added low-density suburban and in some cases rural areas into the new municipal geography. Given that increases in modal share were lower in such areas, the modal share increases were less pronounced (and negative in the case of Halifax where a vast rural area was added to the municipality) when calculated on the basis of the 2011 boundaries than on the 1996 boundaries. Table 1 shows commuting modal share changes based on the 1996 municipality boundaries.

City/Province	Neighbourhood	Bicycle Commuting Modal-Share (%) - Neighbourhood			Bicycle Commuting Modal-Share (%) - Municipality*		
		1996	2011	Change 1996-2011 (%)	1996	2011	Change 1996-2011 (%)
Calgary, AB	West Hillhurst - St. Andrews Heights	2.38	10.25	331	1.10	1.28	16
Halifax, NS	North End	2.00	5.78	189	1.96	2.40	23
Montreal, QC	Parc Molson	2.22	7.42	233	1.76	4.07	132
Ottawa, ON	Westboro Village	4.16	9.62	131	3.88	4.77	23
Saanich, BC	Broadmead - Cordova Bay	1.16	3.39	192	3.81	4.36	14
Toronto, ON	Parkdale	2.77	9.73	252	2.73	5.40	98
Vancouver, BC	Grandview-Woodland	4.29	9.75	127	3.26	4.36	34
Winnipeg, MB	Wolseley	3.96	12.75	222	1.46	2.13	46
Canmore, AB	Not applicable	NA	NA	NA	1.87	5.36	187
Revelstoke, BC	Not applicable	NA	NA	NA	4.94	11.54	134

Table 1. Bicycle commuting modal share for study areas, 1996 and 2011. *Sources:* Statistics Canada, 2013 & 2016.

* The municipal modal share changes are calculated using the 1996 municipal boundaries.

Table 2 gives a brief description of each case study, looking at the areas' main characteristics in terms of location, climate, economy, history, and demographics.

Municipality (Neighbourhood)	2011 municipal/town population (2011 neighbourhood)	Location	Main characteristics

	population)		
Calgary (West Hillhurst – Briar Hill – St. Andrews Heights), AB	1,096,833 (7,901)	Municipality: in the foothills of the Rocky Mountains, along the Bow River. Neighbourhood: on the northern shore of the Bow river.	The neighbourhood is located close to employment areas, like the CBD and universities, and its population is more educated, wealthier, whiter and older than the city average. Winters can be very harsh.
Canmore, AB	12,228	Town: on the eastern slopes of the Rocky Mountains (elevation: 1309 m), 106 km west of Calgary.	Canmore became a touristic hub for outdoor activities following the 1988 Calgary Olympics. It is one of Canada's prime destinations for mountain biking. Weather is variable due to the presence of the Rocky Mountains and the warm winds of the Chinook.
Halifax (North End), NS	390,096 (16,442)	Municipality: bordering the Atlantic Ocean. Neighbourhood: occupies the northern part of the Halifax Peninsula, close to downtown, and is bounded by water on its northern and eastern sides.	The North End has gentrified considerably in the past decades, although housing in the area still consists mainly of apartment buildings. It is very culturally diverse, poorer and younger than the city average. Winters are milder than in central Canadian cities, while fog is present quite often.
Montreal (Masson), QC	1,649,519 (20,069)	Municipality: on an island in the St. Lawrence River whose terrain is mostly flat, except for a modest mountain in the city centre. Neighbourhood: a few kilometres north-east of downtown.	The Masson neighbourhood welcomes a lot of immigrants and consists mostly of apartments in triplex and duplex buildings. Its history is linked to industrial development, and the population is wealthier and more educated nowadays than 20 years ago. Climate is characterised by warm summers and harsh winters.
Ottawa (Westboro), ON	883,391 (7,412)	Municipality: along the Ottawa river. Neighbourhood: west of downtown.	The capital of Canada has a very educated and wealthy population. Westboro is known for its outdoor and sport-focused retail, and is whiter and wealthier than the city average. Weather conditions are similar to Montreal's.
Revelstoke, BC	7,139	Town: in the Rocky Mountains, (elevation: 443 m), 415 km west of Calgary on the Trans-Canada Highway and the CP railway.	Revelstoke's tourism and hospitality sector boomed in the past decades. In 2007, four-season Revelstoke Mountain Resort opened. It has an international reputation and attracts outdoorsy people for long-term and seasonal stays. Mountain biking, which had been very present in Revelstoke since the end of the 1990s, exploded in popularity following the opening of the resort. The town also received a "resort community" status in May 2008, which led to provincial funding for developing infrastructure promoting tourism. The city receives a lot of precipitations all year long, whether in the form of rain or snow depending on the season.
Saanich (Broadmead – Cordova Bay), BC	109,752 (14,314)	Municipality: within Greater Victoria, on Vancouver Island. Neighbourhood: in the north-eastern part of Saanich District	Broadmead and Cordova Bay are upper-middle-class, low-density residential neighbourhoods consisting of mainly single-family homes. There are plenty of green spaces in the area and large water bodies impacts the area. Regional weather is characterised by a lot of rain. The district of Saanich aims to become a greener city and to reduce its greenhouse gas emissions by 30% by 2020.
Toronto (Parkdale), ON	2,615,060 (20,578)	Municipality: along the western part of Lake Ontario. Neighbourhood: west of downtown, on flat terrain.	Parkdale has a fairly high density, and welcomes a lot of newcomers (including a lot of artists) because of its large rental stock. The area is poorer, younger and more multicultural than the Toronto average. Winters in Toronto are usually cold and snowy, although less so than in Montreal.
Vancouver (Grandview – Woodland), BC	603,502 (30,349)	Municipality: on fairly flat land, bordering the Pacific Ocean. Neighbourhood: a few kilometres east of downtown.	The neighbourhood is poorer and slightly younger than the Vancouver average. Its proportion of recent immigrants is also lower. The city experiences mild but wet winter weather.
Winnipeg	663,617	Municipality: in the Prairies,	Winnipeg experiences very cold and snowy winters.

(Wolseley), MB	(8,298)	along the Red River. Neighbourhood: a few kilometres south-west of downtown.	Wolseley is a medium-density neighbourhood whose housing stock consists equally of apartments and detached/semi-housing buildings. The area is known as a “hippie” neighbourhood due to the presence of businesses selling organic and fair trade products. It attracts politically and socially active residents.
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Table 2. Description of case study areas. *Sources:* Childs, 2014; City of Calgary, 2016a; City of Ottawa, 2017; City of Revelstoke, 2016 & 2015; Ottawa Neighbourhood Study, 2017; Statistics Canada, 2016; Tourism Winnipeg, n.d.; Town of Canmore, n.d.

5. Results and Analysis

This section presents our assessment of the factors that have contributed to the observed increase in utilitarian cycling in the ten case studies. Factors were grouped by categories to simplify the analysis and discussion. The categories were chosen based on the literature review and then further refined based on patterns that became visible during the interview analysis phase. The categories are: governance, planning and policies; infrastructure and parking; programming and advocacy; bike supply; built environment; demographics, culture and economics. **Table 3** shows how the different factors explored in the interviews relate to the six categories.

Governance / Planning / Policy	Infrastructure	Programming / Advocacy	Bike supply	Built environment / Transport systems	Demographics / Culture / Economics
<ul style="list-style-type: none"> - Transportation plans and programs - Administrative changes - Funding and investments - Monitoring - Role and degree of involvement of provincial governments 	<ul style="list-style-type: none"> - Off-street and recreational paths - On-street cycling infrastructure - Infrastructure maintenance - Bike parking - Bike-transit integration policy and facilities 	<ul style="list-style-type: none"> - Community and advocacy groups’ role and impact on municipal decisions - Community groups’ social involvement in local communities - Municipal programs - Social media - Large events 	<ul style="list-style-type: none"> - Bike-sharing systems - Bike shops and clinics 	<ul style="list-style-type: none"> - Densification - Impacts of congestion and other transportation modes - Car parking measures - Traffic calming measures and bike-friendly environment 	<ul style="list-style-type: none"> - Gentrification and housing prices - Economic conditions - Perceptions and popularity of cycling - More active lifestyles - Generational and demographic changes - Trigger events

Table 3. List of categories and factors

In the following analysis, we will first look at the importance of each category of factors on cycling trends within each case study (Section 5.1), before focusing on an overall analysis of the major categories and factors across the range of case studies (Section 5.2). Section 5.3 will address the differences in terms of factors between neighbourhood and municipality levels. Then, the distinction will be made between macro-trends and local factors, on which governments and groups have control (Section 5.4). Factors will then be assessed based on the size and type of economy characterizing the studied municipalities (Section 5.5). Finally, we will evaluate

whether case studies are influenced by a specific dominating factors or an ecosystem of factors (section 5.6).

5.1. Importance of categories and factors within case studies

After analyzing the interviews for each case study, an assessment of the most important categories of factors for each case study was performed. The results are shown in Table 4. Categories that were seen as having the most important influence on cycling were given a double X. It is important to note that in the case of a category receiving a double X, there may be only a few factors within that category that are influential. For instance, in the case study of Montreal, the category “bike supply” received a double X because of the important role played by BIXI in democratizing cycling and increasing substantially its visibility. Toronto’s “built environment” category has a double X because densification and problems linked to traffic congestion and inadequate public services have impacted importantly transportation modes in the central areas of the city, including Parkdale. Categories which received a “-” for a case study were deemed as having a negligible impact on the increase in cycling in that specific community. It is important to mention that these factors, although listed separately here, did interact and influence each other. Therefore, each factor’s importance and effects are linked with the other factors’ impacts.

City / Province	Case study name	Governance / Planning / Policies	Infrastructure and parking	Programming / Advocacy	Bike supply	Built environment / Transport systems	Demographics / Culture / Economics
Calgary, AB	West Hillhurst - St. Andrews Heights	XX	XX	X	-	-	XX
Canmore, AB	Canmore	XX	XX	X	-	X	XX
Halifax, NS	North End	X	-	XX	-	X	XX
Montreal, QC	Masson	XX	XX	X	XX	X	XX
Ottawa, ON	Westboro	XX	X	X	-	XX	XX
Revelstoke, BC	Revelstoke	XX	XX	XX	-	X	XX
Saanich, BC	Broadmead - Cordova Bay	XX	XX	XX	-	-	X
Toronto, ON	Parkdale	X	XX	XX	X	XX	XX
Vancouver, BC	Grandview-Woodland	XX	XX	XX	-	-	XX
Winnipeg, MB	Wolseley	XX	XX	XX	X	-	X

Table 4. Importance of each category of factors within each case study

Obviously, opinions varied across interviewees. Some advocacy group representatives, for instance, were very enthusiastic via-à-vis the impact of social programs, while some municipal staff had more to say regarding infrastructure projects and policies. However, interviewees were chosen for their knowledge of the overall context of their case study area, and the interview questions allowed them to express their thoughts on the full range of factors being investigated. Some similar narratives came out throughout the interviews and helped assess the impact of each factor within the studied areas. Throughout the analysis, opinions from the interviewees were compared and put together, and similarities and differences were highlighted to assess which factors were perceived as the most important ones. The variety of backgrounds across interviewees prevented bias towards one particular category of factors. Interviewees were specifically asked to respond to questions with their personal opinions and to avoid any type of political or public discourse on cycling levels.

5.2. *Perceived importance of categories and factors across all case studies*

Table 5 below shows the perceived importance of the various categories across the ten case studies, based on the interviewees’ responses. Categories are ordered from most important on the left to least important on the right, with those mentioned more frequently as important by interviewees being on the left. As well, within each category, specific factors have been positioned according to their perceived importance, with the factors most frequently seen as important being at the top of each column. Thus, the closer a category or factor is to the upper left part of the table, the more often it was mentioned by interviewees of each location as playing an important role in the increase in utilitarian cycling in their community. Factors that are located in the bottom section of the chart, below light grey, empty cells, are those whose influence was perceived as very small or negligible by most interviewees throughout the case studies.

Categories	Perceived as most important ← → Perceived as least important						
	Demographics / Culture / Economics	Governance / Planning / Policy	Infrastructure	Programming / Advocacy	Bike supply	Built environment / Transport systems	
Factors	Perceived as most important within each category ↑	Generational and demographic changes	Transportation plans and programs	On-street cycling infrastructure	Community and advocacy groups’ role and impact on municipal decisions	Bike-sharing systems	Impacts of congestion and other transportation modes
	Changes in perceptions and popularity of cycling	Administrative changes (in certain cases)	Off-street and recreational paths (in certain cases)	Community groups’ social involvement in local communities			
	More active lifestyles	Funding and investments	Bike parking	Large events			
	Gentrification and housing						

Perceived as least important within each category	prices					
	Economic conditions	Role and involvement of provincial governments	Infrastructure maintenance	Municipal programs		Densification
	Trigger events	Monitoring	Bike-transit integration policy and facilities	Social media	Bike shops and clinics	Traffic calming and car parking measures

Table 4. Perceived importance of categories and factors

Our analysis, based almost exclusively on the interviews, suggests that there is not a single pre-eminent factor or regular combination of factors that explains the increase in cycling modal share across all cases. Rather, it is a combination of factors unique to each case study that explains the observed changes. That being said, there are some categories and factors whose perceived importance was more recurrent throughout the case studies. Below, we discuss each category from the one perceived as most important to the one seen as least important.

5.2.1. Demographics / Culture / Economics

The category that gathered the most unanimity across interviewees as being one of the most important in explaining local increases in utilitarian cycling was demographics, cultural and economic changes. Indeed, it was considered fundamental to the increase in cycling in every case study. No other category was cited as crucial in every municipality.

The ubiquitous presence and importance given to this category of factors in the case studies reflect the fact that the Canadian population has evolved in the past two decades. Our living habits and perceptions have changed quite drastically, no matter the region and this has impacted every age group, with some generations being more affected than others. Whether it is due to a shift towards more active urban lifestyles among younger people, the trend within the general population towards healthy living habits, or a change in the cycling culture and how people perceive cycling, urbanites in Canada are much more inclined towards active transportation than before. More is known about the benefits of cycling on health and the environment, as well as the negative impacts of car pollution and congestion. That being said, according to an urban planner from Vancouver, *“health and environment were not the primary factors for people’s motivation to bike.”*

As well, cycling is now widely recognized as a legitimate mode of transportation rather than just a recreational activity. Finally, the social status associated with cycling has improved: many people no longer associate cycling with children or low-incomes and bicycle use has become fashionable in young and central areas of many towns and cities. The media also contributed to this change, as mentioned by an advocate in Calgary: *“[they] have been more positive towards bikes, [and some] have had reporters and columnists who have been ‘bike-positive.’”* This was also visible in other cities, such as Ottawa, where *“the City promoting cycling and the media drawing positive attention have [raised awareness] and [helped make] cycling more acceptable to the general public and create a change in culture,”* according to a project manager from the City of Ottawa. Meanwhile, the social status associated with cars has declined among some groups, especially tech-savvy youth who use social media and sharing apps to meet their transport needs without having to own a vehicle themselves. One interviewee from Bike Winnipeg described the phenomenon: *“There are a lot more people who at least recognize [cycling] as legitimate. They don’t think you’re some kind of nerd if you show up at a*

meeting on a bicycle. I think there's been a change there. It's not everybody, and there's probably parts of the population that changed more than others. I think those who are more comfortable economically, middle class, more educated, are more likely to be on board with those changes. [...] I think when you're on a bicycle in some contexts, people think 'you can't afford a car' so they look down on you. But I think that's changed a lot for most of the people in our culture, and they really are supportive these days, at least in the middle-class parts of the city."

These broad cultural currents were reflected in the case studies through observable changes in the demographic make-up of the neighbourhoods and towns involved. In many case studies, gentrification and demographic change have boosted cycling by concentrating people with favourable attitudes towards two-wheeled transport. Many of those people are also younger, more urbane and wealthier than preceding populations. As more people cycle in a given area, a positive feedback loop is created, with the increased visibility and legitimacy of cycling encouraging other citizens to try to bike. This is, for instance, the case in the North End in Halifax, where low rents attracted youth, artists and students to the area in the mid-1990s. A city planner from the Halifax Regional Municipality explained that "*10 years ago you could buy a property there for ridiculously little money if you were willing to save and convert an old house. People jumped on the bandwagon.*" This led to changes in the neighbourhood over time and to the eventual gentrification of the area as it became trendier.

Many cities have also seen their economies change drastically, like Toronto and Vancouver, which transitioned to more knowledge-based employment often located in central areas. These changes attracted wealthier urbanites who are more inclined to cycling into central neighbourhoods. Other case studies, like Revelstoke and Canmore, saw their economies shift heavily towards tourism, which also brought a new wave of bicycle-friendly residents.

These changes in citizens and cities are primordial, and without them, it is possible that the increase in cycling would not have been as pronounced. Even major investments in cycling infrastructure or the adoption of progressive policies and programs may not have insured the boom in cycling witnessed in the case study locales without these background trends creating a receptive clientele for more active transportation modes.

5.2.2. Governance / Planning / Policy

The second most important category in explaining the increase in utilitarian cycling in the case study areas, according to the interviewees, is governance, planning and policy. Unlike the demographics, culture and economics category, the impact of factors in this category was not homogenous across all case studies. While in many case studies, such as Calgary or Montreal, plans and policies played a major role in boosting utilitarian cycling, in a few cases, like Halifax, the impact of government policy was less noticeable than other factors.

Transportation plans have been instrumental in the blossoming of cycling in many case studies. These plans put cycling on the table and created commitments for cities in terms of active transportation. They set goals for cycling modal share and the amount of cycling infrastructure to be built, and also led to funding commitments for cycling infrastructure and programs. In many municipalities like Ottawa and Calgary, transportation plans led to major changes within transportation departments and to the hiring of active transportation specialists dedicated to developing cycling infrastructure or managing cycling programs. As a result, cycling became an integral component of city and transportation planning activities. The City of Calgary hired a person specifically to manage outreach and educational cycling programs, while

Ottawa created a Cycling Unit two years after the publication of its first Cycling Plan. In Montreal, the 2008 transportation plan led to major infrastructure expansion, as did Calgary's 2011 Cycling Strategy. Many plans also expressed other major commitments that were beneficial to cycling, such as maintaining winter routes, improving monitoring or creating bike-share systems like BIXI in Montreal. It is safe to say that without such plans, many of the case study cities would have most likely not witnessed the increase in biking recorded over the study period. The plans helped legitimize cycling as a normal transportation mode deserving government support, and they were crucial in triggering many of the other factors explored in this study.

Other cities also went through administrative reforms that created more adequate and efficient departments dedicated to cycling infrastructure and programs, independently of transportation plans. For example, in the early 2000s, the City of Montreal started putting more resources toward biking, going from two to 14 people working on cycling matters. Bicycle Advisory committees were also created in many case studies like Saanich and Vancouver.

Provincial and national governments' actions and programs also played a role in a few study cases. For instance, the BikeBC grant program was instrumental in investments made in case studies located in British-Columbia, such as Saanich and Revelstoke. The provincial designation of Revelstoke as a "resort community" in 2007 also led to major funding opportunities for the town that ultimately impacted cycling practice. Post-recession stimulus packages provided by the provincial government were also crucial in the development of cycling infrastructure in Winnipeg. A member of Bike Winnipeg explained that the "*2010 stimulus package was a pretty huge boost in things. It was \$20.3 million, a huge investment for the City [...] in bike terms. In other terms it's probably not that big of an investment. But that really kind of spearheaded things, and we managed to keep that increase over the years.*"

5.2.3. Infrastructure

Infrastructure development was of great importance in explaining increased cycling in most of the case studies. In many cases, the cities and towns studied witnessed an infrastructure boom towards the late 2000s and early 2010s, following the implementation of major transportation plans and funding opportunities. These paths added to the initial cycling network, which was mostly constituted of recreational-oriented paths also used by commuters, as in the cases of multi-use pathways along rivers in Montreal, Ottawa and Calgary. In other cases, like Saanich or Canmore, multi-use trails were installed more recently and still constitute the main components of the cycling network, used by both recreational and utilitarian cyclists.

That being said, the most instrumental infrastructure when it comes to the impact on utilitarian cycling is, according to the interviewees, on-street paths, especially separated cycle tracks and painted lanes. These paths increase the perception of safety by providing cyclists with a dedicated and sometimes physically-protected space reserved for them. This type of infrastructure helped to create a more cohesive network in most of the case study communities, allowing cyclists to reach daily destinations. The space allocated for cyclists also helped to legitimate cycling in these case study communities and normalized the idea that motorists would have to share the road with other users. For instance, Calgary's Centre City Cycle Track Network Pilot Project in 2015 was instrumental in increasing the number of cyclists within the downtown area, while the opening of the Peace Bridge in 2012 helped improve connectivity and access for cyclists between different areas and destinations within the city. This is also the case with the controversial bike lane added on Burrard Bridge in Vancouver in 2009, which demonstrated the will of the new municipal administration to increase cycling infrastructure.

Montreal's cycling network has increased considerably since the 2000s, with the implementation, on de Maisonneuve Boulevard, of the first segregated bike path in North America to go through a major downtown. The City also built 200 km of cycling infrastructure between 2010 and 2015. This had the effect of creating *“more opportunities for people to cycle. When people travel in Montreal, they see BIXI stations and bike paths everywhere, and it has an impact. Seeing more and more cyclists can produce a ripple effect.”* Another city that invested in biking infrastructure within its core is Ottawa, which opened a cycle track on Laurier Avenue in 2011.

Bike parking is another infrastructure component that has encouraged cycling in the case study areas, although its influence is weaker than that of paths. The increase in parking spots allowed people to park their bicycles faster and more easily, making the end-of-trip and general experience more pleasant and predictable. Some cities have dramatically increased their bike parking availability through innovative solutions, such as the bike rings placed around thousands of car parking meters in Montreal. As for the City of Calgary, it offers almost 4,000 parking spaces through the Calgary Parking Authority, Calgary Transit and the Bike Rack Sponsorship Program, which started in 2002.

Some cities, like Vancouver and Montreal, also invested in bike-transit integration policy and facilities, for instance by putting bike racks on buses or allowing bicycles in metro stations. That being said, the impact of these measures on cycling for transportation were considered minor.

5.2.4. Programming / Advocacy

Community and advocacy groups are important players in the cycling field, although their impact on the increase in cycling for transportation varies greatly from city to city. In some cases, as in Calgary or Ottawa, they were not among the strongest factors influencing utilitarian cycling, although their role and importance in promoting it is undeniable. In other specific cases, such as the North End in Halifax, the presence of a vocal cycling community in the neighbourhood helped significantly in promoting cycling and attracting biking commuters to move into the area. This, in turn, contributed to the establishment of more cycling-related or cycling-friendly businesses, generating an increase in the visibility and promotion of cycling and a blossoming of a cycling culture in general. In the case of Revelstoke, community groups were instrumental in the construction of paths, especially mountain biking trails that were eventually integrated in a wider, official cycling trail network used for both recreational and utilitarian purposes.

In other cases, like Montreal, Vancouver and Winnipeg, cycling non-profit organisations and groups played a major role by influencing municipal plans and projects. For instance, Vélo Québec has been very influential when it comes to the development of infrastructure and plans in Montreal, and they also manage several educational programs. HUB Cycling in Vancouver advises municipal elected officials and staff on cycling infrastructure, for instance through their representation on the Active Transportation Advisory Committee. Other programs have been targeting vulnerable groups, like newcomers and immigrant populations, and groups that traditionally cycle less, including children, women and the elderly. These targeted programs helped to democratize cycling, but their overall impact on utilitarian cycling was probably modest. The perseverance and determination of these advocacy and community groups are key in explaining how they were able to impact cycling. An advocate from Vancouver shared his

experience: “*You’re hitting the wall for years and years and suddenly it becomes a collaborative effort.*”

Events organized by cycling organizations and groups also contributed to an increase in cycling’s visibility and provided platforms to discuss cycling issues and promote biking as a transportation mode. For instance, large events, such as the Tour de l’Île in Montreal, gather tens of thousands of cyclists in the streets, and also create an opportunity for people to try cycling within a safe and festive environment. Other events, such as Bike to Work Day or Bike to School programs, focus directly on utilitarian cycling. Bike to Work Week, which was started by the Greater Victoria Bike to Work Society in 1995 before being expanded throughout the province, is a good example of a successful program started by a community group. That being said, however, the direct impact of such events on the increase in cycling for transportation is deemed small.

5.2.5. *Bike supply*

The changes in levels of bike supply were not perceived by the interviewees as a main factor in the case study areas, with the exception of BIXI in Montreal. This bike-sharing system was very successful in attracting new riders, and this contributed greatly to the visibility of cycling on the streets of Montreal. The system, the first major bike-share program in the Americas, encouraged those who did not or could not own bikes to cycle for utilitarian purposes. As a result, it helped democratize and normalize cycling in Montreal. Talking about the effects of BIXI, an urban planner from Vélo Québec explained that “*people try cycling for urban trips [with BIXI] and continue doing it afterwards. It reaches a part of the population that would not have cycled otherwise.*”

Many of the case study neighbourhoods and cities, such as Winnipeg, the North End in Halifax or Parkdale in Toronto, witnessed the emergence of bike clinics and co-ops during the study period. These provide resources for people to repair and maintain bikes, but their impact was perceived by interviewees as limited. In some case studies, local groups - such as re-Cycles in Ottawa or WRENCH in Winnipeg - sell bikes and parts at low prices or donate bicycles to vulnerable populations. WRENCH also has training, rehabilitation and/or employment programs for people from disadvantaged backgrounds, as does Right Bike in Ottawa. All these programs help increasing access to cycling within low-income communities. Again, however, any impacts of these initiatives on the overall number of bike commuters and utilitarian cyclists were thought to be quite small.

5.2.6. *Built environment / Transport systems*

Although not being one of the main factors according to the interviewees, the built environment did have some small impact on utilitarian cycling, for instance through intensification of the urban fabric or changes affecting competing modes of transport.

Bigger cities like Ottawa, Vancouver and Toronto have been subject to substantial intensification pressures, e.g., through the redevelopment of former industrial lands, but densification is also perceptible in smaller communities like Canmore or Revelstoke as well as older residential neighbourhoods like the North End in Halifax. Although these trends have led to an increase in the amount of destinations accessible by bike as well as the volume of residents and potential cyclists in central areas, densification measures were not seen as an important factor in the increase in utilitarian cycling for most of the case studies.

Changes in the conditions affecting non-cycling modes of transport appear to have had observable but minor effect on cycling levels in some case studies. For instance, in cities such as Toronto and Montreal, transit companies have not been able to keep up with increasing ridership, and service quality in specific areas has suffered. Moreover, increasing traffic congestion is slowing both transit and private vehicles, which might have created incentives for commuters to switch to cycling. The growth of car-sharing also introduced a new transportation option that can “discourage car ownership because of its lesser costs,” as mentioned by a Toronto advocate.

Other factors, such as streetscaping, traffic calming measures (which were implemented in most of the case studies), and changes in the supply and measures related to car parking, were not deemed significant factors by the interviewees compared to the other factors mentioned above.

5.3. Neighbourhood vs. municipality factors

Exception in the case of the two mountain municipalities where the whole town made up the case study, interviewees were asked to differentiate factors that had an influence at the municipal and the neighbourhood levels. In most of the cases, such as Montreal, Saanich, Toronto and Calgary, the majority of interviewees discussed factors that were influential throughout their city’s central areas, including the study neighbourhoods. However, in a few case studies, the selected neighbourhood had some really distinctive characteristics differentiating it from other areas. This is the case, for instance, of the North End, which appears to be Halifax’s cycling hub. Westboro, in Ottawa, is famous for its outdoor and sport-focused retail, while Wolseley, in Winnipeg, has been surfing on its “granola neighbourhood” reputation to attract social and environmental-friendly urbanites. As explained by an interviewee from Bike Winnipeg, “[Wolseley] is an area [where] a lot of people ... have environmental awareness and they like their local community. They like being able to walk to their local store, they like to buy organic foods. [It’s] a set of attitudes. So they are much more receptive to the idea of active transportation, I believe.” Otherwise, for most of the case studies, the majority of changing factors that were deemed important are actually representative of largest changes happening in the overall central or urban areas of those cities.

5.4. Macro-trends vs. local factors

Interviewees were asked whether macro-trends or local factors had the most influence on cycling for transportation. Macro-trends include factors over which governments do not have direct control. This includes broad changes in perceptions, preferences and lifestyles, gentrification, or large-scale economic changes. Municipal governments and other local stakeholders may be able to moderate or temper these macro-changes, but in the end they are processes that largely transcend and escape local control. In comparison, local factors are those that governments and other local stakeholders can directly act on, for instance infrastructure, transportation plans and cycling programs.

The interviews suggested that it is the intertwining of both types of factors that has led to an increase in utilitarian cycling in the past 20 years in the study locations. On the one hand, most factors within the demographics, culture and economics categories are macro-trends, and these were crucial in explaining bike modal share increases in every case study. On the other hand, local factors such as governance/planning/policy and infrastructure also proved influential, although the importance of the factors in these categories vary across the case studies. For

example, infrastructure proved more relevant in Montreal, whose cycling network grew tremendously following the 2008 Transportation Plan, than in Halifax, where investments and projects in infrastructure have been slower. In the same vein, government policy and planning played major roles in Vancouver and Winnipeg, whereas in Halifax government actions had a smaller impact on cycling modal share. An interviewee from the Nova Scotia Health Authority explained that “[*People at the municipality*] are doing the best they can with the limited resources they have. They are fighting an uphill battle.” This impression was echoed by other interviewees as well.

The case studies showed that macro-trends and local factors tend to interact with each other to produce the observed rise in cycling. For instance, cycling infrastructure might go relatively unused without pre-existing interest in cycling among the population, which could arise, for instance, from cultural and demographic changes in a neighbourhood. A planner from the Halifax Regional Municipality summarised it like this: “*I wish I could say we built infrastructure and the modal share doubled, but that’s just not the case.*” At the same time, if local demographics shift to more cycling-friendly groups, cycling practice might increase on its own, but not as much as if there was safe infrastructure built to encourage it. It is the mix of both societal factors and governmental and communal decisions and actions that has generated the large increase in utilitarian cycling seen in the case study neighbourhoods and cities.

5.5. Factors by size and economy of municipalities

The case studies reveal different patterns of explanatory factors that apply depending on city size or type of economy. These patterns, as well as context-specific situations, are discussed here for three types of cities: small mountain municipalities, large-sized post-industrial cities, and medium-sized cities.

5.5.1. Small mountain municipalities (Canmore and Revelstoke)

Canmore and Revelstoke are distinctive among the ten case studies. As small tourist-oriented municipalities located in remote locations in the Rocky Mountains, their economies are categorically different from the other case studies. In these municipalities, the increase in utilitarian cycling was directly linked to a recreational activity, mountain biking. This activity, combined with other outdoor trends like skiing or hiking, has led to an increase in recreational tourism and the relocation into town of young, active people who are inclined to cycle. This influx of tourists and new residents led to major investments in bike-friendly projects. After Revelstoke opened its ski resort in 2007, it was officially designated a “resort community” by the province and received major governmental funding commitments that contributed to the development of mountain biking and cycling infrastructure. In the case of Canmore, the municipality capitalized on the enthusiasm generated by the 1988 Calgary Winter Olympics by making major investments in local tourist infrastructure, including the multi-modal Rocky Mountain Legacy Trail. In both towns, the boost in recreational biking contributed to an increase in utilitarian cycling as mountain bikers often cycle for utilitarian purposes as well. This led municipalities to consider investing in urban cycling infrastructure.

Another characteristic specific to these towns is the small size of their municipal administrations and the small number of biking specialists on staff. In Canmore, for example, there is no staff member specifically dedicated to cycling, and it is the engineering department which works towards the development of cycling infrastructure. In Revelstoke, the town has had

one planner dedicated to commuter cycling since 2010. As a result, community groups have been very important in both municipalities, taking the lead in the organisation of events, and being instrumental in the implementation of cycling infrastructure. This is especially the case in Revelstoke, where groups were crucial in the planning, building and maintenance of many trails that are now part of the official network. Their involvement was important in the evolution of both towns' cycling cultures, and it helped to compensate for the lack of municipal resources and investments.

Another common theme in these two cases is the effect of tourism on gentrification and housing and rent prices. Living costs increased in the past two decades and this might have inclined people to rethink their transportation habits to compensate for those rising costs.

The overall picture that emerges for these two case studies is that the increase in cycling was driven by an increase in tourism and the emergence of mountain biking as a trendy activity. This, in return, impacted the towns' economies, led to major changes in the types of people living and coming to these areas, and triggered bike-friendly investments by municipal and provincial governments.

5.5.2. Large-sized post-industrial cities (Calgary, Montreal, Ottawa, Toronto, Vancouver)

This group encompasses Canada's major cities. Their situations are much different from the towns discussed in the previous section. All these cities have created a cycling unit or hired specialists dedicated to cycling infrastructure and education during the study period, leading to an increase in staff expertise and an emphasis on cycling as a transportation planning priority. These larger administrations also have a much greater financial capacity, and as such they were able to invest more without counting on provincial help. This led to the construction of extensive cycling infrastructure in each locale, especially after 2000. In most cities, this infrastructure connected to old recreational multi-use paths that were built between the late 1970s and early 1990s, allowing for the creation of a larger utilitarian cycling network. It is in these cases that cycling infrastructure was the most important factor in explaining the increase in cycling over the study period. Indeed, the creation of segregated or painted paths on the streets drastically improved cyclists' experiences in dense neighbourhoods plagued with motorized traffic and congestion, while also allowing quicker access to major destinations. Those cities also invested in other types of infrastructure that impacted cyclists, such as the pedestrian- and cyclist-oriented Peace Bridge in Calgary, or the much-acclaimed, bike-friendly parking meters in Montreal.

Policy changes also played crucial roles in these cities. The publication and implementation of significant transportation plans, ambitious in many cases, led to major investments, the hiring of expert staff, and the design and implementation of new cycling infrastructure, while also making cities' administrations more accountable towards their population. For instance, a planner in Calgary recalled that *"the 2011 Cycling Strategy was a game changer, as it asked for more staffing, capital and operating budgets. Prior to that, Calgary had no team dedicated to cycling. Various people worked on it as part of their jobs, but it was not a top priority for anyone."* These far-reaching plans also touched other fields related to cycling, such as winter maintenance, education and bike-sharing systems. They led to many projects and programs that had major impacts on cycling practice, such as BIXI in Montreal or educational programs and winter maintenance in Calgary.

Changes in other transportation modes, and especially transit, are also more important in these cities than in the previous group in explaining the increase in utilitarian cycling. For instance, a transit strike in Calgary had an impact on people's perceptions of cycling and made

some residents shift their commuting modes. In Vancouver, intermodality has been prioritised in the past twenty years, making cycling compatible with other options like buses, the SkyTrain network, as well as regional trains and boats. As well, motorists in these cities faced an increase in traffic jams, while public transit users have seen a deterioration of service quality in some instances, including overcrowded transit vehicles slowed down by traffic congestion. In Montreal, BIXI was the first (and very successful) roll-out of a new form of public transportation in Canada, and it led the way for many other similar programs in the country. The implementation of the bike-sharing system also had a crucial impact in terms of bike supply in Montreal. All these developments most likely influenced the decision of many residents to move towards cycling for their urban daily trips in these cities.

Canada's largest cities also faced tremendous changes in terms of their economies: many are now high-tech hubs and post-industrial cities with strong downtown cores and central employment zones. These characteristics have attracted many young urban professionals to these cities, especially to central areas (such as downtowns) located close to major employment districts. Those demographics being more inclined towards cycling, this trend has contributed to the blossoming of a cycling culture, which has interacted with gentrification and rising prices in many neighbourhoods, other indirect factors in the increase in utilitarian cycling. Indeed, as an advocate in Toronto pointed out, the *"increasing unaffordability of living [in Toronto] put forward the relative affordability of cycling."*

5.5.3. Medium-sized cities (Halifax, Saanich, Winnipeg)

The medium-sized cities in our set of case studies are quite diverse in terms of their economies and built environments. For instance, Halifax and Winnipeg are major employment destinations with larger economies, whereas Saanich is a residential suburb. However, they do share some similar characteristics. Over the years, their economies did not change as much as those in the largest cities, and therefore economic factors did not play such a large role in explaining cycling modal share changes. In the case of Winnipeg, provincial funding allowed the city to make major investments in infrastructure. In Halifax, the most important factor increasing cycling seems to have been demographics and cultural changes within the town and in the neighbourhood of the North End, with the establishment of a strong cycling culture and vocal cycling community. Young, urban and artsy people moved into the area in the 1990s, with phenomenon such as the rise of rent prices in university areas also influencing *"more and more students [to] pay less rent and live in the North End,"* as mentioned by a planner from the municipality. This created a demographic basis for the establishment of a cycling community and an increase in cycling in the neighbourhood. As the population moved towards young professionals and wealthier millennials, the trend towards cycling gained steam, with a further boost provided by the establishment of bike-friendly shops. As for Saanich, the municipal administration played an important role in promoting cycling infrastructure and practice in the region, and the rising trend towards active lifestyles and outdoor activities seems to have influenced the propensity of residents to cycle.

In all three cases, community groups were also instrumental in promoting and increasing a cycling culture. They worked with the municipal administrations and often served as advisors on municipal committees. Community groups picked up the slack in municipalities that dedicated fewer resources to cycling matters. This is the case, for instance, in Halifax, where community groups have been very active. Although community groups were active in a majority of the ten case studies, their implication was particularly important and striking in medium-sized cities.

5.6. Dominating factor versus ecosystem of factors

In each case, there was not one single factor that led by itself to a major increase in cycling; instead we found an ecosystem of factors operating together. However, in some cases, a single factor or event stood out as triggering an increase in utilitarian cycling for some part of the study period. For instance, the 1988 Calgary Olympics led to a boom in mountain biking popularity in Canmore, which greatly influenced tourism and cycling practice in town. The opening of the ski resort in Revelstoke in 2007 led to major funding and a tourism boost that ultimately were extremely beneficial to cycling. In Montreal, the 2008 Transportation Plan acted as a pivot and led to major developments in cycling infrastructure and related areas. Similarly, in Calgary the 2011 Cycling Strategy triggered major transformations in terms of the city's cycling infrastructure and its policy and programming approach. A transportation planner from Vancouver also explained how events such as the 2010 Winter Olympics allowed the City to test new planning concepts and ideas: *"[They closed a lane on a viaduct] extensively for security reasons. But [it also allowed them] to realize that there was some excess capacity there. These experimentations had been ongoing since 2006, and in 2010, [the planners] really began to see [the benefits of these experimentations. Following this,] they implemented that into their mode of thinking, and in the way they do business."*

Major funding investments have also been crucial, such as in the case of Winnipeg, where post-recession stimulus packages were key in the development of cycling projects in the city. There were of course many other elements and factors that contributed to the increase in cycling in these locales over the 20-year study period, but it is possible that without these triggering factors cycling in these cities would be less widespread.

6. Conclusion

This study has compared the different factors that have contributed to an increase in utilitarian cycling in ten Canadian communities between 1996 and 2015. Although every case is different and there is no one-size-fits-all explanation for the increase in cycling, some factors and categories clearly have been more instrumental than others, according to the interviewees. Demographics, economic and cultural changes, such as the influence of the millennial population, the development of cycling popularity amongst younger generations and young professionals, and a trend towards active and healthy lifestyles, have had an impact on utilitarian cycling levels in all case studies. As for the other categories we explored, their level of influence varied between the different case studies. For instance, Toronto and Vancouver were more affected by economic factors than Halifax or Saanich. In most case studies, gentrification and the attraction of young professionals to hip (largely central) areas, were also important factors.

Other factors, especially the development of infrastructure, policies and transportation plans, have also been influential, for instance by increasing the resources allocated to cycling within city administrations or by committing cities to make major investments in infrastructure and education. Community groups and programs also played an important role in many case studies, although their role was in most cases secondary. Other factors played an important role in specific cases, such as the implementation of the BIXI bike-sharing program in Montreal, or the Olympics' impacts on Canmore's economy and tourism. The influence of other factors, such

as bike parking, are not negligible, but they overall played minor roles in the development of cycling practices in most cases.

The case studies revealed that it is an interacting combination of factors that has led to the boom in utilitarian cycling in the case study locales. Although in a few cases there was a triggering factor around which self-reinforcing cycles developed, in most cases, no specific trigger could be identified. Patterns in the combination of factors that led to increased utilitarian cycling could be seen between different types of cases, such as small, touristy mountain towns and large, post-industrial cities. Finally, macro-trends beyond the control of local governments and community groups, and local factors that can be changed by governments and organizations, were both instrumental in increasing utilitarian cycling in the ten studied communities. In other words, macro-trends might not be enough to significantly boost cycling and bring more people into streets that are not designed for cyclists and pedestrians, and vice versa.

Many of the factors affecting utilitarian cycling in the studied areas in cities are also present in surrounding central areas, as pointed out by several interviewees. For instance, gentrification as seen in Grandview-Woodland in Vancouver can also be found in other central districts of the city. On the other hand, suburban or non-central areas of the municipality were much less affected by these factors. Only a few case studies, such as the North End in Halifax or Wolseley in Winnipeg, seem to have some elements or factors very specific to their own neighbourhoods in comparison to their surroundings.

As mentioned earlier in the study, the data collection and analysis methods used in this research were qualitative in nature. This entails some limitations regarding the precision of statements that can be made concerning the relative importance of the various factors that may have affected utilitarian cycling levels in the case studies. Interviewees were asked to discuss the importance of each factor and to identify the most important ones within each case study, but the assessment of the relative importance of the factors across the case studies was carried out by the authors. That being said, the rigorous analysis methods and processes used throughout the study allowed us to minimize the risks of potential bias and to focus on the comparisons and similarities between the stakeholders' different perceptions and assessments.

Future research could try to quantify the levels of importance of each factor using set criteria. This would make it easier to interpret and analyse the data, and it would allow more objective comparisons between the different case studies and factors. Further research could also look at the barriers and challenges encountered by stakeholders while developing, implementing and/or enforcing the measures enumerated in this article. While the focus of this study was to assess the impact of a range of factors over two decades, further research on the process behind the implementation of successful and unsuccessful measures might provide useful information on the feasibility and replicability of these measures.

This research looked at various case studies in order to find precedents and ideas for different types of cities and neighbourhoods. Cities, both inside Canada and around the world, can look at cases that share similarities with their own contexts, and also get ideas from places which are very different. The study also shows that barriers to cycling created by non-changing factors such as harsh climate conditions and hilly topography, can be overcome through the use of diverse measures and changes within societies. It is hoped that this study will provide inspiration for cities and other stakeholders, and that it can lead to reflections regarding the possible measures and factors that can be put forward to encourage utilitarian cycling in various contexts worldwide.

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Appendix A: List of interviewees

Calgary				Canmore			
Number	Position	Organization	Date	Number	Position	Organization	Date
1	Urbanist	City of Calgary	May 2016	1	Manager	Town of Canmore Engineering Services Department	08/2016
2	Transportation Engineer	City of Calgary (Livable Streets Division)	May 2016	2	Senior Manager	Bow Valley Builders and Developers Association	08/2016
3	Board Member	Bike Calgary	May 2016	3	Manager	Canmore Nordic Centre Provincial Park	08/2016
4	Transportation Engineer/Planner	City of Calgary	May 2016	4	Planner	Town of Canmore Planning Department	08/2016
5	Transit Planner	Calgary Transit /	May 2016	5	Manager	Town of Canmore Engineering Services Department	08/2016
6	Academic	University of Calgary	June 2016	6	Board Member	Canmore Cycling Culture	08/2016

				7	Board Member	Canmore Community Cruisers	08/2016
				8	Manager	McElhanney Companies	09/2016
Halifax				Montreal			
1	City Planner	Halifax Regional Municipality	10/11/2015	1	Planner	City of Montreal Active and Public Transportation Division	12/2015
2	Project Coordinator	Dalhousie University	23/11/2015	2	Senior Project Manager	Vélo Québec	12/2015
3	Planner	Nova Scotia Health Authority	10/12/2015	3	Advocate	Montreal Bike Coalition	12/2015
4	Advocate	Halifax Cycling Coalition	16/12/2015	4	Engineer	City of Montreal	12/2015
5	AT Committee Member	Bicycle Nova Scotia	17/12/2015	5	Board Member	Association Québécoise pour la promotion de la sécurité à vélo (AQPSV)	12/2015
				6	City Councillor and Member of the Transportation and Public Works Committee	City of Montreal	02/2016
				7	Project Manager	Vélo Québec	02/2016
				8	Academic	UQAM School of Management Sciences (Department of urban and touristic studies)	02/2016
				9	City Councillor and Biking Advisory Committee Member	City of Montreal	02/2016
Ottawa				Revelstoke			
1	Project Manager	City of Ottawa	14/03/2016	1	Board Member	North Columbia Environmental Society	11/2015
2	Former Board Member	Citizens for Safe Cycling	16/03/2016	2	Program Coordinator	Revelstoke Chamber of Commerce	11/2015
3	Project Manager	National Capital Commission	29/03/2016	3	Planner	Selkirk Planning and Design	12/2015

4	Councillor	City of Ottawa	26/03/2016	4	Board Member	Revelstoke Cycling Association	12/2015
5	Board Member	Wellington West BIA	10/04/2016	5	Program Coordinator	City of Revelstoke	12/2015
6	Project Manager	City of Ottawa	26/04/2016	6	Advocate	Bike to Work committee	12/2015
7	Academic	University of Ottawa	12/05/2016	7	Planner	City of Revelstoke Engineering and Development Services	01/2016
				8	Board Member	Revelstoke Cycling Association	01/2016
				9	Senior Program Manager	City of Revelstoke	01/2016
Saanich				Toronto			
1	Board Member	Greater Victoria Cycling Coalition	07/2016	1	Academic	University of Toronto	07/2015
2	Senior Program Manager	Greater Victoria Bike to Work Week Society	07/2016	2	City Councillor	City of Toronto	07/2015
3	Senior Program Manager	Capital Bike and Walk	07/2016	3	Advocate	Cycle Toronto	07/2015
4	Planner	District of Saanich Community Planning Division	07/2016	4	City Councillor	City of Toronto	07/2015
5	Program Manager	Capital Regional District	07/2016	5	Advocate	Cycle Toronto	07/2015
6	Planner/Designer	District of Saanich	07/2016	6	Planner	City of Toronto Cycling Infrastructure and Planning Unit	08/2015
7	Transportation Planner	District of Saanich	07/2016	7	Activist	Cycle Toronto	08/2015
				8	Project Manager	City of Toronto Cycling Infrastructure and Planning Unit	09/2015
				9	Policymaker	Toronto Public Health	09/2015
Vancouver				Winnipeg			
1	Advocate	BC Cycling Coalition	29/07/2016	1	Program Coordinator	Winnipeg Trails Association	06/2016
2	Board member	HUB Vancouver	03/08/2016	2	Program Coordinator	Green Action Centre	06/2016

3	Academic	University of British Columbia	03/08/2016	3	Advocate	Wrench	06/2016
4	Planner	Alta Planning + Design	02/08/2016	4	Advocate	Bike Winnipeg	06/2016
5	Transportation Planner	City of Vancouver Transportation Planning Division	16/09/2016	5	Program Coordinator	Bike Winnipeg	06/2016
				6	Former Planner	City of Winnipeg	06/2016
				7	City councilor (Previously advocate for Winnipeg Trails)	City of Winnipeg	06/2016