INVESTIGATING ACTIVE TRANSPORTATION AND SENIORS IN TORONTO

FOR TORONTO PUBLIC HEALTH

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EXECUTIVE SUMMARY

This literature review and jurisdictional scan focuses on the active transportation needs of seniors. Our research focuses on seniors aged between 55 and 85 years old. It also recognizes that supporting active transportation among young and middle-aged Torontonians can create new behaviours that last into older age.

Active transportation is defined as “any form of human-powered transportation including walking, cycling, using a wheelchair, or skateboarding”. In addition, there is almost always a walking or cycling component (at the start or end of trip) to public transit. As such, public transit has been included as part of this research.

The goals of active transportation are closely interconnected with all aspects of healthy aging and health-focused city building. There is growing evidence and interest in the benefits of active transportation and its connection to individual and population health. However, much less attention has been given to active transportation specific to discrete populations, such as seniors.

The epidemiological evidence for health benefits of physical activity attributable to risk reduction, maintenance of functional capacity, psychological well-being and social outcomes is strong. Emerging interest in neurological and cognitive health as well as psychosocial and mental well-being is yielding new evidence of the multifaceted benefits of physical activity for older adults.

There can be real hesitation towards active transportation, especially among seniors. There are many real and perceived barriers that prevent behaviour change needed to use more active modes of transportation. It is important to consider the underlying reasons for this hesitation. The car can represent independence for some people, and opting to take transit encroaches upon their sense of control and freedom. Some people might feel vulnerable taking transit or walking or cycling in their neighbourhood. Time and convenience is important. If active transportation takes too long and seems too complicated then seniors will not use it. Sometimes the biggest barrier is knowing how to navigate beyond the traditional routes used in the car.

The results of this research provide a number of important lessons that decision makers in Toronto can use to support projects or make decisions about financial investments in urban planning and public safety (modifications to the neighbourhood environment that encourage mobility and social participation). Five general insights summarize and synthesize the literature review findings:

1. Active transportation for seniors is an achievable goal.
2. Health supporting spaces can be as basic as having sidewalks in good repair.
3. Generally, improving pedestrian safety is a crucial first step.
4. Active transportation is the means of creating opportunities to increase physical activity, social connection and improved well-being.
5. Encouragement from friends and family can have a significant relationship in reinforcing physical activity choices.

6. Focus on the cohorts of younger seniors to build capacity for active transportation.
7. Including concerns for addressing social equity is a priority.
8. Encouraging seniors to use public transportation by making it accessible and affordable increases opportunities for social connection and physical activity.

These findings, as well as others, provide direction for design of effective senior health interventions, making policy recommendations related to land use planning and transportation, and in developing other plans and strategies related to the build and social environment.

1. INTRODUCTION

1.1 RATIONALE FOR THIS REPORT

This report is a foundational piece of research for understanding the state of active transportation and seniors based on existing literature and a scan of other jurisdictions. The purpose of the report is to provide an evidence base to support policy and program planning within Toronto Public Health as well as the wider City of Toronto.

Today's population is aging. As of 2015, seniors are now more numerous than children in Canada—a milestone in the country's history. In Toronto, by 2041, adults aged 55 and up are expected to make up more than one third of the population.

Aging today looks very different than it did even just 50 years ago. Not only are there significantly more seniors, but generally speaking, people are living longer and are more active than in previous generations. Older people today also have more varied aspirations, duties (work, care), as well as social and recreational networks, which in turn, affects their needs and travel behaviour.

An aging population and changes in how people age raise a number of critical questions for public health practitioners and policy makers: How do we help people remain independent and active as they age? How can we strengthen health promotion and prevention policies, especially those directed to older people? How do we ensure that seniors in Toronto can enjoy sustained, safe mobility and healthy, active lives?

Toronto Public Health (TPH) has a particular interest in public health interventions to address the needs of seniors to promote a healthy lifestyle. Creating a city that is inclusive and which protects vulnerable groups is critical to the role of TPH as a public health provider.

In 2011, Toronto City Council directed staff to develop The Toronto Seniors Strategy. Completed in 2013, the *Seniors Strategy* lays out strategies and actions for city Agencies, Boards, Commissions, Corporations and Divisions to support older Torontonians to remain active, healthy, engaged in civic decision-making, included in the life of their communities and their ability to live with independence and dignity. City staff are currently working with stakeholders to develop version 2.0 of the Seniors Strategy.

This report aims to inform and complement the *Seniors Strategy* and aligns with Toronto Public Health's commitment to strengthening safe active transportation and supporting seniors in its policies and programs.

1.2 METHODOLOGY

The number of individual studies on determinants of active transportation, as well as the link between active transportation and public health, has increased sharply over the last decade. Additionally, there is growing interest about the association between active

transportation and health for specific populations, such as seniors. This report provides insight into the current 'state of the science' on active transportation, health and seniors.

A comprehensive systematic review was beyond the scope of this project. Thus, our search methodology drew upon recent evidence from peer-reviewed systematic reviews. Where relevant, the findings of these systematic reviews were supplemented with more recently published primary studies to provide the most up-to-date evidence or to highlight information especially insightful to the Toronto context.
For the identification of Toronto initiatives and the jurisdictional scan (sections 5 and 6), we sought input from subject matter experts, including our project advisors and external stakeholders. We supplemented their input with internet research, and used a set of criteria to create a short-list of initiatives to include in the report.

A full description of the methodology is included in **Appendix A**.

1.3 FRAMING THE ISSUE: SENIORS AND ACTIVE TRANSPORTATION

In Canada, **seniors**[1] are often defined as those who are 65 years of age and older, the age at which older adults become eligible for Old Age Security. This definition is reinforced by Statistics Canada's standard age categories from both the *Census of Population* and *Canadian Community Health Survey*.

However, there is no consensus on whether this definition is appropriate for development of seniors policies and programs. Some argue that in the past three or four decades the concept of "old age" has changed with increasing life expectancy, suggesting that 65 is no longer suitable for defining old age. Another view is that all seniors age differently, and therefore there is no common experience across the lifecourse (*Health Care in Canada: A Focus on Seniors and Aging*, 2011).

The term 'older adult' is also commonly used in both academic and grey literature, sometimes referring to the 55-64 age cohort, or sometimes as a replacement for the term senior. The 55-64 age cohort is important to consider when looking at program and policy opportunities for seniors for several reasons. In 10 years, they will be in the 65-75 age cohort – in other words they are 'tomorrow's seniors'. It is also a critical point where policy and program interventions can impact habits and behaviours of people before they move into the later stages of life.

For the purposes of this report, the term older adult and seniors will be used interchangeably to refer to adults 55 years of age and older. This definition is inclusive of younger seniors and consistent with the definition used by the *Toronto Seniors Strategy* and the academic research on seniors. Including the 55-65 age cohort as part of this research also reflects the fact that active transportation can be more effectively encouraged by policies and actions that target people earlier in their life course.

[1] *Bold terms are included in the Glossary of Terms in* ***Appendix B****.*

Active transportation typically refers to any form of human-powered transportation including walking, cycling, using a wheelchair, or skateboarding (*Active Transportation in Canada*, 2011). Many sources also acknowledge that walking and cycling are often combined with public transit (Lachapelle, Frank, Sallis, Saelens, & Conway, 2015; Voss et al., 2016), and therefore strategies and interventions for encouraging the use of public transport and its integration with other aspects of active transportation are discussed in this report.

> Active transportation for older adults will most often take the form of walking – whether it is solely a walking trip or a walking trip to access transit. (Van Cauwenberg, Van Holle, De Bourdeaudhuij, Van Dyck, & Deforche, 2016)

Active transportation has a range of health-related benefits. It provides an opportunity to be physically active on a regular basis and increases social interactions and accessibility. Active transportation also contributes to environmentally-friendly actions that can reduce greenhouse gas emissions, including reducing road congestion and helping older adults save money on gas and parking. Walking and cycling (in particular for transport purposes) may be easily incorporated into a daily routine, increasing the potential for adoption and maintenance of these behaviours over time (Yang, Sahlqvist, McMinn, Griffin, & Ogilvie, 2010)

Provincial agencies, municipalities as well public health agencies recognize the importance of active transportation. For example, Toronto Public Health has conducted a range of studies on walking and cycling over the past several years, such as *Road to Health* (2012), *Healthy Streets - Design Features and Benefits* (2014) and *Jurisdictional Review* (2014), and *Walkable City: Neighbourhood Design and Preferences, Travel Choices and Health* (2012). However, very few organizations in Canada have looked specifically at active transportation and seniors.

1.4 PUBLIC HEALTH AND PLANNING

The interest of public health agencies in active transportation and land use planning has been building over the past few decades. Similarly, sectors that influence health, such as transportation, fresh food, land use, housing, public safety, and education are also becoming more aware and interested in their role in health determinants and promotion. Although public health and land use planning have been indisputably linked since the industrial revolution, when newly urbanized areas needed piped infrastructure services to provide healthy and sanitary conditions, over time there has been a separation of planning and public health (Corburn, 2004).

In recent years, public health has broadened its attention from a focus on individual health behaviours to the broader role of the environment in which one lives, works, learns and plays. Many of today's looming health concerns revolve around chronic disease, such as obesity, heart disease, stroke and certain types of cancer. These conditions are often associated with a lack of physical activity, unhealthy eating, and with environmental exposure to air pollutants (*Improving Health By Design in the Greater Golden Horseshoe*, 2014). There is also a growing recognition that the built

environment and land use planning may impact certain populations differently, thus creating potential health equity issues (*Health Equity and Community Design, 2006*).

The concept of 'health in all policies' is also relevant to this discussion. The *8th World Health Organization* (WHO) *Global Conference on Health Promotion* (2013) defined 'health in all policies' as "an approach to public policies across sectors that systematically takes into account the health and health systems implications of decisions, seeks synergies, and avoids harmful health impacts, in order to improve population health and health equity". It emphasized that government objectives are best achieved when all sectors include health and well-being as a key component of policy development (*World Health Organization*, 2013). This is because the determinants of health and well-being lie outside the health sector, for the most part, and are typically socially and economically formed (Buckett, 2010).

1.5 TRANSPORTATION AND SENIORS: KEY CONCEPTS

Mobility

The concept of mobility is central to the discussion about active transportation promotion for older adult and the ensuing health impacts. **Mobility** is defined as the ability to move oneself (either independently or by using assistive devices) within environments that expand from one's room to one's neighbourhood and regions beyond (Webber, Porter, & Menec, 2010).

See **Figure 1** below for Webber's conical model of the theoretical framework for mobility for older adults, where the levels of **life spaces** outside the home will influence an older adult's ability to use active modes of transportation. Each life space is composed of mobility determinants related to cognitive, psychosocial, physical, environmental, and financial factors. A ring representing gender, culture, and biographical influences surrounds the entire cone exerting influence on all of the mobility determinants. A cross-section of the cone is illustrated below (Webber et al., 2010).

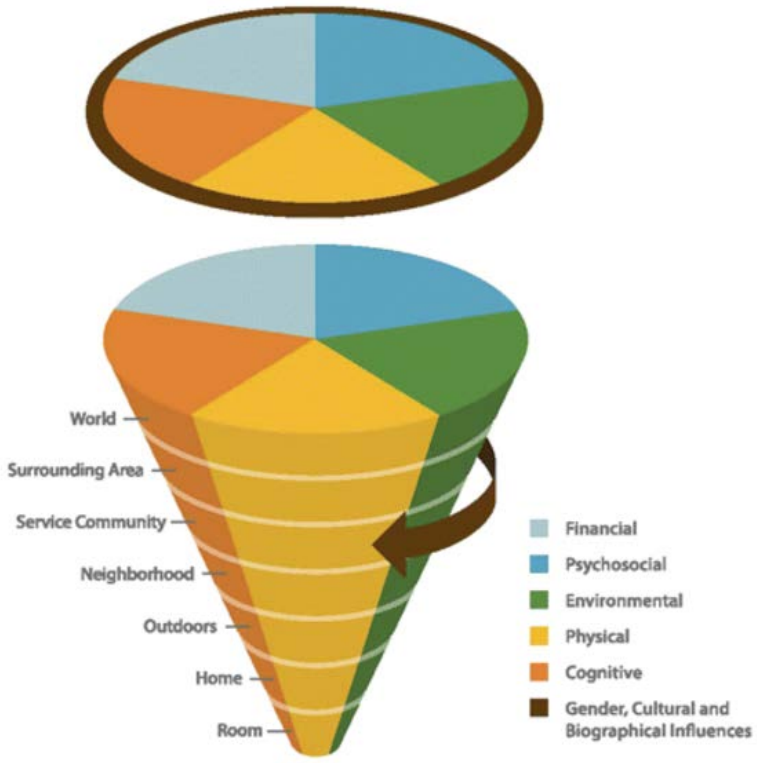


Figure 1. Conical model of the theoretical framework for mobility in older adults illustrating seven life-space locations (Webber et al., 2010).

The World Health Organization (WHO) found that maintaining mobility is considered the best guarantee of older adults being able to cope and remain in their homes and communities (*World Report on Ageing and Health*, 2015). The report suggests that mobility is key for older adults to live active, independent lives and is central to the capacity that determines how they participate in the economy, cultural and social activities and their ability to be physically active. In essence, mobility facilitates health. Conversely, **mobility limitations,** such as physical disabilities that interfere with walking, can negatively affect an older adult's health – they are at risk of greater frailty and disability, increased risk of health service utilization and institutionalization as well as premature mortality. Mobility limitations can also include reduced vision, diminished physical fitness and flexibility, decreased ability to focus attention, and the time necessary to react to unexpected circumstances increases.

Physical Activity

Active transportation is just one of the types or "domains' of physical activity. Others include physical activity associated with occupational, domestic or leisure activities. A much broader body of research has focused on the benefits of overall physical activity (across all domains) among seniors.

Studies of physical activity can provide insight into active transportation benefits and behaviours and are often cited in the literature on active transportation. For example, analyses of the *Canadian Community Health Survey – Health Aging* (2009) found that 55% of those over the age of 50 reported that they were physically inactive (Fisher, Harrison, Reeder, Sari, & Chad, 2015). We also know that Canadian physical activity guidelines recommend that older adults engage in at least 150 minutes of moderate to vigorous physical activity weekly, in bouts of 10 minutes or more, in order to reduce the risk of morbidity and mortality and maintain health, functional independence and mobility (Chodzko-Zajko et al., 2009). For healthy older adults, this translates to about 7,000-10,000 steps/day (Tudor-Locke et al., 2011).

Walking and cycling for transportation can help older adults achieve the guideline recommendations. However, active transportation (be it walking or commuting by bicycle) may occur at intensity levels less than moderate to vigorous activity, and for durations less than 10 minutes. While this may not contribute to 'meeting recommendations' there is established evidence that it still confers meaningful health benefits (Kelly et al., 2014; Lee, 2015). Interestingly, public transit and walk trips yield similar levels of physical activity (~ 5 min moderate to vigorous activity per trip). This is partially explained by the considerable amount of walking involved as part of any public transit trip.

The 'Complete Trip'

The '**complete trip**' refers to all the aspects of a person's trip, from "the time the individual begins to plan the trip, to when he or she leaves the originating location when starting a journey, to the doorstep of the final destination." (*Complete Trip: Helping Customers Make a Seamless Journey*, 2012). A trip has many components which may include multiple modes (e.g. driving, parking, transit, walking, cycling) and various physical assets (e.g. sidewalks, bike lanes, seating, shade, transit stops, parking, roadways as well as access to washrooms).

The complete trip concept helps to demonstrate that solutions and interventions related to active transportation must consider a senior's full journey. It suggests the need to work with multiple stakeholders and disciplines to identify and implement active transportation solutions. The concept of the 'complete trip' is also helpful as an analytical tool to identify barriers at different points in the journey that need to be addressed.

Trip Purpose and Distance

Transportation research takes into consideration **trip purpose**. The purpose of a trip is determined by the activity a person engages in at the destination of the trip. This has important consideration for seniors, as their destinations tend to be unique from other populations (Rosenbloom, 2003). A study of seniors travel behaviour found that most common types of trips among seniors tends to be shopping/errands (50% of all trips), social/entertainment/eating out (24% of all trips), and exercise (15% of all trips); while the remainder of trips (11%) are to attend health appointments, for volunteer/work, or

other purposes (e.g., religious, education) (Chudyk et al., 2015). Older seniors also tend to take fewer trips for work (Rosenbloom, 2003).

Trip distance is another concept that can impact mobility and the likelihood of using active modes of transportation. Discussions about trip distance often focus on seniors' access to a private vehicle, as those who have access to a car can travel longer and farther than those who do not (Banister & Bowling, 2004). With regards to walking and cycling, trip distance research is limited; however, one Australian study found that walking distance was similar for all age groups up to 84 years of age and then decreased for those aged 85 years and over (O'Hern & Oxley, 2015). The study also found that seniors travelled longer distances on public transport and shorter distance by bicycle, compared with younger adults.

1.6 CONSIDERATIONS FOR PROMOTING ACTIVE TRANSPORTATION IN SENIORS

There are a number of considerations that are important to understand when planning or promoting active transportation for seniors. Some of these factors are described below. At the same time, it is also important to recognize that seniors are not a homogeneous group, varying in culture, mobility, financial situation, living arrangements, health status and so on. Thus, the experiences and expectations around active transportation may be highly variable.

Socio-economic, Demographic and Cultural Considerations

Active transportation use can vary by gender among seniors. Older women are more likely to be limited in their day-to-day travel. This may be because they are less likely to have a driver's licence or be passengers instead of drivers (Turcotte, 2012). Given increasing income, education, and job achievement among women over age 40 today, it is likely that future cohorts of elderly women will more resemble men in their desire for an active post-retirement lifestyle, in which travel plays an important role (Rosenbloom, 2003).

Lower income neighbourhoods tend to have fewer transportation options and poorer access to amenities, such as retail, community services and facilities. Yet more amenities are positively associated with seniors mobility. One study found that older adults who lived in 'vital urban areas' (described as areas with lively pedestrian activity on the street) took more trips and were therefore more engaged in activities than those who lived in non-vital areas (Marquet & Miralles-Guasch, 2015).

Lower income levels also make it more difficult to own an automobile and afford transit, impacting mobility. Transportation literature often distinguishes between transit-dependent riders, who do not have ready access to a car; and those who have a car available, and can choose to use public transit because of its comparative advantage for a given trip (Lachapelle, Frank, Sallis, Saelens & Conway, 2015). These two groups tend to have distinct socio-demographic profiles, as well as lifestyles, preferences, and constraints (e.g., time constraints) (Lachapelle et al., 2015).

Few studies have looked at the impact of race and ethnicity on the travel patterns of seniors specifically. Research conducted by the Center on Urban and Metropolitan Policy in the US suggests that elderly black, Asian, and Hispanic make fewer and shorter trips than white elderly, and generally travel less often in a car (Rosenbloom, 2003). Although this research is from the US, it suggests a need to understand how older people from different backgrounds view travel and active transportation.

Cultural expectations and attitudes also influence transportation behaviour. For example, cycling is much more common in Europe than it is in North America. In the Netherlands people will cycle well into older age; as many as 25% of trips taken by older adults are by bicycle (Pucher & Dijkstra, 2003). In Canada, only 3.5% of those aged 65–74 years reported cycling or walking as their primary means of transportation (Turcotte, 2012).

Seniors, Behaviour Change and Active Transportation

There can be real hesitation towards active transportation, especially among seniors. There are many real and perceived barriers that prevent behaviour change needed to use more active modes of transportation. It is important to consider the underlying reasons for this hesitation:

- **Independence**: The car can represent independence for some people, and opting to take transit encroaches upon their sense of control and freedom.
- **Safety**: Some people might feel vulnerable taking transit or walking or cycling in their neighbourhood. Perhaps there are no sidewalks to connect their home to the closest bus stop? Perhaps the streets are poorly lit at night or the sidewalks are icy? Perhaps there is fear of crime in the neighbourhood? Or maybe there are no separated bike lanes and there is too much traffic on the roads?
- **Time and convenience**: When transit stops are too far or difficult to get to, people tend not to use transit. It takes too long and seems too complicated.
- **Wayfinding**: Sometimes the biggest barrier is knowing how to navigate beyond the traditional routes used in the car.

History of Physical Activity

Getting seniors to participate in active transportation can be more challenging than with other demographics, especially if active transportation has not been part of their lifestyle in earlier years. There is emerging research on how one's experience growing up can influence physical activity as one ages. Social research suggests that as older adults encounter change in their lives, they rely on previous experiences and make specific choices to maintain consistency (Atchley, 1989; Ricon, Weissman & Demeter, 2013). In cycling research, studies suggest that cycling as a child is associated with cycling as an adult (Dill and Voros, 2007). Winters, Sims-Gould, Franke and McKay (2015) investigated this theory with regards to cycling among an older adult population in

Vancouver and concluded that a history of cycling was indeed a factor in the propensity of older adults to ride.

Aging Stereotypes

Socially ingrained negative attitudes towards aging can also present challenges. *The World Report on Ageing and Health* (2015) states that ageist attitudes consider older adults as frail, unable to work, physically weak, mentally slow, disabled or helpless. Such stereotypical attitudes divide young and old and prevent seniors from participating in society and have a negative impact on the wellbeing of the elderly. Negative attitudes can become self-fulfilling by promoting stereotypes of social isolation, physical and cognitive decline, lack of physical activity and economic burden (Levy, Slade, Kunkel, & Kasl, 2002). They can also limit the way problems are conceptualized, the questions that are asked, and the capacity to seize innovative opportunities (*World Report on Ageing and Health*, 2015)

Impact of Technology

Technology has and will continue to affect transportation infrastructure and services, through automation, connectivity, ride sharing, and even self-driving cars. Historically, the usage of most technology by older people has been low (Tacken, Marcellini, Mollenkopf, Ruoppila, & Széman, 2005). People with low income and a low education levels also tend to use new technologies less than people with a high income or higher education. Cognitive abilities also impact technology use: a basic level is needed to memorize a PIN and to understand the instructions. Furthermore, access to some of the new technologies can be prohibitively expensive for a number of older people (Tacken et al., 2005).

However, a new generation of older adults has grown comfortable with technology and is open to its possibilities for improving their lives as they age (Sixsmith, 2013). Research has shown that older people can learn to handle new techniques and once overcome, they can be enthusiastic users (Tacken et al., 2005). Provided that the interface is appropriate, electronic information signs, route information, trip planning services, automated information kiosks, can help seniors to move around their environment more effectively. Technology may also facilitate physical activity through social communication and tracking (Tacke et al., 2005).

Physiological Changes Associated with Aging

There are a numerous of physiological changes that occur as people age, many of which account for physical health and functionality and are relevant to one's ability to partake in active forms of transportation. For example, sensory functions such as hearing and vision decline. Muscle mass and bone density also decrease with advancing age (Taylor & Johnson, 2007). Motor control decrements slow reaction speed and influence balance control (as does a decline in vestibular function). Many older adults live with chronic conditions, such as arthritis, diabetes, heart conditions, and lung disease. Mild memory loss is also common (Taylor & Johnson, 2007). Frailty, which is characterised by shrinking, weakness, poor endurance, slowness, and low activity, also increases as people age. A recent Canadian cross-sectional analysis of 740 community-dwelling seniors found that, overall, 7.4% were classified as frail, 49.7% prefrail and 42.8% non-frail (Fried, Darer, & Walston, 2003).

Use of Mobility Devices

As a result of these physiological changes, the use of mobility aids (cane, walker, electronic/motorized scooter, or hip protector) become more prevalent as people age. Overall, 22% of Canadian seniors say they use at least one mobility aid, with canes and walkers being the most prevalent (Savas, 2009).

Each kind of mobility-supportive device presents its own set of considerations when it comes to active transportation promotion for older adults. For example, the marked rise in the use of electronic/motorized scooters has created challenges as there is often uncoordinated policy, planning and public knowledge about best methods and location (i.e. sidewalks or roadways) for operation and, as a result, increased risk of crashes and injuries exists (Blais, Rutenberg, & Suen, 2012). When it comes to walkers and canes, it has been shown that **gait** in older adults who use a walking aid is more irregular and unstable than gait in independently mobile older adult, but that walking aid users have better gait when using their walking aid than when walking without it (Härdi, Bridenbaugh, Gschwind, & Kressig, 2014).

Moving from Driver to Passenger

For most seniors, aging also means a shift from being a car driver to a car passenger or relying on public transit. *The Seniors Vulnerability Report* (2011) published by the Lower Mainland United Way, suggests this shift can sometimes lead to diminished sense of independence and feelings of guilt and shame from relying on friends and families for rides. The report also notes that not having affordable and appropriate transportation options increases risks of social isolation (*Seniors Vulnerability Report*, 2011).

While walking and cycling can help seniors to increase their level of independence and accomplish some of their day to day tasks and activities, they are often not feasible options for many travel needs. This makes public transportation critical for seniors; it brings mobility, access, and personal autonomy to older adults who can’t drive but need to travel beyond their immediate neighbourhoods (Green, Jones, & Roberts, 2014). This is especially true in neighbourhoods where the location of housing, shops, employment, and services are not within walking distance.

2. HEALTH BENEFITS AND RISKS

Active transportation provides a viable way to bolster health by providing an opportunity to be more physically activity and socially connected as people move about through their community. Thus, active transportation plays a role in facilitating healthy behaviours for all populations, including older adults. However, active transportation may also confer risks, such as a potential for increased risk of injury from falls or crashes, for example – or other exposures. From a government agency perspective, the benefits and trade-offs of active transportation promotion must be factored in to decisions on program, policies and infrastructure design.

Currently, there are no review studies detailing the health benefits and risks of active transportation specifically for older adults, thus, in the first section below we draw on the state of the science demonstrated in a few quality review studies from the general population. This evidence provides insight into the relationship between health and active transportation and surfaces key considerations relevant to older adult populations. In the subsections, we also draw on established evidence on the health benefits of physical activity (for any purpose, not just transportation), and introduce the evidence on physical inactivity as well. Finally, we present evidence on health risks associated with active travel and conclude with an assessment of the trade offs.

2.1 EVIDENCE ON THE HEALTH BENEFITS OF ACTIVE TRANSPORTATION

State of the Science – Physical Health Benefits of Active Transportation

Several recent reviews highlight the health benefits of active transportation. While none focused on older adults specifically, we include them in this report because they provide insight into how the relationship between health and active transportation might translate for older adult populations. For instance, a meta-analysis of 21 studies which evaluated associations of walking and cycling behaviours on all-cause mortality (walking outcomes: 280,000 adults; cycling outcomes: 187,000 adults) demonstrated that walking and cycling have population-level health benefits even after adjusting for other physical activity behaviours (Kelly et al., 2014). Relevant to the promotion of active transportation for older adult populations, this study found a non-linear shape of the ‘dose response curve’ – meaning that shifts among those with the lowest levels of walking and cycling, such as older adults, had the greatest gains in the reducing mortality risk. The authors suggest that public health interventions would have the biggest impact if they were able to increase walking and cycling levels in groups that currently have the lowest levels of these activities.

With regards to cycling specifically, a review of 16 primary studies assessed the health benefits and found that prospective observational studies demonstrated a strong inverse relationship between commuter cycling and all-cause mortality, cancer mortality, and cancer morbidity among middle-aged to elderly groups (Oja et al., 2011). Intervention studies among working-age adults indicated consistent improvements in cardiovascular fitness and some improvements in cardiovascular risk factors due to

cycling commuting. Six studies showed a positive dose-response between the amount of cycling and the accrued health benefit (outcomes: including fitness, all-cause mortality, colon cancer measure, cardiovascular disease incidence, weight measures) Systematic assessment of the quality of the studies showed most to be of moderate to high quality. The authors put forth that more intervention research is needed to build a solid knowledge base on the health benefits of cycling but that current evidence justifies promotion of cycling transport for health. Future work in this area should also consider age group specific benefits and trip purpose analysis to help inform public health initiatives, such as active transportation promotion for older adults.
A third review of 22 primary studies focused on the impact of active transportation on obesity and obesity-related outcomes in adults (Saunders, Green, Petticrew, Steinbach, & Roberts, 2013). The authors did not find significant association between obesity (primary outcome) and active transportation behaviour meaning that, based on the findings of this systematic review, active transportation does not have an impact on obesity. However, in the same study, the authors showed that for individuals who travelled longer distances by active modes, small positive health impacts were found for all-cause mortality, hypertension and Type 2 diabetes.

A review of 27 articles assessed the relationship between public transportation use and physical activity levels in adults (Rissel, Curac, Greenaway, & Bauman, 2012). The study found that public transportation use can increase walking by 8 to 33 minutes per day. Thus, public transportation is likely to lead to significant increases physical activity among adults.

Based on the evidence synthesized in these reviews, even after accounting for other forms of physical activity, active transportation confers positive impacts for outcomes such as all-cause mortality, cancer, hypertension, and Type 2 diabetes – with the largest impacts for those who are the least active. As these reviews focused on the general adult population, concrete evidence to justify active transportation promotion to support older adult health is not yet established, but there is reason to believe that many of these findings would be transferable.

Physical Health Benefits of Active Transportation Among Seniors

Our literature search yielded one primary study that investigated the association between active transportation and health in older adults specifically. One was a cross-sectional study using data from the WHO Study on *Global Ageing and Adult Health* that included 40,477 older adults (primarily 50 years and older) from low and middle-income countries (China, India, Mexico, Ghana, Russia and South Africa) (Laverty, Palladino, Lee, & Millett, 2015). The study assessed the health benefits of active transportation on obesity outcomes as they are linked to increased disability as well as mortality. High use of active transportation was associated with lower risk of being overweight, low waist-to-hip ratio, and lower BMI, while both moderate and high use of active transportation were associated with lower waist circumference and lower systolic blood pressure. This evidence suggests the positive impacts of active transportation could have on obesity-related health outcomes for older adults.

Social Health Benefits of Active Transportation Among Seniors

The study of social health benefits is newer, with a diversity of research methods. This is an area of growing interest for public health and community planning. When mobility is challenging, opportunities to participate in social activities can be diminished. An analysis of Canadian Community Health Survey – Healthy Aging (2009) data found that inadequate access to transportation or difficulty getting around can be a barrier to seniors' social participation (defined as family activities, physical activities with other people, community activities, volunteer work, etc.) (Turcotte, 2012).

A review of 50 articles looking at how neighbourhood environment is associated with mobility and social participation in older adults found that having sufficient and convenient local business stores in the neighbourhood allows older adults to remain active, which is beneficial for their health and may allow them to remain independent longer (Levasseur et al., 2015).

Another review of 33 studies, also found that there were social health benefits to active transportation among seniors. For example, the study notes that walking to and visiting public locations allows older adults to feel like part of the broader community and that walking in a neighbourhood can help to create a sense of community by facilitating connections among neighbours (Heather, Ashe, McKay, & Winters, 2012). In contrast, car use physically distances people from their community and makes people more anonymous, which has been associated with less trust among neighbours, an increase in opportunities for crime, and a breakdown of community involvement (Turcotte, 2012).

Public transportation also been found to have social health benefits. A primary study of the effects of a subsidized bus pass on social outcomes among older adults in London, England found that taking the bus played a significant role in maintaining friendship networks among older adults and provided opportunities for meaningful social interaction. Travelling as part of the ‘general public’ provided a sense of belonging and helped to tackle chronic loneliness. Taking the bus allowed seniors to access shopping facilities as a way to shop around to cut costs, and shop frequently to lighten the load (Green, Jones & Roberts, 2014). Public transit is also a critical resource that may allow older adults to age in place, especially as the ability to drive declines with older age and increasing health complications (Voss et al., 2016).

Implications of Physical Inactivity

The health impacts of physical inactivity, or sedentary behaviour have been of great interest in recent years. Physical inactivity is the fourth leading risk factor contributing to deaths and the burden of disease globally, ranking ahead of overweight or obesity (Lee et al., 2012). In Canada, sedentary behaviour has emerged as a risk factor for health and has surpassed epidemic proportions in all age brackets (Katzmarzyk & Janssen, 2004). For the general adult population, the estimated direct, indirect, and total health care costs of physical inactivity in Canada in 2009 were $2.4 billion, $4.3 billion, and $6.8 billion, respectively, each representing nearly 4% of the health care budget overall health care costs in Canada (Katzmarzyk & Janssen, 2004).

A recent systematic review of 22 studies demonstrated the consistent increase in sedentary time with age (even when adjusted presence of chronic condition or other illness), with sitting time averaging 9+ hours/day among older adults (Harvey, Chastin, & Skelton, 2015). Bauman and colleagues posit that innovative population-level efforts are required to address physical inactivity and to prevent health decline because of physical inactivity. Further, they call on all levels of government to investment in healthy aging in order to reduce the burden of disease and disability among older adults (Bauman, Merom, Bull, Buchner, & Singh, 2016). With older adults accounting for the most sedentary segments of the population, targeted efforts to increase time engaging in physical activity, such as walking and cycling for transport purposes, have the potential to greatly impact health outcomes and other downstream system level impacts.

2.2 EVIDENCE ON THE HEALTH BENEFITS OF PHYSICAL ACTIVITY

Physical Health Benefits of Physical Activity

Active transportation is of course just one of the types or “domains’ of physical activity. Others include physical activity associated with occupational, domestic or leisure activities. A much broader body of research has focused on the health benefits of overall physical activity (across all domains). A recent high quality review of reviews takes stock of the most current epidemiological, prevalence and intervention evidence on the relationship between physical activity and health outcomes specifically among older adults (Bauman, Merom, Bull, Buchner, & Singh, 2016). In this section, we draw the main points from this review paper and provide some specific and additional citations to highlight specific information most relevant to the Toronto context. For public health practitioners seeking more comprehensive perspectives on the current state of health and aging, we suggest a review of the *World Report on Aging and Health* (2015).

A summary of the range of health benefits of physical activity specific to older adults is shown in ***Figure 2*** below (*Physical Activity Guidelines for Americans*, 2008) as cited in

(Bauman et al., 2016)[2]. It highlights the health benefits of physical activity attributable to risk reduction, maintenance of functional capacity, psychological well-being and social outcomes. The epidemiological evidence for these benefits is strong. Of note, emerging interest in neurological and cognitive health as well as psychosocial and mental well-being is yielding new evidence of the multifaceted benefits of physical activity for older adults.

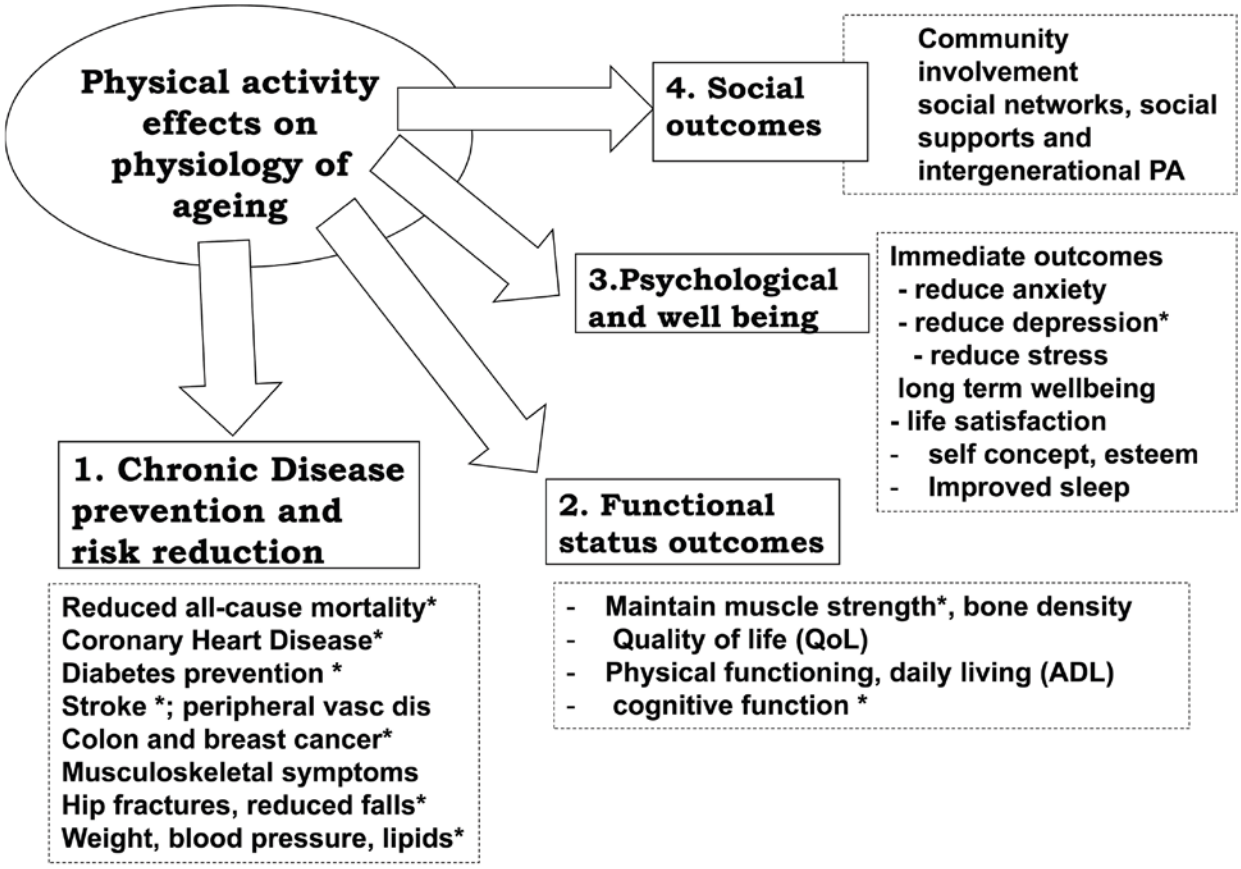


Figure 2. A conceptual framework for the benefits of physical activity in older adults. *Reported as "strong" epidemiological evidence by the U.S. Department of Health and Human Services and the 2008 Physical Activity Guidelines Advisory Report (Bauman et al., 2016; Physical Activity Guidelines for Americans, 2008).

The general population evidence on physical activity benefits for reducing all-cause mortality risk, preventing cardiovascular disease and type 2 diabetes, and evidence on benefits on lipid levels, hypertension and reducing the risks of breast and colon cancer, apply to older adult populations as well (Chodzko-Zajko et al., 2009). Regular physical activity among older adults also reduces the risk of stroke (Wannamethee & Shaper, 1999) and helps to retain independence, a high quality of life, reduces health care costs (Chodzko-Zajko et al., 2009) and as well reduces frailty risk and prevents admission to higher levels of care in later life (Landi et al., 2010).

[2] *Generally, the Canadian and American Guidelines are the same. The main difference is that the American Guidelines recommend an additional 75 minutes of vigorous exercise on top of the 150 minutes of moderate to vigorous exercise.*

Emerging evidence suggests that physical activity can improve cognition in people without dementia, reduce the incidence of dementia, and improve health among people with existing dementia (Sofi et al., 2011). In a Canadian review of epidemiological and clinical studies, evidence suggests that physical activity can improve cognitive function in older adult populations (Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010). A recent review showed a 28% reduced risk of developing dementia among physically active older adults (Blondell, Hammersley-Mather, & Veerman, 2014). This is important given the rise in dementia-related conditions: projections suggest there will be a 30 % increase in the number of Canadians living with dementia in the next 15 years, 937,000 of whom will be over the age of 65 (*Prevalence and Monetary Costs of Dementia in Canada*, 2016).

Social and Mental Health Benefits of Physical Activity

One in four Canadian
The most common mental health issues were mood and anxiety disorders, depression, cognitive and mental disorders due to a medical condition (including dementia and delirium), substance misuse (including prescription drugs and alcohol) and psychotic disorders (MacCourt, Wilson, & Tourigny-Rivard, 2011). Further, increasing amount of seniors may be at risk of being socially isolated or lonely. This may be due to a number of factors such as increased likelihood of living alone, death of family members or friends, retirement or poor health (*Sixsmith & Gutman,*2004).

Being physically active can provide older adults the opportunity to experience more social interactions and contribute to positive mental health. There is mounting evidence that physical activity can reduce symptoms of depression and anxiety and improve general mental health outcomes among older adults (Bridle, Spanjers, Patel, Atherton, & Lamb, 2012). The Toronto Public Health Report *Road to Health* also found that there were social health benefits to physical activity (general adult population). For example, the Report found that physical activity can reduce the symptoms of depression, anxiety and panic disorders, improve self-esteem, improve mood, reduce stress and enhance perceptions of happiness and satisfaction (*Toronto Public Health*, 2012).

In terms of the social benefits of physical activity, in their review of other review papers, Bauman and colleagues advance the notion that the volume and quality of data on this is lacking but individual measures of confidence, mastery, and self-esteem as well as social interaction, reduced isolation, and increased community engagement are improved (Bauman et al., 2016; McAuley et al., 2000). The literature, although limited, suggests a ‘bi-directional’ relationship between physical activity and social factors. This is because being more mobile and physically active can afford older adults the opportunity to experience social interactions and at the same time, engaging in social activities also promotes physical activity. For example, walking or cycling to social events provides older adults with a source of physical activity.

2.3 EVIDENCE ON THE HEALTH RISKS OF ACTIVE TRANSPORTATION

Active Transportation & Road Safety

Safety concerns, both real and perceived, are primary barriers to active transportation for people of all ages. Road safety risks need to be mitigated in the promotion of active transportation.

In all age groups, pedestrian and cyclists are considered vulnerable road users, given that injury and fatality risks are much higher for walking and cycling than for driving. Studies on traffic-related fatality rates from British Columbia (Teschke et al., 2013) and the United States (Beck, Dellinger, & O'Neil, 2007), indicate that public transit is the safest travel mode, while motorcycling is the riskiest. Driving, walking and cycling are intermediate between these, with walking and cycling having more risk than travel by car. Thus, if older adults shift from driving to active transportation, there may be some increased road safety risk.

Older adults are typically disproportionately represented in pedestrian and cyclist injuries and fatalities. Toronto's *Pedestrian and Cyclist Safety Report* analyzed police reported incidents, and found that an average of 2050 pedestrians and 1095 cyclists were injured in collisions with motor vehicles annually over 2008-2012 (*Toronto Public Health*, 2015). ***Figure 4*** shows that while the overall injury/fatality rates are relatively similar for those aged 45 and older, the rates of major injuries and fatalities increased with age. It has been postulated that older pedestrians are at greater risk of severe injury when struck by a motor vehicle than other age groups due to their increased physical vulnerability as well as age-related changes that may influence their ability to judge safe crossing situations (changes in perceptual and cognitive functions, hearing vision, reaction time).

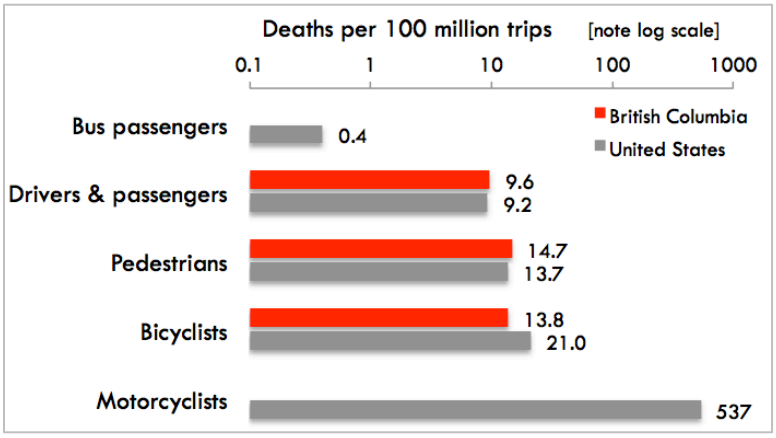


Figure 3. Exposure based traffic-related fatality rates from British Columbia (Teschke et al. 2013) and the United States (Beck, Dellinger et al. 2007). Figure from Teschke's website: http://cyclingincities.spph.ubc.ca/injuries/

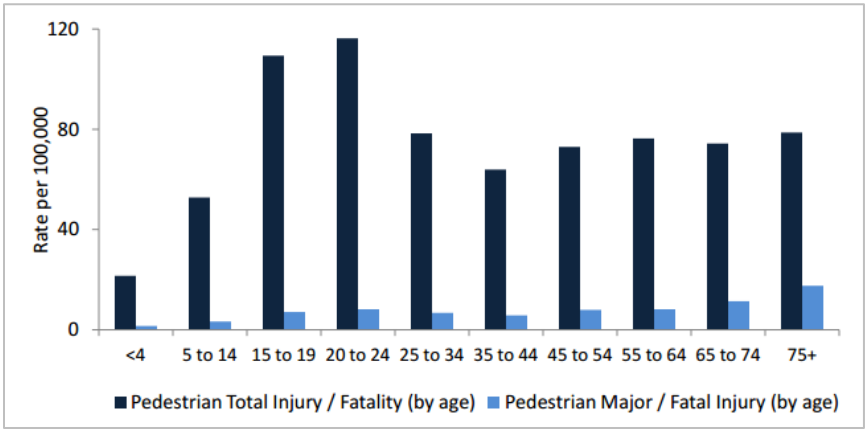


Figure 4. Pedestrian Injuries and Fatalities, by Age Category, 2008-2012 (Per 100,000 population). Data Source: City of Toronto Police Motor Vehicle Collision Reports 2008-2012, Population Estimates, IntelliHEALTH Ontario (Toronto Public Health, 2015) .

Interestingly, with increases in walking and cycling, there may be safety improvements through the "safety in numbers" phenomenon. Studies have consistently shown that over time, across cities, and between countries, walking and cycling are safer in places with higher rates of active transportation (Elvik, 2009; Jacobsen, 2003; Pucher, Dill, & Handy, 2010), although the mechanisms for this are still topics of debate (Jacobsen, 2003). Thus, as more people in any age groups engage in active transporation, there may be widespread safety benefits (Jacobsen, 2003).

Active Transportation & Fall Risk

Falls are an important public health concern for the older adult population as they can have serious consequences: injury, disability, hospitalization and even death (*Seniors' Falls in Canada*, 2014). Falls also tend to occur among more active seniors (W. Li et al., 2006). Thus, there is reason to consider fall risk when promoting active transportation for older adults.

The 2009 Canadian Community Health Survey data show that almost half of all injuries (all age groups) occurring each year are caused by a fall, and this is greater among the older adult population, where nearly two in three injuries are due to a fall (Handrigan et al., 2016; Thomas & Wannell; 2009). The same survey also showed that ~ 20 % of adults aged 65 years or older fell during the preceding 12-month period (Handrigan et al., 2016). Over 70% of older adults who fell sought treatment for their injuries or visited a hospital emergency department. In addition to the negative physical and mental health consequences of falling for older adults, there are significant financial implications: it is estimated that falls among older adults total $2 billion annually, a value 3.7 times greater than that of falls among younger adults (*The Economic Burden of Injury in Canada, 2009)*.

The cause and location (environment) of fall-related injuries among seniors is relevant to the promotion of active transportation. There is limited evidence on the proportion of

falls that happen outside the home while walking or cycling for transportation or while accessing transit. We found one meta-analysis of cross-sectional and cohort studies that investigated the role of the physical environment as a fall risk factor in community dwelling older adults (Letts, 2009). The cross-sectional studies showed that falls were more likely to occur outdoors and during periods when it was cold (perhaps indicating a role for snow and ice) (Letts, 2009). The cohort studies showed that people who seldom walk outdoors are more likely to experience any type of fall – attributable to reduced mobility. Taken together, active transportation promotion can increase the risks of falls among seniors.

In Toronto, weather is closely related to fall risk, especially for older adults (*Preventing Injuries from Wintertime Slips and Falls in Toronto*, 2016). Rates of emergency department visits and hospitalizations related to slips and falls on snow or ice are higher among those who are 65 years and over than among those aged 15 to 64 years for each year from 2006 to 2015 (*Preventing Injuries from Wintertime Slips and Falls in Toronto*, 2016). The report also notes that when there was snow or ice on the ground, over 60% of those aged 60-85 years said that they would go out less as a way to cope with the weather and 44% of those aged 65 and older said that better snow removal/winter maintenance would encourage more walking.

It is also important to acknowledge perceived safety and fear of falling. Fear of falling can lead to health problems due to de-conditioning, social isolation, more falls, greater frailty, decline in mobility and increased mortality (Scheffer, Schuurmans, van Dijk, van der Hooft, & de Rooij, 2008) and can cause a person to avoid daily activities that he/she could be capable of performing (Tinetti & Powell, 1993). A cross-sectional study that examined fear of falling among 1,841 community-dwelling older people 65-74 years of age, showed that fear of falling is an important psychological factor that is associated with reduction in **life space** of older adults in different social and cultural contexts (Auais et al., 2017). Another cross-sectional study of 445 robust community-dwelling older people aged 65 and older, found fear of falling was high and that the main concerns of participants were walking on slippery/uneven surfaces, in crowded places and up/down a slope (Liu, 2015). Thus, it is important to balance the health benefits of active transportation with the increased risk of falls. Specific population level mobility factors (i.e. use of mobility aids) should be considered.

2.4 BALANCING THE EVIDENCE ON THE HEALTH BENEFITS AND RISKS OF ACTIVE TRANSPORTATION

In recent years, there has been increased effort to model the health impacts of shifts toward active transportation, taking into account benefits from physical activity and risks from road safety crashes or air pollution. A review of 30 such modeling studies provides strong evidence that benefits of active transportation consistently outweigh the risks, with a median benefit cost ratio of 9 across studies (range -2-360) (Mueller et al., 2015). None of these health impact modeling studies were specific to older adults although some have included age-stratified models (Götschi et al., 2015) and may begin to provide insights into the balance of risks and benefits for age specific groups. These modeling efforts are still in early stages (W. Li et al., 2014).

3. ROLE OF THE BUILT ENVIRONMENT

In this section we use three domains of the built environment - transportation systems, land use patterns, and urban design - to organize the research findings. For each, a discussion of the evidence related to the influence of the built environment on active transportation among seniors is provided, highlighting specific barriers and facilitators that impact use.

We report evidence from several recent reviews on older adults (Hanson et al., 2013; McCormack & Shiell, 2011; Rosso, Auchincloss, & Michael, 2011) and add in specific studies where certain topics have not been included in the reviews, to highlight a particular finding or where new research as been developed. While we focus on the literature on older adults, much of the evidence is similar for other age groups.

The evidence in this area has been growing over recent decades. While research strongly supports a conclusion that the built environment impacts individual and population health, there are also conflicting results in the built environment literature, which have been attributed to methodological differences and study designs. A discussion of this is beyond the scope of this report, but an interested reader may consult reviews mentioned below, as well as broader reviews such as those related to measurement (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009) or co-benefits (Sallis et al., 2015).

3.1 TRANSPORTATION SYSTEMS

Transportation systems relate to how people travel through a neighbourhood and how easily a person can get to where they want to go. These systems include characteristics of the physical street network and walking trails, as well as the transit systems themselves.

Motor Vehicle Traffic

Rosso et al. (2011) conducted a review of 17 empirical studies looking at the effect of the built environment on older populations. Several of the studies looked at traffic-related street characteristics in relation to mobility. The results suggest that the presence of traffic safety measures for pedestrians is positively associated with walking.

Interestingly, high traffic volume was also positively associated with walking. This is related to the overall number of commercial businesses, the number of likely retail walking destinations, and the percentage of high-volume and low-volume streets in their local neighborhood, which led to more time spent walking each week.

We also highlight results from several Canadian-specific studies for additional insight. One is a qualitative study of older adults in Quebec and Ottawa, where themes mentioned by seniors were: fear of being hit or splashed by a car, insufficient time to traverse intersections, poor visibility in busy intersections, and traffic lights located at inconvenient spots on a route, forcing them to either walk out of their way or risk traffic

collisions and jaywalking – all of which acted as barriers to walking or affected safety (Lockett, Willis, & Edwards, 2005). Another study in Vancouver found that user-friendly crosswalks with good visible/audible signals were strongly associated with walking among older adults (Hanson et al., 2013).

In studies specific to cycling, seniors, like other populations, report that traffic is a major barrier to cycling and to be avoided (Winters, Sims-Gould, Franke, & McKay, 2015), Another study suggests that most seniors will only consider riding on cycle paths or very quiet roads (Zander, Passmore, Mason & Rissel, 2013).

Trails

Rosso et al.'s review (2011) found across studies that proximity to walking paths and trails was associated with amount of daily walking, however, was not associated with frequency of neighbourhood walking among older adults. One of the studies reviewed, looked specifically at older women and concluded that the pathways which are integrated within a neighbourhood, may lead to increased walking behaviour (Hall & McAuley, 2010).

Public Transportation

Public transit trips include a walking or cycling component at the start or end of trip, and in this way may encourage active transportation. While no literature reviews exist, there are recent studies quantifying the physical activity associated with public transit use. Most studies are not older adult-specific; however, a study of the travel behaviour of older adults in a highly walkable neighbourhood in downtown Vancouver found that older adults accrued similar amounts of physical activity in trips by public transit, as for their walking trips (~ 5 min) (Voss et al., 2016).

Two other studies are worth noting: one in the London, UK area that found density of bus stops was more important than bus frequency for older adults' use of public transport (Su & Bell, 2009) and another in Melbourne and Victoria, Australia that found having public transportation stops within a 500m walking distance encouraged the use of public transport among seniors, and improved use of public transportation and active transportation among older adults (O'Hern & Oxley, 2015).

3.2 LAND-USE

Connectivity

Street connectivity relates to how direct a route of travel is and the number of routes between any two destinations. In general, communities with high levels of street connectivity reduce route distances, increase non-motorized route options and convenience, and dissipate vehicular traffic (Dunn, Creatore, Peterson, Weyman, & Glazier, 2009).

Rosso et al.'s (2011) review found one study that showed a positive association between street connectivity and mobility among older adults, two studies showed no association, and one showed a negative association. Here, the review suggests

differences in study site, neighbourhood definitions, and how walking initiatives were put into practice likely accounted for some of the differences.

Density

Rosso et al.'s (2011) also found there was an association between housing density and greater levels of walking among older adults. Greater population densities have also been found to be positively associated with physical activity among adults (McCormack & Shiell, 2011). This is likely a result of the relation between population density and other environmental attributes.

Destinations

Hanson et al. (2012) conducted a review of 33 studies with the aim of highlighting factors of the built and social environment as they affect older adult mobility. A key finding from the review is that destinations within the community were important factors to encourage walking among older adults. Businesses, malls, trails, parks and green space, retail destinations, and amenities in general are destinations that promote walking among older adults. For example, one of the studies reviewed was a cross-sectional study of 546 seniors in Portland, Oregon. The study found that closer distance to retail and parks explained walking activity. In the studies reviewed, no association was found between walking and presence of recreational facilities, gyms, or schools among older adults.

A primary study of older adults in Vancouver aimed at understanding which destinations were most important to older adults found that the most common destinations visited by older adults were grocery stores and malls (Chudyk et al., 2015). For shopping trips, other common destinations were the bank, health and personal care store, and libraries. For social trips, restaurants/cafés and private residences were the most common, and for exercise, neighbourhoods, natural environments, and recreation centres were important. The study concludes that neighbourhoods with a high number of destinations may provide older adults an attractive opportunity to walk, instead of drive, and as a result, 'take part in incidental physical activity.' It also notes that accessible neighbourhood destinations may be especially important to older adults with low income as they are more likely to walk as a primary travel mode.

Parks

Rosso et al.'s (2011) review found three studies indicating a positive association between the presence of parks and walking among seniors, but also three studies where this relationship was not significant. They suggested methodological differences may explain the mixed evidence, in part.

Walkability

Walkability is a composite metric for the built environment which typically combines factors related to land use mix, residential density, street connectivity, and the presence of parks and trails.

A review of 33 studies on the built environment and physical activity in older adults found four studies showing a positive association between a neighbourhood walkability factor/pedestrian index and physical activity (McCormack & Shiell, 2011).

Another review (Hanson, Ashe, McKay, & Winters, 2012) found that there is a positive association between neighbourhood walkability (objectively measured and perceived) and older adults' outdoor physical activity. One of the studies reviewed from Portland, Oregon found that 22% of the variance in neighbourhood walking among older adults was explained by neighbourhood walkability variables (employment density, household density, number of street intersections, and area of green and open spaces). Another US study cited in the review found that older adults who lived in more walkable neighbourhoods walked an average of 38 minutes/week compared with only seven minutes/week among those who lived in less walkable neighbourhoods (King et al., 2011). In Toronto, the *Walkable City* study found that people living in walkable neighbourhoods across the GTA, and in Toronto, do more utilitarian walking, take transit more often, drive less often and less far, and have lower body weights, than those who live in less walkable neighbourhoods (*Toronto Public Health*, 2012).

When Cyclists and Pedestrians Collide

Active transportation programs aim to encourage both cycling and walking. However, sometimes there can be conflicts when cyclist and pedestrians share the same paths. Several studies have identified concerns among pedestrians with sharing the path with cyclists. Seniors tend to feel unsafe around cyclists dangerously riding on sidewalks and prefer to be segregated from cyclists and bicycle lanes.

Similar to the literature for built environment, overall there are mixed findings on the association between walkability and walking. It is also worth noting here that an older adult's assessment of his/her physical capacity has been found to influence walking (Hall & McAuley, 2010). This means that, in addition to actual walkability, the perception of whether a community is friendly for walking might influence a senior's decision to walk (Montemurro et al., 2011).

3.3 URBAN DESIGN

Urban design relates to the more street-scale elements of the built environment such as sidewalks and other public amenities. Urban design can influence safety, attractiveness and ultimately decisions about whether or not to walk.

Sidewalks

The presence and condition of sidewalks have been frequently identified as an important feature for older adults' mobility. Several studies in Hanson et al.'s (2012) review found that absence or poor maintenance of sidewalks can create serious issues for seniors' mobility, whereas uneven sidewalks were identified by older adults as being impediments to mobility.

Sidewalks improve street connectivity and help to create more direct, and thus shorter distances from home to potential destinations. The Toronto Public Health Report *Road to Health* (2012) found that among the general population, the extent and continuity of sidewalks are associated with increased walking and reduced pedestrian-vehicle collisions.

Two Canadian studies provide further insight into the importance of sidewalks among seniors. A concept mapping exercise in British Columbia used statistical software to understand aspects of the built environment and social environment that influence older adults' outdoor walking (Hanson et al., 2013). The study found that keeping streets and sidewalks clear of snow, ice, sand and gravel was one of the most important and feasible interventions. Another qualitative study found that the condition of sidewalks, such as cracked and had uneven or slanted surfaces were a big concern for seniors. Such hazards made it difficult to walk, especially when using an assistive device such as a walker. Accessibility and connectivity of sidewalks, pathways and ramps were also raised as being concerns that can impede walking (Lockett et al., 2005).

Public Realm

Some evidence suggests the attractiveness of the public realm has also been associated with walking. For example, one study reviewed in Hanson et al. (2013) found that graffiti or vandalism is associated with less walking among seniors. Similarly, adequate lighting, was found to be desirable and also thought to encourage walking among seniors.

Amenities

Several qualitative studies suggest that small-scale public realm amenities can encourage walking among older adults. This is likely because mobility impairments increase with age and the lack of places to rest can result in people walking shorter distances. A study of seniors 60 years of age and over in Vancouver found that benches contributed to older adults' mobility experiences by: "enhancing their use and enjoyment of green (trees, grass and other flora and fauna) and blue spaces (lakes, rivers, oceans, and ponds), serving as a mobility aid, and contributing to social cohesion and social capital" (Finlay, Franke, McKay, & Sims-Gould, 2015). Another Canadian study found that benches and washrooms helped to facilitate walking by providing a place for the seniors to rest when they become fatigued. Having mailboxes, newspaper boxes, and shops nearby also provided a convenient and efficient destination, which can also help to facilitate walking (Lockett et al., 2005).

Wayfinding

Wayfinding includes elements such as physical signage, electronic signage, and certain types of tactile and audio features. Regardless of age, street wayfinding addressed the need of people to orient themselves in the landscape, navigate between destinations and to understand their next move ("Re: streets," 2017)

Seniors, especially older seniors, face particular challenges when it comes to wayfinding (*Beyerle et al*., 2013). Losses in memory, judgment or sensory ability can result in difficulty recalling landmarks, recognizing locations and seeing or understanding signs quickly enough to avoid hazards on roads or pathways. Those using walkers or wheelchairs may have a harder time seeing signs or other information intended for people walking. Another challenge is that seniors sometimes need to devote more cognitive resources to the processes of moving, which reduces their mental capacity for wayfinding and making it more challenging (*Beyerle et al*., 2013). For those with vision impairments, audible beeps at crossings can be helpful for people. Pedestrian control boxes can also be equipped with a vibration device as a tactile alternative to let users know when to cross (*Beyerle et al*., 2013).

Building Accessibility

With the concept of the complete trip in mind, it is important to consider the factors related to entering and exiting a building that can affect seniors' mobility. Peer-reviewed evidence on how accessibility can affect physical activity is limited. However, one study of older adults found that after home adaptations that improved accessibility (i.e. the ability to enter or leave the building), participants reported that they increased their outside activities, reduced naps during the day and slept better at night (Niva & Skär, 2006).

Housing for Older Canadians: The Definitive Guide to the Over-55 Market (2012), a report developed for the Canada Mortgage and Housing Corporation, provides some direction on building accessibility as it relates to entering and existing a building. The report notes that as people age, they lose the ability to go up and down steep grades and long flights of stairs. For this reason, flat and level pathways and entrances are important. Multi-unit developments that include seating at regular intervals along walkways, and clear and easy access to and from public transportation can also be helpful.

Older people can experience difficulties in locating the entry to a building and finding their way inside a larger building. Therefore, in multi-unit developments, there is a need for clear layout, signage and entries. Furthermore, entryways should be clear of tripping hazards and protective canopies over entries are also desirable (*Housing for Older Canadians: The Definitive Guide to the Over-55 Market*, 2012).

Spotlight on Safety

Safety concerns, whether real or perceived, can impact the participation of seniors in active transportation as well as a number of key safety issues.

Falls - Outdoor falls tend to occur among more active seniors and are heavily influenced by characteristics of the outdoor environment (W. Li et al., 2014). Notably, most outdoor falls are caused by environmental factors, such as uneven surfaces and tripping or slipping on objects, and usually occurred on sidewalks and streets. Walking was the most common fall-related activity (W. Li et al., 2006).

Crime – Perceived risk of crime in a neighbourhood has a greater negative influence on the physical activity patterns of older adults compared to younger adults (Centers for Disease Control and Prevention, 1999). Similarly, a common finding among studies examining physical activity and older adults was that fear of crime and violence is associated with fewer social ties and less physical activity (Hanson et al., 2012).

Weather – Weather conditions can influence both walking and cycling. This is partly related to safety, as ice, snow and wet weather can increase the chance of falling, as well as the fear of falling. A Toronto study found that 27% of participants and 56% of older participants had trouble moving around outdoors in the winter (*Preventing Injuries from Wintertime Slips and Falls in Toronto*, 2016). Wet sidewalks and roads can also increase fall risk among seniors (W. Li et al., 2006). Cycling, no matter what age, can be dangerous in the winter, and requires keeping roads and bikes lanes clear of snow. Notably, Toronto's recently installed east-west bike lanes came with a commitment to keep them free of snow.

Crashes – Crashes associated with walking and cycling are a major public health concern and older adults in Toronto are the most vulnerable to the risks of collision while walking and cycling, In 2016, older adults accounted for 82% of the pedestrian fatalities (*Road Safety Plan Staff Report*, 2016).

Perception of timing and ability – Declining sensory and perceptual abilities, which are common among older seniors, have important implications for mobility. Visual impairments, can interact with attention deficits to create perception issues – a safety concern, especially if out walking, cycling or getting onto transit (Glisky 2007).

4. ROLE OF THE SOCIAL ENVIRONMENT

Certain factors in the social environment can encourage or discourage active transportation choices and behaviour. Some trends are apparent in the literature such as the influence of social re-enforcement and interactions, community safety and cohesion on older adults' physical activity and active transportation. The evidence associated with these themes are discussed below, using the research collected from recent literature reviews.

However, Hanson et al.'s (2012) review also suggests that the social environment is an important avenue for further investigation in order to better understand the benefits of social interactions that result from a physically active lifestyle and the amount and type of physical activity that stems from social interactions.

Our research did not uncover studies that looked at the impact of the social environment on transit use; however, it is likely the many of the factors that help to facilitate walking and cycling (e.g. social reinforcement, community safety, and socialization) would also help to increase transit use.

Interestingly, the relationship between the social environment and active transportation is bi-directional; being more mobile and physically active can lead to increased participation in social activities and being more involved socially can lead to more physically activity (e.g. walking or cycling associated with getting to and from a social event). The directionality of the relationship is a challenge in this area of research because it is not always clear whether the social environment facilitates active transportation, or whether active modes of transportation allow people to be more socially engaged.

Relationships and Re-enforcement

The review conducted by Hanson et al. (2012) looked at 33 studies related to the social and built environment and seniors mobility. The review found one study that looked at the impact of interpersonal interactions with friends, neighbours, or family in association with walking among older adults and found that it is was positively associated with physical activity. A significant relationship was found between physical activity and the social reinforcement older adults received from friends or family

Two other Canadian studies were reviewed to provide additional insight on this topic. One study in British Columbia, found that having a walking partner was positively associated with walking (Hanson et al., 2013). Another study of 74 older adults with low income residing in Metro Vancouver found that walking with a group helped to pass the time more quickly, and that having a friend to walk with encourages them to "get out the door" (Tong, Franke, & Sims-Gould, unpublished).

Community Safety and Cohesion

An association was also found between fear of crime and violence and fewer social interactions and less physical activity. Vandalism, graffiti and the presence of litter, were associated with decreased physical activity (Hanson, Ashe, McKay & Winters, 2012).

The study of low income residents in Metro Vancouver also found that a positive social environment can encourage walking among older adults. Study participants described enjoying aspects of the social environment as part of walking, including seeing familiar faces at local shops, waving to neighbours, and watching families play in the local parks (Tong et al., unpublished) .

Socialization

Seniors who have active social lives may be more likely to engage in physical activity. Going to social or recreational activities provide an opportunity for walking or cycling. Light activity associated with participation in enjoyable leisure tasks can provide older adults with a source of physical activity (Hanson et al., 2012).

Social exchanges and familiar routines were also found to encourage older adult mobility (Franke et al., 2013), and strong social relations may reduce the risks of older adults' limited mobility (Gardner, 2014).

For cycling, recent reviews have highlighted the importance of social and psychological influences for people of all ages (Heinen, van Wee, & Maat, 2010; Willis, Manaugh, & El-Geneidy, 2014), however, this topic has not received much attention in transportation research. The social aspects of cycling, such as spending time with friends, being outdoors, or running errands have been found to be a key motivator among older adults (Winters, Sime-Gould, Franke & McKay, 2015).

5. TORONTO CONTEXT

5.1 DEMOGRAPHICS OF TORONTO'S SENIORS

In 2011, there were 680,945 adults aged 55 years and older in Toronto, just over one-quarter of the city's population (*Toronto Seniors Strategy*, 2013). The distribution by age group is depicted in **Figure 5.** The City of Toronto forecasts that by 2041, there will be 1.2 million adults aged 55 and older, making up 36% of the City's population (*Toronto Seniors Strategy*, 2013).

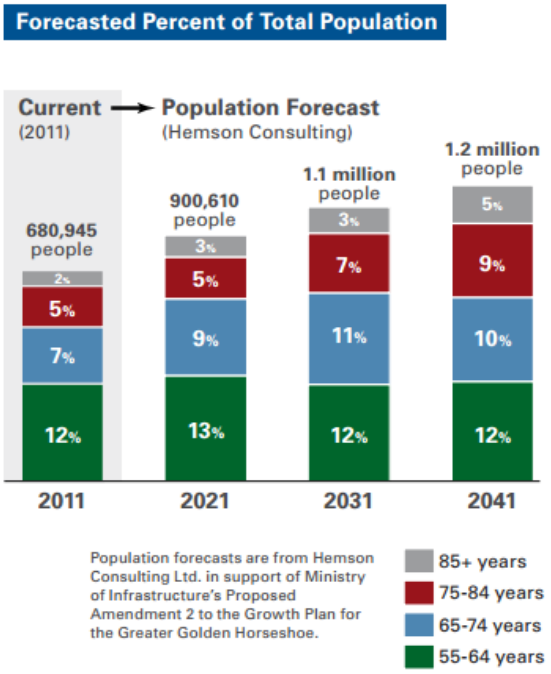


Figure 5: Estimates from forecast significant growth in Toronto's older adult population (Toronto Seniors Strategy, 2013)

Socio-economic Characteristics

Ten-percent (10%) of Toronto seniors 65 years of age and older have low income[3], a slightly lower proportion than in than other age groups. However, many seniors are living just above low-income lines and so remain economically vulnerable (*Toronto Seniors Strategy: Income and Housing Profile* 2016).

Many seniors today are working beyond age 65. Since the end of mandatory retirement in Ontario in 2006, the number of adults 65 years and older participating in the work force has more than doubled. The reasons for this could be by choice, or for economic reasons (*Toronto Seniors Strategy: Demographic Imperative,* 2013) .

Diversity

Like all Torontonians, Toronto's seniors are culturally diverse. The 2011 Census reports that over a third (37%) of adults 55 years of age and over in Toronto spoke a language other than English or French on a regular basis at home. Notably, 68% are immigrants, which is a higher proportion than any other age group in Toronto, and more than double the proportion in either Vancouver or Montreal (*Toronto Seniors Strategy: Demographic Imperative,* 2013).

Data from Citizenship and Immigration Canada shows that about 8,800 permanent and temporary residents 55 years of age and older arrive in the City of Toronto every year. Newcomer older adults are more likely to be visible minorities, have lower income, have less positive health and are less likely to speak one of the official languages (*Toronto Seniors Strategy: Demographic Imperative,* 2013).

[3] *Low income is defined using Statistics Canada Low Income Measure After Tax.*

Health and Mobility

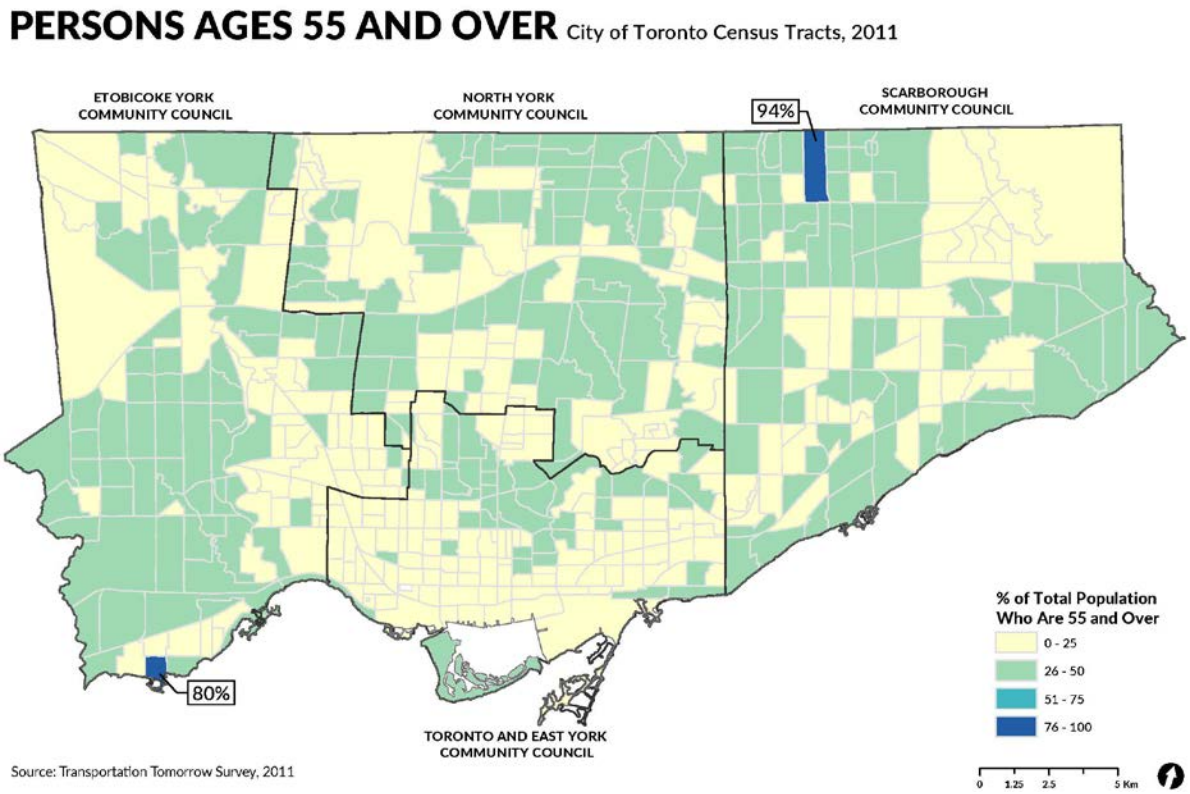
Health status and mobility declines with age. Data for Toronto seniors illustrates this trend (*Toronto Seniors Strategy*, 2013).

Over half (55%) of older Torontonians between ages 55-75 describe their health as "very good" or "excellent." But 40% of Toronto residents 75 years of age and older describe their health as either "fair" or "poor". Around 70% of Torontonians 80 years of age and older report a disability or activity limitation that has lasted or is expected to last six months or more, compared to 47% of adults 65-79 years of age and 32% of adults 45-64 years of age.

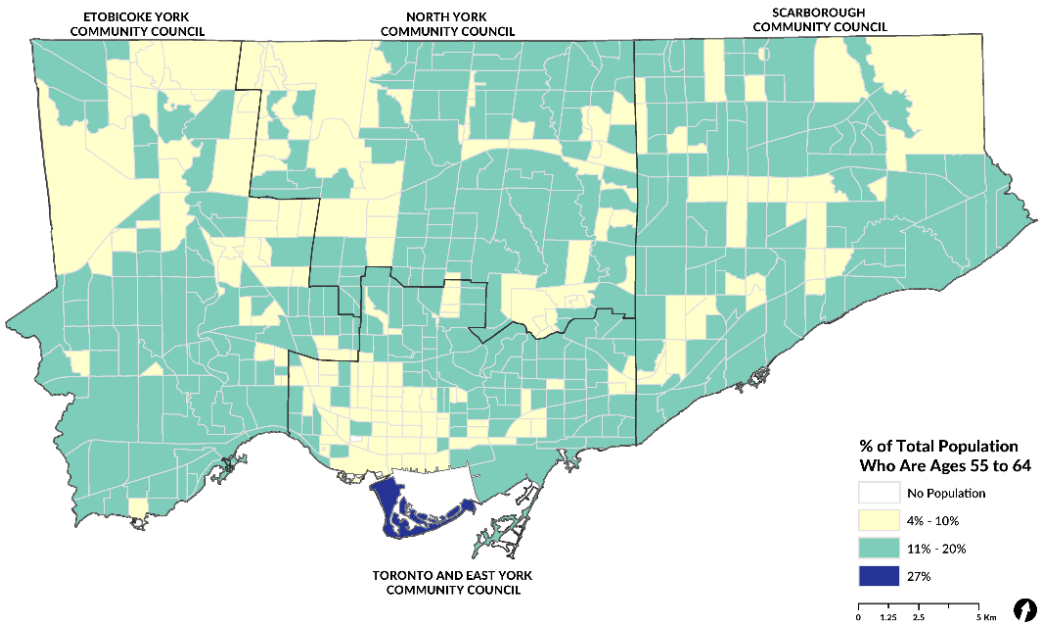
Where Seniors Live

Seniors live in all areas of the city. The map below shows the percent of people over the age of 55 living in each census tract in the city. Seniors tend to be less concentrated in the downtown town areas, which are the more pedestrian and cyclist friendly areas (Map 1). The two blue areas have a very high percentage of seniors (over 80%), where as no other ward in the city has over 50% residents over 55. Maps 2 and show where younger seniors 55-64 years of age (Map 2) and older seniors 75 years of age and older (Map 3) are most concentrated across the city.

Map 1: Where Seniors (55 years of age and older) Live in Toronto

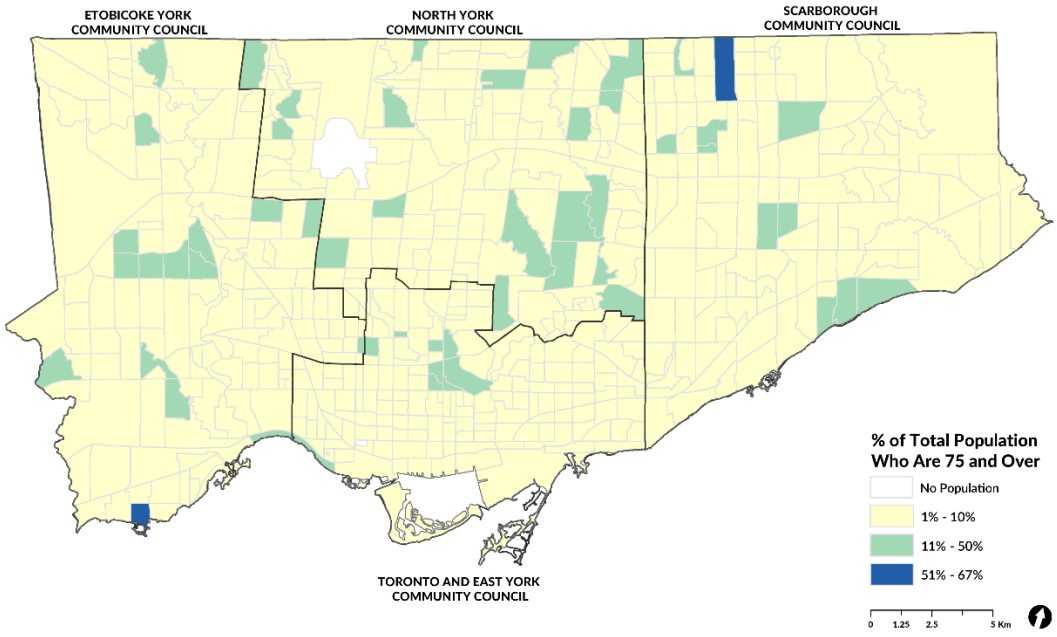


Map 2: Where Seniors (55-64) Live in Toronto



Source: Transportation Tomorrow Survey, 2011

Map 3: Where Seniors (75+) Live in Toronto

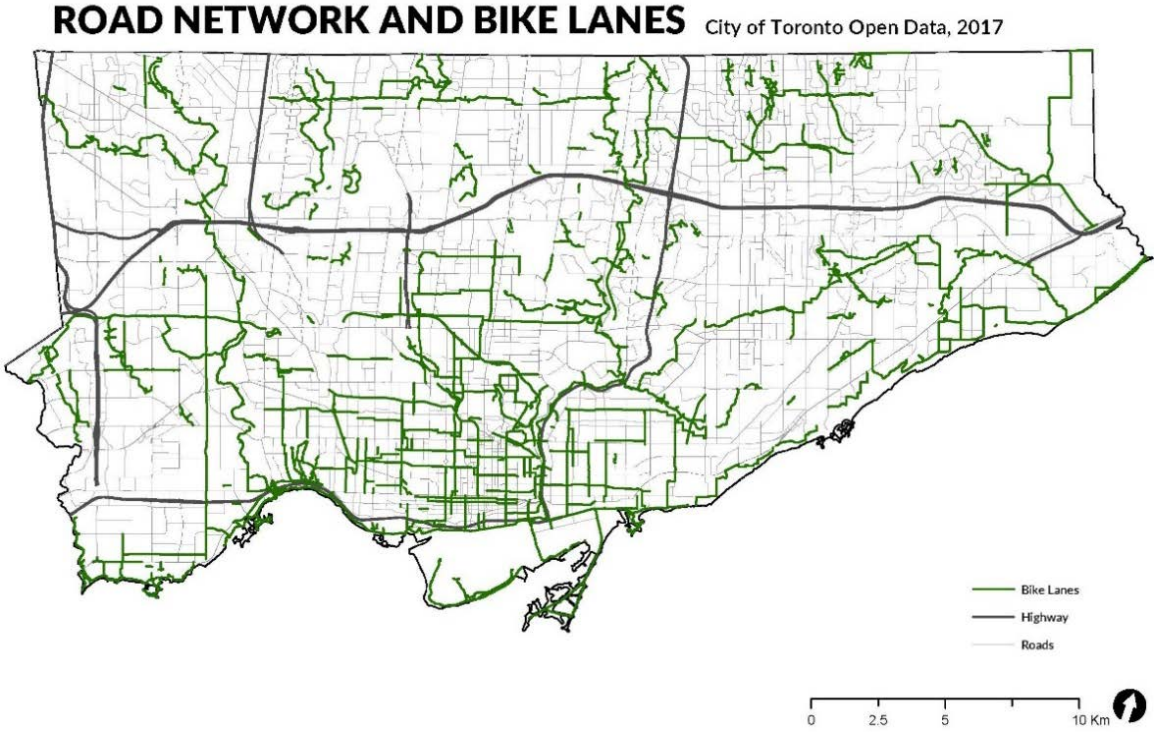


Source: Transportation Tomorrow Survey, 2011

5.2 TORONTO'S URBAN-SUBURBAN GEOGRAPHY

It is important to consider the geographic characteristics of Toronto and how this has an impact on the mobility of Torontonians and seniors in particular. The old city of Toronto is generally better serviced by an interconnected network of rapid transit (subway, streetcar, buses lines) than the suburbs. The central area, with its grid street network, is also denser, more walkable and bikeable.

Map 4: Toronto Road Network and Bike Lanes



In the suburbs, indirect routes, and wide, desolate arterial roads that may be intimidating to cross for pedestrians, can impact active transportation and access to services and amenities. Toronto is also home to many high-rise communities, which were designed based on the assumption that apartment dwellers would have cars. As a result, both the apartment complexes and the areas that surround them are characterized by hostile pedestrian environments (Hess & Farrow, 2010). It is worth noting however, that current City initiatives are seeking to change the planning framework in apartment neighbourhoods to support more vibrancy and diversity of apartment neighbourhoods.

Amenities in most suburban areas and high-rise communities, such as community centres, grocery stores, libraries, public health and social service facilities, are typically beyond a reasonable walking distance. Since many low income communities are located in high-rise neighbourhoods in the suburbs, these patterns result in transportation and health inequality (*Toronto Public Health*, 2012).

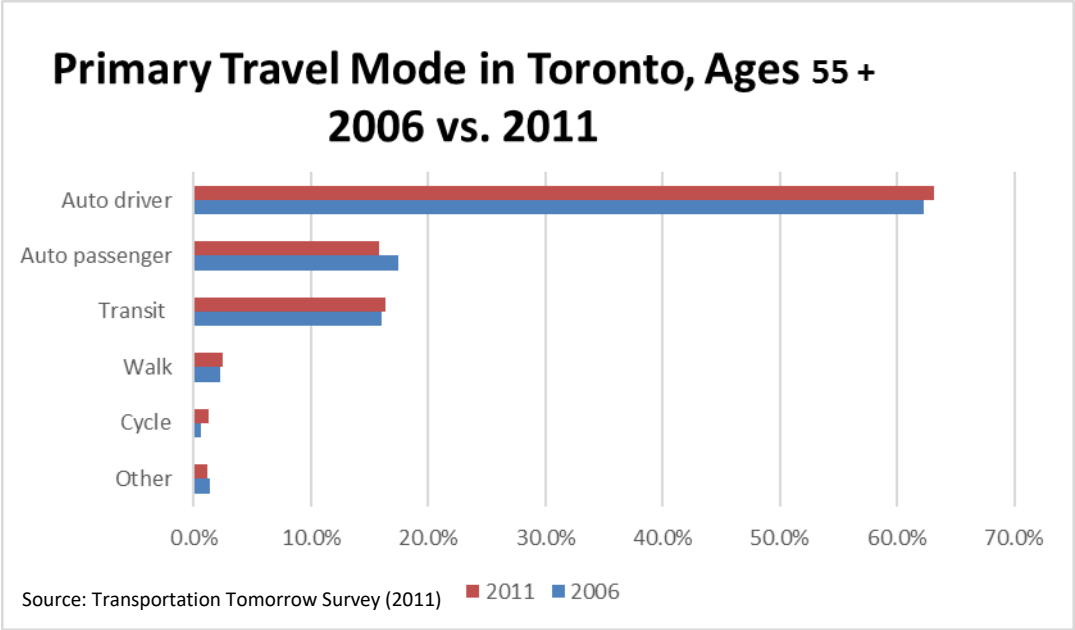
5.3 TRANSPORTATION PATTERNS OF TORONTO'S SENIORS

The Transportation Tomorrow Survey (TTS) is a self-reported travel diary survey of households in the Greater Golden Horseshoe Region (GGH) conducted every 5 years. The TTS is jointly undertaken by the Ministry of Transportation of Ontario (MTO), Metrolinx/GO Transit, the Toronto Transit Commission (TTC) and municipalities across the GGH. The data helps local and regional governments, as well as the province and transit agencies, make transportation planning and investment decisions.

The most recent data available is from 2011. **Figure 6** shows the primary trip mode of those 55 years and older. More than 80% of seniors use the automobile, either as a driver or passenger, as their primary means of transportation. Just over 15% use public transit, while 2.5% walk and 1.2% cycle.

When data from 2006 is compared to 2011, a slight increase can be found in cycling, walking and transit as the primary mode of transportation among seniors; however, these changes are very small and should be considered in the context of the TTS survey limitations.[4]

Figure 6: Household Member Aged 55 + Primary Travel Mode in Toronto, 2006 to 2011

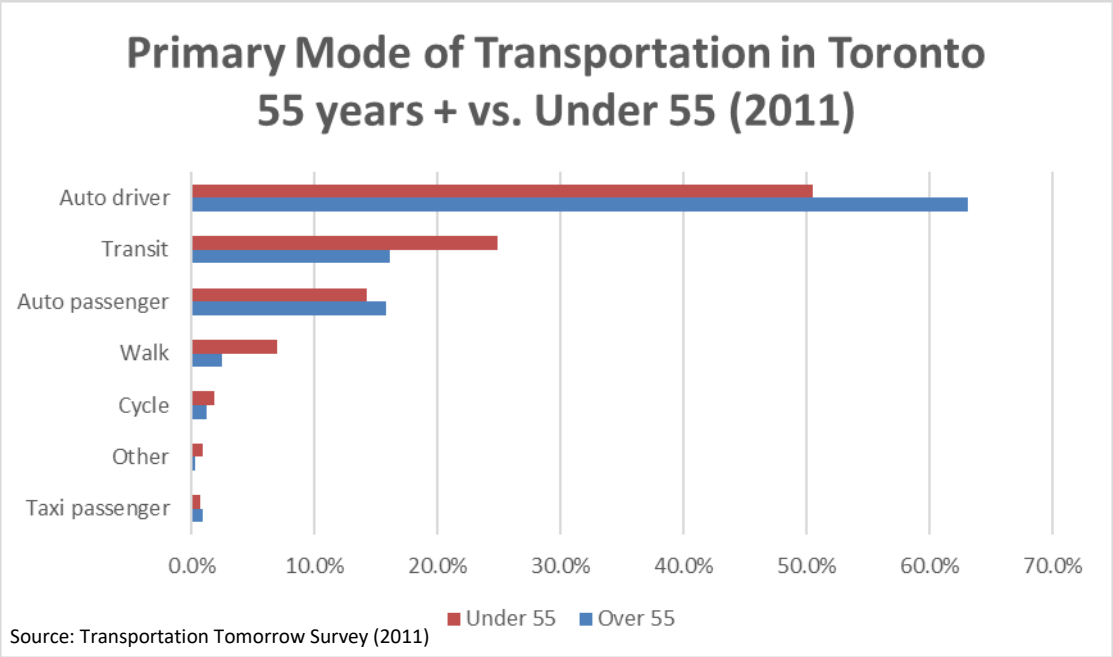


When compared to the rest of the population, seniors tend to drive more often; 51% of those under 55 vs. 63% of those 55 and over drive as their primary mode of transportation. Seniors are less likely than other people to use walking and cycling as the primary mode of transportation; 7.5% of people under 55 walk as their primary mode

[4] The two primary sources of bias in the survey results are sample selection and non-response. More information on the Transportation Tomorrow Survey data validity, sources of error and bias can be found here: http://dmg.utoronto.ca/pdf/tts/2011/validation2011.pdf

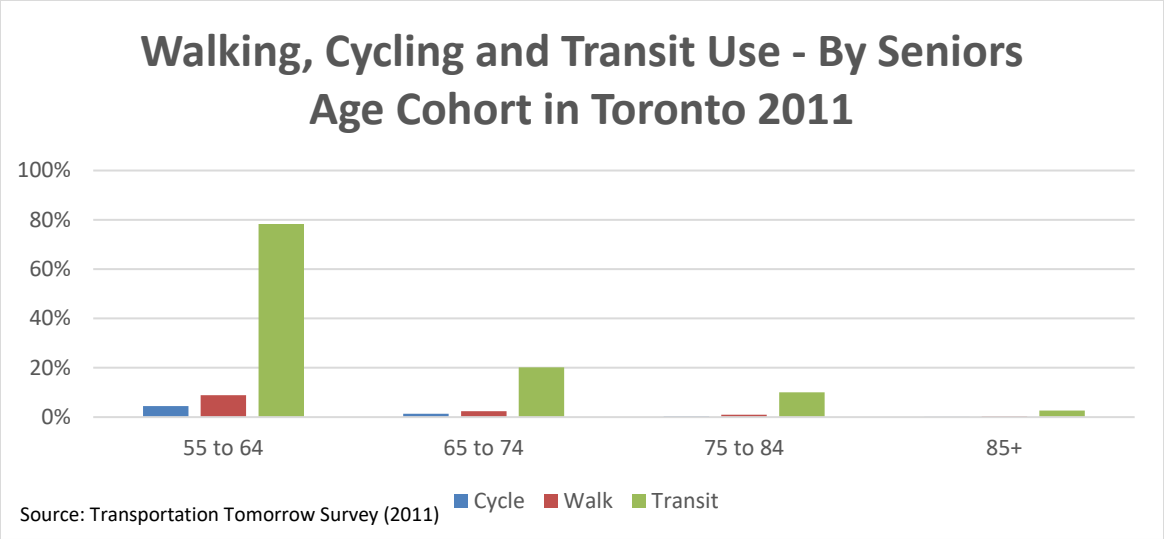
of transportation, compared the 2.5% of those 55 and over. Seniors also use transit less than the rest of the population; 25% of those under 55 use transit, while 16% of those 55 and older use transit as their primary mode of transportation.

Figure 7: Primary Mode of Transportation in Toronto 2011 - 55 years and older vs. Under 55



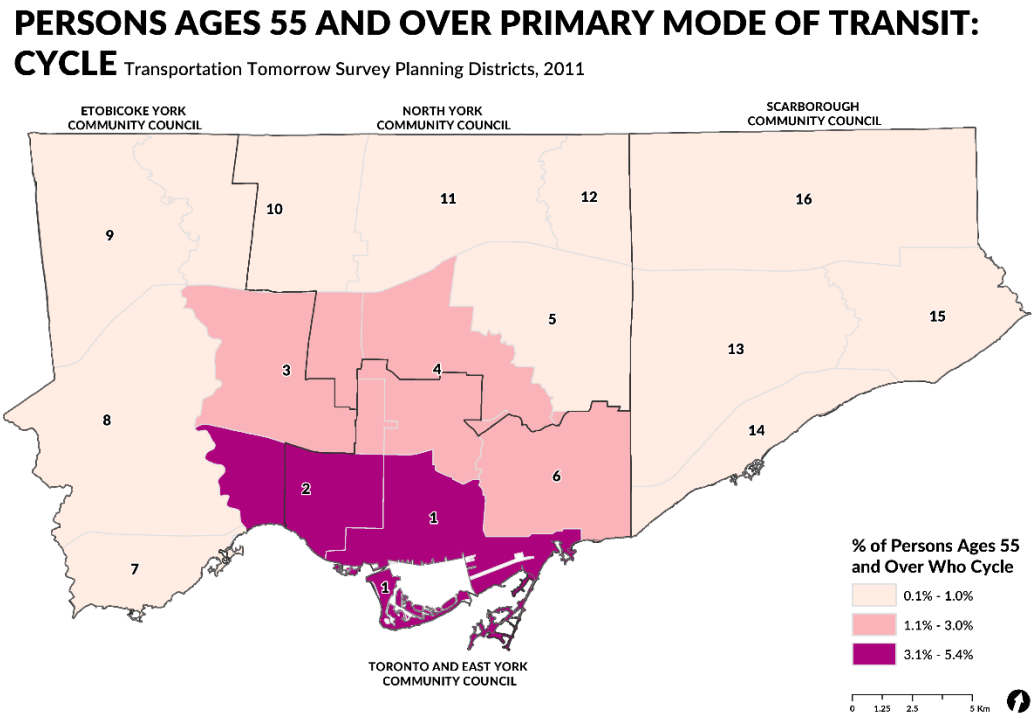
When the seniors age cohort is broken down (Figure 8), it is clear that walking, cycling and transit use decline as people age. Very few seniors over the age of 75 walk or cycle.

Figure 8: Walking, Cycling and Transit Use - By Seniors Age Cohort in Toronto, 2011

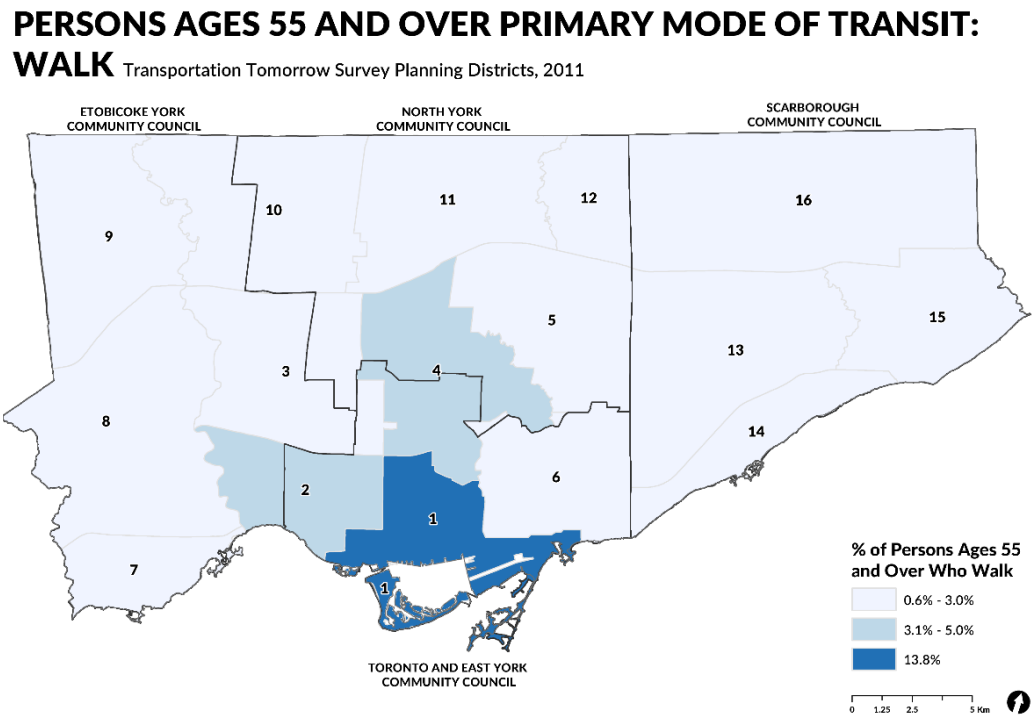


Maps 5 and 6 show that differences in urban form are closely tied to transportation patterns among seniors. Those seniors living in and around the downtown are more likely to walk and cycle.

Map 5: Primary Mode of Transportation Among Seniors Ages 55+ (Cycling)



Map 6: Primary Mode of Transportation Among Seniors Ages 55+ (Walking)

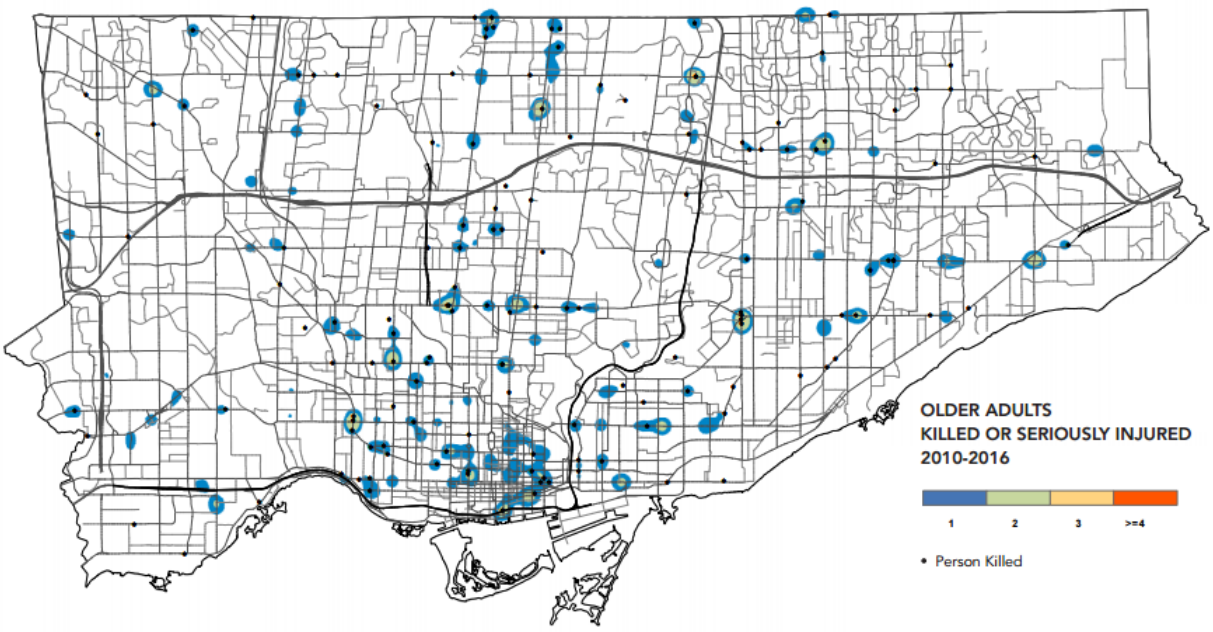


5.4 PEDESTRIAN AND CYCLIST SAFETY

Toronto's seniors are among the most vulnerable road users and face the highest risk of being killed or seriously injured in a collision. Between 2011 and 2015, collisions involving pedestrians over the age of 55 totalled 386 between 2011-2015 (*Road Safety Plan Staff Report*, 2016). While only 26% of the population, pedestrians over 55 years old represented 40% of all pedestrian collisions and 63% of all pedestrian fatal collisions. Fatalities involving pedestrians over age 55 have trended upward significantly over the past three years. In 2016, older adults have accounted for 82% of the pedestrian fatalities (*Road Safety Plan Staff Report*, 2016).

Map 7 shows the locations of the pedestrian collisions across the city. The downtown has more collisions than other areas of the city, which is likely the result of there being more traffic and pedestrian activity in the downtown area.

Map 7: KSI Collisions Involving Older Adults (*Vision Zero: Toronto's Road Safety Plan*, 2016)



5.5 WEATHER (ICE & SNOW)

Winter in Toronto makes moving around the city more difficult and in some cases more dangerous. A Toronto study found that 27% of participants and 56% of older participants had trouble moving around outdoors in the winter (*Preventing Injuries from Wintertime Slips and Falls in Toronto*, 2016). Emergency department visits, hospitalizations, and liability insurance claims related to slips and falls on snow and ice are also closely linked to annual snowfall in Toronto.

The presence of snow and ice on sidewalks reduces walkability, especially for people with strollers or assistive devices, and for people who are frail or face physical challenges due to age or disability. Risk and fear of falling can reduce the likelihood that people will choose to walk as a means of transportation or for physical activity (Li, Hsu, & Fernie, 2013). Keeping sidewalks clear of snow and ice is likely the best way to reduce the risk of slips and falls in the winter.

5.6 POLICY CONTEXT FOR ACTIVE TRANSPORTATION AND SENIORS

The direction to create age-friendly, healthy active cities, is supported from the international scale down to the local level. The World Health Organization (WHO) has adopted a *Global Strategy and Action Plan on Ageing and Health* (2016-2020). The Strategy and Action Plan calls for the development of age-friendly environments and the alignment of health systems to the needs of older populations. It emphasizes equity and human rights, including the important role of involving older adults in all decisions that concern them.

The Ontario Seniors Secretariat (now upgraded to the Ministry of Seniors Affairs) undertakes and supports policy and program initiatives that help improve the quality of life of seniors. They also work with seniors organizations and across government to develop programs and services that promote active and healthy living among seniors. The *Age-Friendly Community (AFC) Planning Guide* was created by the Ontario Seniors Secretariat to provide advice to municipalities on how to develop, implement and evaluate plans for seniors-friendly communities which are socially and physically accessible and inclusive (*Finding the Right Fit: Age-Friendly Community Planning, 2015*).

The WHO's Global Age-Friendly Communities (AFC) Network points to the importance of identifying community level facilitators and barriers in the health and wellbeing of older adults. Age-Friendly Community initiatives highlight the importance of safe outdoor spaces and built environments that are conducive to active living as well as the importance of inexpensive and convenient transportation options. Proponents of these initiatives call for a paradigm shift where the health sector would incorporate a more prevention-focused, community-based approach to the typical delivery of interventions at an individual level (Jeste et al., 2016).

From the public health perspective, the 2006 report *Healthy Aging in Canada: A New Vision, A Vital Investment* describes a strong new vision for healthy aging in Canada. It sets out the “what,” the “why” and the “how” governments, communities and civil society can bring healthy aging to the forefront of Canada’s social policy agenda (*Healthy Aging in Canada: A New Vision, A Vital Investment*, 2006). The Ontario Public Health Standards also highlight the important role the built environment plays in supporting physical activity to prevent chronic diseases (*Active City: Designing for Health (TPH,* 2014)).

Metrolinx’s Regional Transportation Plan, *The Big Move*, aims to guide the transformation of the transportation network in the Greater Toronto and Hamilton Area (the GTHA). Enhancing and expanding active transportation is a key strategy outlined in the plan, although the needs of seniors are not specifically addressed. Priority actions range from pilot studies to new active transportation connections over major roadways.

At the local level, the City of Toronto supports active transportation. The City’s Official Plan promotes improving the quality and convenience of active transportation options within all communities by giving full consideration to the needs of pedestrians, cyclists and public transit users. In August 2014, Council approved Official Plan Amendment 274 to revise the transportation policies of the plan dealing primarily with pedestrian and cycling policies, goods movement and the promotion of 'complete' streets.

The City of Toronto *Complete Street Guidelines,* released in 2016*,* provide direction to city planners and designers for how to design streets to promote healthy and active lifestyles by making streets more comfortable and inviting for people to walk and bicycle and be physically active.

As discussed in the Introduction, the *Toronto Seniors Strategy: Towards an Age-Friendly City* lays out a strategic plan for City Agencies, Boards, Commissions, Corporations and Divisions to support older Torontonians to remain active, healthy, engaged in civic decision-making, included in the life of their communities and living with independence and dignity. The *Seniors Strategy*, which is currently in the process of being updated, includes a chapter on transportation and includes several recommendations that support public and active transportation. The City's Transportation department recently launched a pilot program (Seniors Safety Zones), built around the identification of places with a high incidence of pedestrian accidents involving seniors. This initiative is described in more detail below.

Several other plans and strategies support active transportation for seniors, such as the *Toronto Walking Strategy*, *Vision Zero*, and the *Toronto Parks and Trails Wayfinding Strategy*. A list of City policies that support active transportation is listed below.

Table 1: City Policies that Support Active Transportation (adapted from Active City: Designing for Health Staff Action Report)

Type of Policy	Name of Document
Legislative	• Official Plan
Guidelines	• Complete Streets Guidelines • Urban Design Streetscape Manual • Vibrant Streets Guidelines • Performance Standards for Mid-Rise Buildings • Tall Building Design Guidelines • Infill Townhouse Design Guidelines • Toronto Accessibility Design Guidelines • Design Criteria for 'Greening' Surface Parking Lots • Guidelines for the Design and Management of Bicycle Parking Facilities • Draft Urban Design Guidelines for Site with Drive through Facilities • Shade Guidelines • Curb Radii Guidelines • Vehicle Travel Lane Width Guidelines
Plans/Strategies	• Walking Strategy • Traffic Calming Policy • Toronto Bike Plan

	• Bikeway Trails Implementation Plan • Parks Plan (2013-2017) • Recreation Service Plan (2013-2017) • Sustaining and Expanding the Urban Forest: Toronto's Strategic Forest Management Plan • Diabetes Strategy • Strong Neighbourhoods Strategy • Seniors Strategy
Standards	• Development Infrastructure Policy and Standards • Construction Standards for Road Works • Toronto Green Standard • Standards for Traffic Control Devices

There are of course challenges to expanding the active transportation network. A fulsome discussion of this is beyond the scope of this report. Financing, expanding and maintaining public transit is an on-going challenge. Fares have recently increased, and many areas of the city still lack adequate service. Toronto has seen some success in recent years in adding bike lanes and cycling connections on public lands such as hydro corridors and rail spurs. The City also implemented a program to remove snow from certain bike lanes during the winter. However, there is still a struggle to find support from Council, meet the needs of all users, and to provide suitable infrastructure for these users (commuters, recreational users, and short-distance users). It should be noted that while painted bike lanes (sharrows) can be beneficial for encouraging cycling, they do not result in improved safety or fewer collisions (*Toronto Public Health*, 2015).

5.7 TORONTO PUBLIC HEALTH AND ACTIVE TRANSPORTATION

Toronto Public Health has been focused on supporting active transportation for many years. In 2012 TPH led the development of the *Road to Health: Improving Walking and Cycling in Toronto* which investigated the health benefits related to prioritized modes of active transportation. This document provides a framework for the costs and the benefits of active transportation within the City of Toronto. Following that report, TPH was directed by the Board of Health to work jointly with Transportation Services on a pilot initiative to explore measures recommended in the *Road to Health* report. TPH selected four areas for active transportation pilot projects. Communities in the selected communities were engaged throughout 2013-2014.

More recently, TPH developed the *Active City: Designing for Health* which focuses on the built environment to create healthy places that encourage active living for all Torontonians. The report outlines design principles to guide changes to neighbourhoods, streets and buildings that allow people of all ages and abilities to

incorporate physical activity into their daily routines without extra costs for physical exercise.

In 2015, Toronto Public Health released *Pedestrian and Cyclist Safety in Toronto*, which describes the health impacts of collisions involving pedestrians and cyclists in Toronto and identifies strategies to reduce vehicle collisions that result in pedestrian and cyclist injury is needed in order to enable safe active transportation in the City (*Toronto Public Health, 2015)*.

5.8 ACTIVE TRANSPORTATION INITIATIVES FOR SENIORS IN TORONTO

In order to identify active transportation initiatives for seniors in Toronto, we surveyed professionals working in Toronto involved in transportation, active transportation, and seniors. A comprehensive online search was also conducted to supplement the input received. Details on the methodology for this component of the research are included in **Appendix A**.

Senior Safety Zone

The research indicated that there are road safety and active transportation initiatives in Toronto, but only a few are tailored specifically for seniors. One of these is the introduction of "**Senior Safety Zones**" as part of Vision Zero*;* an initiative intended to address the potential risks seniors may encounter while walking. It identifies areas that have a higher concentration of older adults and intends to improve pedestrian safety measures and accessibility. Some of the elements that will aim to produce safer transportation zones for seniors are lower speed limits, improved street lighting, advance green for pedestrians, Watch Your Speed" driver feedback signs, red light cameras, sidewalk extensions, additional crossing opportunities, increased enforcement and improved pavement markings, among other possible improvements. These "senior safety zones" will be created as advisory areas in their initial state, but may obtain legal standing after reviewing their possible benefits. In late 2016, Mayor Tory announced that senior safety zones will be fast-tracked, to help deal with the alarming percentage of seniors and older adults that are involved in traffic related fatalities.

Sidewalks

In the former City of Toronto, York, and East York, snow is not mechanically cleared on the sidewalks on local roads. These sidewalks tend to be more difficult to clear because they are narrow, have more encroachments, street furniture and other obstructions that prevent equipment from passing through freely, and on-street parking limits equipment maneuverability and snow storage capacity. In areas without mechanical snow clearing, owners or occupants are required to clear sidewalks next to their property within 12 hours after any snowfall. The City of Toronto offers the **Free Snow Removal from City Sidewalk** program for seniors who live in these areas, and some wards in the Etobicoke and North York Districts. This program facilitates active transportation for seniors since the proper maintenance of sidewalks, pathways, and other components of the built environment during the winter season is an important precondition for seniors to remain active throughout the year.

Transit Affordability

The Toronto Transit Commission (TTC) provides **fare and monthly pass discounts** to senior citizens who are 65 years of age or older. Current discounts provide seniors with a 33 percent price reduction on single fares, while their monthly passes cost 21 percent less than standard rates.

In 2016, City Council passed the **Fair Pass Program**. The program provides discounts for low income individuals in Toronto and will be implemented in three phases beginning in March 2018 (subject to approval by Council as part of the 2018 Operating Budget). There was some concern that this program could affect the existing seniors discounts; however, in late 2016, Mayor Tory affirmed his intention to preserve the TTC's seniors fares. The TTC and Metrolinx are also working towards the transition to Presto fares. This could have implications for seniors discounts, because by default, the card is set to the adult fare, and in order to have their discount applied, riders must visit Davisville or Union station.

Education Initiatives

iNavigait is an education and awareness program that aims to reduce pedestrian injury and death, by providing details on road and walking safety, traffic rules and injury bulletins. The program was developed in collaboration with Sunnybrook Health Sciences Centre and the Toronto Area Safety Coalition.

B.A.S.S.I.C. (Bringing an Awareness of Senior Safety Issues to the Community) is an initiative that works to improve quality of life for seniors by raising awareness of senior safety issues. Members represent not-for-profit organizations (from Toronto and the Greater Toronto Area) and include several levels of government. B.A.S.S.I.C. delivers safety seminars and symposiums and produced a safety calendar. Members include: City of Toronto Transportation Services, Baycrest Centre Health Sciences, Insurance Bureau of Canada, Older Canadians Network, Ontario Provincial Police, Ontario Seniors Secretariat, Toronto Public Health, Toronto Seniors Forum, Toronto Police and Fire Services, among others.

Table 2: Summary of Toronto Seniors Active Transportation Initiatives

Initiative	Focus	Date	Lead Organization(s)
Senior Safety Zones	Improve pedestrian safety measures and accessibility	January 2017	City of Toronto (Transportation Services)

Initiative	Focus	Date	Lead Organization(s)
Free Snow Removal from City Sidewalk Program	Sidewalk maintenance	January 2005-Present	City of Toronto (Transportation Services)
Seniors Discounts on Public Transit Fares and Passes	Affordable public transit	January 1981-Present	Toronto Transit Commission (TTC)
B.A.S.S.I.C.	Improving quality of life for seniors by raising awareness of senior safety issues.	1993 - present	Members include fire, police and emergency medical services in Toronto and York Region, as well as government organizations and other non-profit organizations.
iNavigait	Education and awareness to reduce pedestrian injury and death	2009 - present	Sunnybrook Health Sciences Centre and the Toronto Area Safety Coalition.

6. INSPIRATION FROM OTHER JURISDICTIONS

The section provides a description of 12 initiatives that support active transportation for seniors. Similar to the Toronto initiatives section, to develop this list we sought input from subject matter experts, including our project advisors and external stakeholders involved in seniors and active transportation sectors. We asked them to identify examples of active transportation initiatives in other jurisdictions, which support active transportation for seniors. We supplemented this input with internet research, using Google search and terms including: active transportation, seniors, older adults, cycling, walking, public transportation. A more fulsome description of the methodology is included in **Appendix A**.

This process determined that there are very few well-documented exemplary programs and practices in this area. We found many active transportation initiatives, but very few that focused on seniors. As can be expected, many excellent practices emanated from European countries, however, literature in English was limited.

The initiatives included are for the most part programs or interventions implemented by health-focused agencies, community groups or governments. Our research did not identify examples of policies focused on improving or adapting the built environment for the benefit of seniors. For the most part, changes in municipal policy and operational practices are those inspired by or required by the need to conform to the *Accessibility for Ontarians with Disabilities Act* (AODA). References in public policy to seniors tend to view older adults as people with special needs or disabilities rather than a significant, growing component of the population with diverse abilities and a legitimate call on municipal resources. More research could be conducted to better understand the policy context for active transportation for seniors in other jurisdictions.

a) Being and staying mobile – the use of modern modes of transport (Thun, Switzerland)

The project began with a pilot in Thun 1999 and is now being carried out throughout Switzerland. A series of training modules on urban mobility and safe cycling were developed and delivered to seniors aged 60+ to strengthen older people's independence. The courses were focused on helping seniors navigate public transit (including ticket purchasing, orientation, health and safety) and encouraging walking and cycling among seniors. The training was delivered using local specialists in the field of mobility. The project was well-received and found that offering training across the range of mobility options helped older adults to travel autonomously. Similar projects focused on educating and making seniors more comfortable with a range of travel options and activities from walking, to cycling, to using ticketing machines and taking the bus could be undertaken in Toronto.

b) Testing e-bikes for middle-aged and older adults (Graz, Austria)

This pilot study was aimed at increasing activity levels for adults aged 45-70 years old and decreasing car trips in the hilly town of Graz, Austria. E-bikes were loaned to 20 middle aged and older adults and activity was monitored over a one-month period. Findings included an increase in activity, shift in mobility modes and shift in attitudes and behaviour of study participants. Opportunities for using e-bikes to encourage cycling among older adults could be explored in the Toronto context.

c) Senior cycling: A plus in older Citizens Quality of Life (Munich, Germany)

This pilot project found that with guidance, seniors could be re-introduced to cycling in ways that are more comfortable and inviting. It was started because seniors were not cycling due to a number of fears: fear of traffic, fear of accidents, health reasons and not wanting to be out alone. The initiative offered introductions to cycling techniques and road safety on alternative bicycles, such as recumbent bikes and tricycles in a social setting. Through a series of talks and hands-on applied learning, seniors were introduced in a social and fun setting to alternative bicycles and bike safety. Originally supported by Green City, HPV, Treffpunkt55plus and the City of Munich, the project was extended and was financially supported by the Department of Health and Environment. Initiatives that teach seniors cycling skills and safety, catered specifically to seniors needs, taught in a social setting could help to encourage active transportation among seniors in Toronto. The initiative also exemplifies how partnerships among health agencies, municipalities and other government departments, can be used to deliver such programs.

d) Promoting Active Transportation for Older Adults (Alameda County, California)

The Alameda County Transportation Commission has a number of initiatives and programs to increase physical activity among older adults by promoting and enabling active transportation options and make public transportation accessible and appealing for older adults. This includes peer-led walking groups, supporting active transportation projects for older adults and people with disabilities, travel training for seniors, development of countywide safe routes, bicycle and pedestrian plans for seniors. The County takes advantage of available grant funding to implement active transportation initiatives, and uses municipal revenues to offer specialized transportation for seniors and people with disabilities. They have also implemented a half cent transportation sales tax dedicated to planning, funding and legislative efforts to advance active transportation. Toronto Public Health could work with the City of Toronto to develop a similar programs and initiatives to promote active transportation among Toronto older adults and seniors.

e) Aiding SuStainable Independent Senior TrAvellers to Navigate in Towns (ASSISTANT) (Europe)

ASSISTANT is an online application created in 2011, targeted at older adults aged 54+ in Austria, Finland and Spain. The application was developed to provide support for seniors' trip planning, guidance on transfers, alerts to inform when to get out of vehicle and assistance with getting from vehicle to final destination. Product features included:

personalized smartphone interface; guidance based on real time vehicle location; navigation for the 'first and last kilometre' of a journey – to/from public transport vehicles; and a modified journey plan if a passenger misses his/her stop. It was designed as a simple to use technology that is accessible via computer at home, mobile phone and provides information relevant to time, using visuals and audio. ASSISSTANT provides some ideas for types of technological applications that could be developed to support seniors in Toronto.

f) Safe Streets for Seniors (New York, New York)

Safe Streets for Seniors is a pedestrian safety initiative for older New Yorkers. The program studies collision data, and develops and implements mitigation measures to improve the safety of seniors and other pedestrians and road users. The program was launched in 2008 and seniors pedestrian safety issues have been addressed in 25 focus areas across five boroughs. The focus areas were selected based on the density of senior pedestrian (age 65+) collisions resulting in fatalities or severe injuries. Since the program began, annual senior pedestrian fatalities have decreased 10% citywide. Since 2009, 137 Street Improvement Projects (SIPs) have been implemented within the Senior Areas citywide. Of the total, 78 SIPs have at least one year of crash data available for analysis. These 78 projects have produced an 11% decrease in total injuries, an 11% decrease in pedestrian collisions, and a 7% reduction in injury crashes. Based on findings, there are now plans to implement other changes, such as extending pedestrian crossing times at crosswalks to accommodate slower walking speeds, constructing pedestrian safety islands, widening curbs and medians, narrowing roadways, and installing new stop controls and signals. The city has partnered with the NYC Department for the Aging to coordinate outreach and share resources. Safe Streets for Seniors is an inspiring example of how the City is putting priority on the safety of seniors and other pedestrians and using data to target particular areas. Street improvement projects focused around areas in Toronto where there are the most crashes and fatalities would be valuable for improving seniors safety and encouraging active transportation among seniors in Toronto.

g) An Age-Friendly Walkability Report - Safe Streets for Seniors and Other Valuable People (Ottawa, Ontario)

This initiative involved conducting walking audits to assess the degree that walking and traveling by wheelchair and/or scooter was safe and age-friendly in the City of Ottawa. The report determined that age-friendly designs and maintenance of sidewalks and pathways, curb cuts, road crossings and intersections are especially important for the safety of older adults. Additionally, access to public toilets, shelter and places to rest are important with age. Serious challenges, such as winter weather conditions are imposed on older adults and outlines strategies to address. A better understanding of pedestrian and cycling opportunities and barriers thorough walkability (or bikability) audits would be valuable in Toronto.

h) Participatory Walkability Assessment Tool (Lisbon, Portugal)

The purpose of this initiative was to increase civic participation among the target population and increase suitability of public spaces/buildings for older people. The **Walkability Assessment Tool** is a practical, systematic method to measure the quality of the pedestrian environment from the perspective of seniors, while engaging older adults in the development of objective, effective and comprehensive walking-related strategies and interventions. Implemented in partnership with local authorities and organizations, the tool rated the walking quality of streets through the perspective of seniors. The results indicated clear differences in walkability scores for different pedestrian groups, namely between adults and seniors or impaired pedestrians. A walkability assessment tool or program, implemented by TPH in partnership with the City and other organizations could be explored for Toronto.

i) Senior Cyclist Program - Biking is Back! The Older Adults Three-Wheeled Biking Program (Portland, Oregon)

The innovative Senior Cyclist program encourages bicycling for older adults for both transportation and fitness. Group rides for beginner or intermediate riders are offered through the City's Parks and Recreation Department, which provides three-wheeled recumbent bicycles for participants. A two-hour orientation is offered to riders who need extra time to get used to braking, shifting gears, and manoeuvring the bicycles. The program has been successful in encouraging older adults to invest in their own bicycles for transportation or recreational use, and rides are now primarily led by older adult volunteers who began as participants. Group cycle rides could be a good way to encourage active transportation use, while at the same time encouraging social interaction and stronger social networks among Toronto seniors.

j) Connecting Older Adults Map (Victoria, British Columbia)

Connecting Older Adults Map is an initiative aimed at providing seniors, service providers and caregivers with information to encourage independence and quality of life for seniors. It consists of an online mapping tool that provides an opportunity for seniors to interactively map out the best route to services using existing public transportation routes, walking distances and trails. The Map also provides insight into whether existing infrastructure and services are meeting the needs of the population, and where improvement can be planned. Toronto can benefit by exploring a similar initiative that will not only provide its senior population with access to resource and transportation information, but it can also provide insight into the adequacy of existing infrastructure and services

k) Wheelability Assessment Project (City of New Westminister, British Columbia)

The Wheelability Assessment Project began in 2009 as an initiative to improve accessibility for seniors who rely on physical aids such as scooters, walkers, and canes for active transportation. The initiative included an audit of existing city infrastructure in both the downtown and the uptown neighbourhoods of New Westminister. Key transportation routes and destinations were mapped to identify existing accessibility

challenges and opportunities for improvement. An open dialogue was also established between the City of Westminister and the target population of senior adults to facilitate exchange of education throughout the initiative. As a result of this project, a video was produced for staff training purposes; a map was prepared to better inform mobility aid users about route choices; and the assessment information was used to address identified deficiencies and inform design decisions. The initiative provides an example of how engagement with target groups can open a dialogue and provide important information on how the physical environment can be modified from being a barrier against active transportation for seniors to catering and empowering active transportation.

l) Walk Wise, Drive Smart (City of Henderson, North Carolina)

The Walk Wise, Drive Smart program began in 2006 as an initiative aimed at improving pedestrian safety particularly for senior adults. It is a community-based program that holds educational workshops and conducts walking audits of existing neighbourhoods in order to improve senior pedestrian safety. Collaboration from Walk Wise, Drive Smart, the City of Henderson and the Council on Aging for Henderson County led to the creation of a 1.5-mile senior pedestrian friendly walking route. This route is specially designed with seniors' needs in mind and has features such as bright orange paint in areas where there is potential tripping hazards and extra caution should be taken. In 2007, another initiative was implemented to create a friendlier senior pedestrian climate by offering rewards to drivers who correctly stopped at crosswalks for seniors, and reminding drivers of their responsibility to do so if they did not give way to seniors. Frequent organized walks are aimed at increasing awareness of senior pedestrian safety. Several components of this program are relevant to Toronto, including the community and educational programs that target drivers and the creation of a seniors safety route.

m) Civitas Elan – Safe Public Transport for Elderly People (Zagreb, Croatia)

This project established a series of 17 workshops to improve safety for seniors on public transportation and encourage more active transportation; 500 seniors participated in the workshops, which focused on the safest ways of entering, exiting and traveling on public transportation. Workshops were also held between seniors and public transportation drivers, and between seniors and youth in order to sensitize both groups to the particular needs and challenges seniors face while taking public transit. Brochures and videos focused around senior safety on public transit were also distributed to 8000 and 3000 seniors respectively. The Civitas project also partially funded low-floor trams and buses equipped with CCTV cameras to minimize senior safety concerns. Education to seniors and other groups of the population can improve safe travelling by understanding the concerns and difficulties seniors face in regards to using public transportation. The project provides an example of how engaging multiple user groups can help to improve awareness and encourage active transportation.

7. LESSONS LEARNED FOR TORONTO

The results of this research provide a number of important lessons that decision makers in Toronto can use to support projects or make decisions about financial investments in urban planning and public safety in order to encourage active transportation.

The following five general insights were summarized and synthesized from literature review findings. In addition, this section also includes a number of more specific insights related to the built and social environment.

General Lessons Learned – Framing Active Transportation for Seniors in Toronto

1. **Active transportation for seniors promotes health or health supporting** - Even though relatively few studies to date have focused on health-related aspects of active transportation for seniors per se, there is strong evidence linking physical activity to positive health outcomes for the general population. All forms of physical activity are seen as important ways to avoid or mitigate the potential for chronic disease and, in addition, contribute positively to mental health and well-being. Activities such as walking and cycling are strongly associated with good health, and the literature points to many promising examples that suggest staying active is a key factor affecting quality of life as people age.

   TPH has identified seniors as a 'priority population' meriting public health interventions "to meet their health needs," including promotion of a "physically active lifestyle." Findings from the literature review confirm that the validity and value of this direction.

2. **Active transportation is the means, not the end** - Although the public health movement in general, and TPH in particular, has long emphasized the importance of active transportation (AT) as an effective strategy to support "active aging" our review of the literature and jurisdictional scan suggests that the most successful AT strategies are those where AT is viewed as the means, not the end. This conclusion stems from discussions and debates related to what motivates older adults to undertake a specific activity. This can manifest itself as a desire to interact with friends, attend a health appointment or simply the need to go shopping. In any of these examples, this is where the conditions pertaining to the built environment come in to play, whether they be physical (such as crossing a busy six lane arterial road) or perceptual (such as an ability to enjoy public parks, which some older adults perceive as 'contested spaces' when they are dominated by boisterous youth).

   The literature identifies many attributes related to the built environment where TPH policies, practices and other interventions have the potential for impact when designed to be applied at the local or neighbourhood scale. The flip side of being active is to be sedentary – a worrying trend describing the lifestyle of people of all ages. As documented in the literature review, the layout of neighbourhoods deemed to be walkable and connected provide the basis for an active lifestyle. Whether the issue is the availability (land use and density) and accessibility of

destinations (site layout and the building code), or issues related to wayfinding (urban design), factors that facilitate AT or which motivate seniors to engage in various forms of physical activity are strongly associated with or determined by local conditions.

3. Partnerships are critical -The scale of the demographic shift under way in Ontario in general and Toronto in particular is unprecedented. From the perspective of policy makers, it is the pace of change as well as the absolute numbers that will need to be addressed. In order to be able to respond to change in ways that are both practical and affordable, both the literature and jurisdictional scan identify the importance of working in partnership with others to make meaningful connections between the needs of individual seniors and actions likely to benefit the health and well-being of older adults overall.

TPH has a successful track record of working constructively with the City's departments, boards and agencies. Viewing AT and seniors through a public health lens leverages inter-departmental relationships in a positive way, which can turn department heads into champions for initiatives that are central to the mission of TPH.

4. Health, social and built environment are interconnected - Emerging evidence highlights that built and social environments can both facilitate and act as a barrier to older adults' mobility, community engagement and health. The evidence also suggests that it may be the interaction between the person, the built environment, and elements of the social environment that encourage or dissuade an older adult to be physically active out of doors and in his or her community. However, relatively few studies specifically addressed the role of both built and social environments on older adult mobility. A better understanding of factors that encourage older adults to remain active in their community could have a substantial impact on individuals, communities, and the health- care system alike.

5. Social equity and mobility – The mobility needs of seniors vary depending on a wide assortment of social factors including age, level of health, financial resources, as well as ethno-cultural background. Active transportation policies and interventions for seniors must recognize that the mobility needs of seniors are diverse. There is limited research in Canada on the impact of socio-economic conditions on the mobility of seniors. However, we do know that many of Toronto's low-income and high-rise communities offer poor environments for pedestrians and cyclists, and that many seniors also live outside of the downtown/old city of Toronto. Having analyzed the demographic patterns of Toronto, we also know that many of Toronto's seniors are immigrants and newcomers. A better understanding of how socio-economic status and ethno-cultural background impacts active transportation use in Toronto would be useful.

6. Older adults vs. seniors vs. elderly – This research has focused on the active transportation needs of seniors aged 55-85+. Even though age of 65 is still often used for "seniors," such as for qualification for old age security or, in Toronto,

eligibility for senior's transit tickets, it is to some degree an arbitrary number. Including "younger seniors" between the ages of 55 and 65 in this review is important because the positive traits associated with AT can be more effectively addressed by policies and actions that target people earlier in their life course.

At the other end of the spectrum, the literature defines people aged 85 and older as "elderly," whose propensity to engage in active transportation is less than for younger seniors. The emphasis of public health and other public policy for the elderly is on smaller scale interventions such as the design of building interiors and matters related to accessibility. Although there are individuals in their nineties and beyond who remain active, the preponderance of studies and AT initiatives – and the focus of this area of public policy – is nevertheless focused on older adults 55-85.

Specific Insights Regarding Programs and Policies for Seniors

The following examples will be useful for the design of effective senior health interventions, making policy recommendations related to land use planning and transportation, and in developing other plans and strategies related to the build and social environment. This list is in no particular order.

Table 3: Insights regarding programs and policies for seniors in Toronto

Insight	Supporting Evidence	Potential Implementation Approach
Focus on cohorts of younger seniors to build capacity to undertake active transportation	Many studies reviewed for this project point to a link between the propensity to be active as an older adult with activities or habits developed earlier in life. Initiatives focused on supporting active transportation for young and middle-aged Torontonians have the potential to pay dividends in the decades to come.	TPH strategic planning Public health programing - e.g. education programs through clubs and active transportation networks Outreach – e.g. presentations at Toronto Seniors Accountability Table and similar venues
Get friends and family involved in active transportation promotion	Encouragement from friends and family has been found to encourage physical activity. This presents an opportunity to get other family members involved in encouraging seniors to walk, cycle and take transit.	Public health programing TPH communication strategies Partnerships – e.g. with organizations such as Toronto Centre for Active Transportation

Insight	Supporting Evidence	Potential Implementation Approach
Provide opportunities and facilities for social activity	Integrating older adults into their community and providing places for such interaction, can provide them with emotional support, motivation, information, social interaction, friendship, sense of belonging, etc., which can encourage active transportation. This can be especially important for newcomers whose social networks are not as significant as other Canadians.	Public health programing Community services and facilities/land-use planning Partnerships – e.g. NICE, Toronto Council on Aging, local chapters of CARP
Improve pedestrian safety	This research supports the idea that improving pedestrian safety can encourage active transportation and mitigate the resulting health risks. The Seniors Safety Zone initiative is a good example of this. Further initiatives that aim to improve awareness of road safety would be useful.	Cross-disciplinary research with City's Transportation Department Communication and outreach - e.g. publicizing Vision Zero and other safety initiatives Partnerships - e.g. with BIAs to identify motor vehicle collisions, crashes etc. hotspots to support complementary designation of Aging Improvement Areas
Implement small scale public-realm interventions (e.g. benches, wayfindng)	Seniors – particularly older seniors – cannot walk as long or far as younger people. Benches are a simple and relatively inexpensive intervention that can help to encourage walking among older adults.	City of Toronto budgeting process – e.g. advocate for budget for Parks, Recreation and Forestry to install benches, signage and publicly accessible washrooms in priority parks and green corridors Partnerships with local BIAs to implement public

Insight	Supporting Evidence	Potential Implementation Approach
		realm improvements with consideration for seniors. Outreach - e.g communicating information from this report with City of Toronto Public Realm division
Promote neighbourhood safety and beautification	Keeping neighbourhoods safe and clear of vandalism may also help to promote active transportation.	City of Toronto budgeting process Partnerships (e.g. City of Toronto Public Realm Division, Toronto Police Services and TABIA)
Support presence of sidewalks	The presence of sidewalks is associated with increased walking and reduced pedestrian-vehicle collisions. It's important that all neighbourhoods in Toronto have adequate sidewalks in order to support active transportation among seniors.	Land-use planning policy, Urban Design Guidelines City of Toronto capital budget Partnerships (e.g. Public Works)
Promote sidewalk maintenance in winter	The maintenance of sidewalks was identified as being strongly associated with walking. Ensuring sidewalks are well maintained, especially in the winter can help to reduce falls and encourage active transportation.	City of Toronto budgeting process Research – e.g. to support introduction of superior designs, materials and signage (possible partnership with Toronto Rehab Institute and Public Works department) Advocacy – e.g. provide data to Transportation Department in support of enhanced city-wide

Insight	Supporting Evidence	Potential Implementation Approach
		Winter Operations Program
Test opportunities for using technology for encouraging active transportation, especially transit	There is some evidence that seniors – even those at the older end of the age spectrum – are adapting to new technology. Also, several successful initiatives used technology to support active transportation. There is an opportunity for TPH and its partners.	Research – e.g. feasibility and interest in active transportation technology among Toronto seniors Partnerships - e.g. with Toronto Public Library seniors specialist to support educational programming in use of Apps and other new technology aids to active transportation OR with private sector app developers Note: Opportunity to take advantage of changing mandate of WheelTrans to expand access and eligibility of qualified seniors
Address and support transit accessibility and affordability	Greater uptake of public transport by inactive adults would likely lead to significantly greater increases in the adult population considered sufficiently active. In Toronto, many seniors live just about the poverty line. Keeping the cost of public transportation low for seniors and ensuring facilities are accessible can help to facilitate active transportation.	Advocacy and partnerships - e.g. TPH Vulnerable Adults and Seniors team social services, TTC and select private carriers, Ontario Society of Senior Citizens Organizations, SPRINT, YWCA, YMCA
Build more separated bike lanes	Dedicated bike lanes and routes are key for encouraging active transportation among seniors, as they improve real and perceived safety.	City of Toronto budgeting process Outreach and partnerships with

Insight	Supporting Evidence	Potential Implementation Approach
		Transportation Services and Transportation Division of City Planning Department
Build confidence in cycling as a mode of transportation	Self-efficacy and confidence was found to be a key factor in active transportation among seniors.	Opportunity to partner with Cycle Toronto and Toronto Centre for Active Transportation and Toronto Bicycling Network
Locating seniors/affordable housing near amenities, resources and to recreational facilities may also help to facilitate AT.	Locating seniors housing near amenities increases walkability, which improves health among seniors.	Land-use planning policy Partnerships with City of Toronto Planning Dept. and non-profits such as Ontario Association of Non-profit Homes and Services for Seniors
Target interventions at high priority groups	Targeted interventions to promote active transportation to fall-risk groups such as people with a history of falls and those using mobility assistive devices should be done with caution.	Outreach and partnerships to raise awareness of the free and accessible opportunities for physical activities that are offered in the community E.g. LHINs
Support transit investment	Increasing transit use leads to increases in walking and overall health among seniors	Advocacy at all three levels of government

8. CONCLUDING REMARKS

8.1 AREAS FOR FURTHER RESEARCH

As active transportation for seniors is a fairly new area of interest, we identified several possible areas for further research, including:

- The impact of ethno-cultural background on active transportation use and the role that culture, immigration and length of settlement play in terms of older adults' use of active transportation.
- Neighbourhood walkability in Toronto's neighbourhoods and the impact on seniors' mobility.
- How socio-economic status impacts active transportation use in Toronto.
- Explore the health effects of specific interventions like outreach programs in socially isolated older adults.
- How the social environment and factors such as socio-economic status and ethnocultural background can affect public transportation use and accessibility, and how this can impact health.
- How policy can support senior's safety and active transportation and best practices from across Canada and internationally.

8.2 CONCLUSION

Even though the health-related aspects of active transportation for seniors is a relatively new topic of research, there is strong evidence linking physical activity to positive health outcomes for the general population. All forms of physical activity are seen as important ways to avoid or mitigate the potential for chronic disease and, in addition, contribute positively to mental health and well-being. Activities such as walking and cycling are strongly associated with good health, and the literature points to many promising examples that suggest staying active is a key factor affecting quality of life as people age.

Having reviewed dozens of research studies, reports and reviews of specific elements of the literature, and having examined the results of a broad range of initiatives and programs in other jurisdictions, we conclude that in order to promote active transportation, it is not enough to simply tell people they should be active. People's personal choices need to be supported by amenable physical, social, and cultural environments. Active transportation is the *means*, not the end.

Our jurisdictional scan identified many useful initiatives for local application and suggests a potential role for TPH to influence future research and planning. These initiatives, and the findings from the literature review provide some important lessons that decision makers in Toronto can use to support projects or make decisions about financial investments in urban planning and public safety.

APPENDIX A - METHODOLOGY

Literature Review

The number of individual studies on determinants of active transportation, as well as the link between active transportation and public health, has increased sharply over the last decade. Additionally, there is growing interest about the association between active transportation and health for specific populations, such as seniors. This report provides insight into the current 'state of the science' on active transportation, health and seniors.

A comprehensive systematic review was beyond the scope of this project. Thus our search methodology drew upon recent evidence from peer-reviewed systematic reviews. Where relevant, the findings of these systematic reviews were supplemented with more recently published primary studies to provide the most up-to-date evidence or to highlight information especially insightful to the Toronto context. All literature searches focused on articles published between 2009 and 2016 and included key databases (Google Scholar, PubMed, Web of Science).

All literature referenced in this report was considered against a hierarchy of evidence. Generally, in the hierarchy of evidence, study types are represented as a pyramid showing weaker study designs in the bottom (primary and case series), followed by stronger designs (case–control, cohort studies, and then randomized controlled) – with systematic reviews and meta-analysis at the very top (Murad, Asi, Alsawas, & Alahdab, 2016). In most cases, this structure is true. However, in some cases, the study designs do not reflect the evidence quality. In the active transportation research, there is a limitation on the types of study designs possible because research is taking place in real-time and in communities. For example, randomized control trials are not often possible. We were mindful of this reality when assessing this literature for this report. Further, as suggested in the Murad paper, we used the results from high quality systematic reviews (those that used a rigorous method for study inclusion) to contextualize and evaluate the data presented in primary studies. Figure 9 reflects the pyramid of evidence. (A) The traditional pyramid. (B) Revising the pyramid: (1) lines separating the study designs become wavy (Grading of Recommendations Assessment, Development and Evaluation), (2) systematic reviews are 'chopped off' the pyramid. (C) The revised pyramid: systematic reviews are a lens through which evidence is viewed (applied).

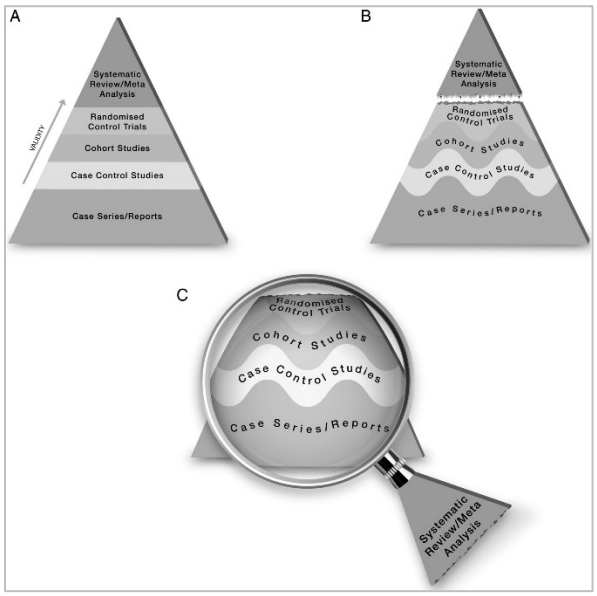


Figure 9*:* Pyramid of evidence

All literature included in this report needed to focus on older adults (55 years of age and older) and focus on the determinants of active transportation and health for older adults. To demonstrate relationships and concepts, a few studies conducted in the general adult population were included where no evidence exist specific to older adults. In attempt to present information most relevant to the Toronto and Canadian context, studies needed to have been conducted in North America, Australia, and Western Europe. Studies were excluded if they were in a language other than English.

Additional databases such as Canadian Public Policy Collection, Proquest and Web of Science were used to gather grey literature studies and reports. Additionally, conference proceedings and expert interviews were examined to identify emerging ideas, initiatives, and priorities associated with active transportation for seniors. Further, expert advice on specific topics was sought to ensure that relevant articles, reports and examples were included.

Terms for all literature searches included:

- health, public health, population health
- physical activity, sedentary behavior, sedentary time, physical inactivity
- active transportation, active transport, active transportation, active transit
- older adults, older people, seniors
- walk, walking, pedestrians
- bicycle, bicycling, bike, bike lane, cycling,
- built environment, land use, safety, sidewalk, speed limits
- social environment, social networks
- traffic, traffic calming, network connectivity, safety
- public transit, public transport.

Toronto Initiatives and Inspiration from Other Jurisdictions

For the identification of Toronto initiatives and initiatives from other jurisdictions, we sought input from subject matter experts, including our project advisors and external stakeholders involved in seniors and active transportation sectors. Experts included representatives from the City of Toronto (Parks and Recreation and Transportation Services divisions) and the non-profit sector (80 to 80 Cities, CARP, Centre for Active Transportation, Toronto Police, Older Adult Centres' Association of Ontario).

We contacted each expert by email and asked them to suggest examples of initiatives in Toronto or in other jurisdictions, which support active transportation for seniors. We supplemented the input with internet research, using Google search, as well as by examining conference proceedings and grey literature. Search terms including: active transportation, seniors, older adults, cycling, walking, public transportation.

Our criteria for selecting initiatives included:

- Does the initiative relate to active transportation?
- Is it specific to seniors?

For the initiatives from other jurisdictions research, we also added the following criteria:

- Is the program far enough along that some results or lessons learned can be determined? and
- Is the location of the initiative similar or applicable to Toronto?

We developed a preliminary list of possible initiatives and narrowed it down based on which initiatives best met the above criteria, and developed project summaries for each case.

This process determined that there is very few well-documented exemplary programs and practices in this area. We found many active transportation initiatives, but very few that focused on seniors. As can be expected, many excellent practices emanated from European countries, however, literature in English was limited. However, few examples were provided, demonstrating the limited number of initiatives specifically focused on seniors.

APPENDIX B – GLOSSARY OF TERMS

Active transportation: any form of human-powered transportation: walking, cycling, in-line skating or skateboarding, and using a wheelchair. Public transportation is also considered a components of active transportation in this report, because of the walking and cycling that takes places at the beginning and end of a transit trip.

Age-friendly communities: communities with policies, programs, services and environments that support and enable people to age actively. As all communities are unique they may take different approaches to achieving age-friendliness. However, all age-friendly communities share some common values.

- Recognizes the wide range of capacities and resources among older people
- Anticipates and responds flexibly to aging-related needs and preferences
- Respects decisions and lifestyle choice of older adults
- Supports the older adults who are most vulnerable
- Promotes the participation of older adults and encourage their contributions to all aspects of community life.

Built environment – refers to the surrounding setting that is built by humans. Key elements of the built environment include: urban design, land use and the transportation systems. We further differentiate built environment factors according to street-level factors (e.g., sidewalks, street crossings, lighting, etc.) or community-level factors (e.g., destinations, parks, street networks, land-mix use, etc.).

Commuter cycling – cycling as a method of transportation to complete a trip, rather than one of recreation, sport, or leisure.

The complete trip – refers to all the aspects of a person's trip, from "the time the individual begins to plan the trip, to when he or she leaves the originating location when starting a journey, to the doorstep of the final destination."

Functional mobility – The ability to perform practical tasks, activities, and behaviours that fulfill one's role in society, maintain independence, and enhance quality of life.

Gait – refers to a manner of walking. Observation of gait can provide early diagnostic clues for a number of disorders and physiological changes associated with aging.

Health – Health applies to physical, mental, social and psychological dimensions. Positive health is not merely the absence of disease or infirmity, but the capacity to withstand challenges and to accomplish life's activities with pleasure and energy.

Land use patterns – reflect where and how residential, commercial, and industrial uses are distributed in a neighborhood.

Life space – refers to the the physical and psychological environment of an individual or group. It estimates the magnitude or extent of travel into the environment, regardless of how one gets there.

Mobility – The ability to perform specific activities such as walking, climbing stairs, and engaging in instrumental activities of daily living. Closely related to mobility is the concept of community mobility, which is as the ability of a person to move about and

complete physical activities in their community setting, with a focus on non-motorized personal mobility (e.g., walking).

Mobility disability – refers to when a person is not able to move or navigate their environment; it can result from impairments and/or activity restrictions.

Mobility limitations – impairment or dependence in movement, can affect between one third and one half of adults aged 65 or older.

Physical activity – Any bodily movement produces by skeletal muscle and expends energy. It is a form of mobility.

Seniors – in this report, we use the term senior to refer to adults between 55 and 85. The term older adult and seniors are used interchangeably to refer to this demographic. This definition is inclusive of younger seniors and consistent with the definition used by the Toronto Seniors Strategy and the academic research on seniors.

Social environment – The social environment is comprised by the social relationships and culture within which people function and interact. Key elements of the social environment include: social support, social networks, socioeconomic position, and social cohesion.

Social health – relates to the sense of having support available from family and friends. In this report, social health also includes emotional health and mental health.

Street connectivity – A term used to describe how the built environment is constructed in regards to the street networks. Street connectivity includes factors such as block size, block length, intersection density, street density and connected intersection ratios. Good street connectivity is identified as having a variety of short routes to the same destination. Walkability is also closely reliant on how connected street networks are.

Trip purpose – The purpose is determined by the activity a person engages in at the destination of the trip.

Urban design – The process of design of buildings, groups of buildings, spaces and landscapes, and establishing the processes that make successful development possible. In this report, urban design relates to street-scale elements of the built environment such as sidewalks and other public amenities.

Walkability: A term used to describe both the prevalence and convenience of geographical access and its quality for pedestrians. Walkable areas can be characterized as those that are safe well serviced, and are positively experienced by pedestrians.

Walking – Two main types of walking are identified in literature as recreational and utilitarian. Recreational walking refers to physical activity for quality of life and other health benefits; utilitarian walking refers to personal transportation while completing tasks and/or commuting.

Wayfinding – refers to information systems that guide people through a physical environment and enhance their understanding and experience of the space.

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