Senior Transit Accessibility in Edmonton, Alberta

Abstract

For Edmonton to be an Age-Friendly City, it is important that seniors can access the services they need and remain engaged in the community. As Edmonton supports a mode shift to mass transit, combined with the tendency of seniors to cease driving, mass transit access becomes increasingly important. Using the transit system data from the City of Edmonton, service areas of medical, essential, and social trips were computed highlighting areas where seniors in Edmonton have low or no transit accessibility based on destination proxies. Seniors are generally located at the city fringe as measured through the 2016 Canadian Census while transit access is most comprehensive in the core. This means Edmonton may need to increase funding to ensure seniors have transit access through either mass transit or paratransit services. Policymakers may also want to locate amenities for seniors in areas that do not rely on automobility to meet transportation needs.

Executive Summary

Seniors in Edmonton that seek to rely on mass transit face barriers in accessing key services. In this way, Edmonton faces conflicting goals as it seeks to shift its citizens out of the personal automobile, adjust its bus network, and meet the goals of the internationally defined Age Friendly City. While most considerations around mass transit access focus on the proximity of a residence to an active bus stop, this measure misses the destination of the trip in determining the viability of transit in meeting transportation needs of citizens.

In particular, as the Medically At-Risk Driver (MARD) Centre notes, seniors with medical issues that limit their ability to use a car must find other ways of getting to their destinations. Their data from the 2016 and 2017 Provincial Transportation Needs Assessment, used in this geospatial analysis, identifies three trip types of particular importance. Medical, such as appointments with doctors and specialists; essential, such as grocery shopping; and social, such as attending religious services, community events, or meeting friends and family. When these trips are not completed, it quantifies an unmet transportation need.

Within Edmonton, like many automobile-dependent cities in North America, there is a statistically significant relationship between the ability to operate and car and the likelihood that a person has unmet transportation needs. Seniors in Edmonton who do not drive are more likely to have experienced a transportation deficiency in the 6 months prior to completing the provincial survey.

Looking within Edmonton, proxies for the medical, essential, and social trip types were identified and mapped to specific points. These proxies were family physicians, major grocery stores, and senior centres, respectively. Drawing on the open data on the Edmonton Transit System, a network was built in ArcMap and ArcCatalog with the network analyst extension. Using the

proxy destinations, the average speed of transit, and the model of the transit network, 30 minute service areas were generated for each destination at the three levels of service provided in Edmonton; Peak (weekday), Off-peak (weekday), and Weekend. Layered together they created a map of where seniors can meet their needs using transit, where they have partial or limited access, and where no capacity for transit exists.

Edmonton has just begun the public engagement around draft changes to its bus network, following the adoption of the Transit Strategy in 2017. This destination-based spatial analysis can help conceptualize what level of service is needed for seniors to remain connected to their city and able to live independently without a personal vehicle. It can also help city planners in determining where senior-focused housing options and supportive services are best placed to enable mass transit use. It demonstrates where additional resources for paratransit programs like the Disabled Adult Transit Service (DATS) or volunteer-run transportation services will have the highest demand and greatest impact, which can benefit financial decision-making. At the individual level, when people seek to change homes in their senior years, this analysis can show them where they can age-in-place and remain independent without relying on automobile travel. This can help seniors avoid having to rely on friends, family, or taxis for transportation while ensuring they have access to continue their engagement with and contributions to their communities and city.

Background and Introduction

In 2010 the City of Edmonton declared its intention to be an Age Friendly City, an international standard that refers to having senior populations able to continue being involved in and engaged with their city and communities (City of Edmonton, Age Friendly Edmonton). However, like most North American cities, its urban form is one that has been built around the automobile. This has been a noted concern with delivering transit service cost effectively (Hanson & Guiliano, 2004). As people age, they are likely to develop medical conditions that directly impact their ability to drive, or rely on medications and treatments that can have a similar impact indirectly (Dobbs 2012). If they continue to live in areas that demand automotive travel, but cannot operate a car themselves, they are put in a position of transportation insecurity.

The Medically At-Risk Driver (MARD) Centre at the University of Alberta has been exploring the nature of this insecurity through the study of unmet transportation needs - a term referring to trips not taken because individuals couldn’t find a way to travel to their destination. Their report of the Alberta Provincial Transportation Needs Assessment in 2016-2017 found that senior non-drivers were likely to have lower incomes, live alone, and use a mobility aid like a cane or walker (Dobbs et al., 2018). Transportation deficiencies are also connected to reduced quality of life and social isolation in Alberta. The Medically At-Risk Driver centre knows that not all seniors face transportation challenges, which is why rather than age, they focus on individuals that do not drive.

Even without a medical issue triggering a loss of their license, senior drivers are found to limit their driving in response to the perception of risk in operating a vehicle as either their ability or

confidence in their ability to drive declines (Jouk et al., 2014, p. 2). This process is voluntary and can extend all the way up to a complete cessation of driving. However, not all seniors regulate their driving the same way (Kowalski et al., 2014) and it is unpredictable as to when an individual will choose to alter driving behaviours. In general, seniors self-regulate by reducing the times they drive, the road conditions they drive in, and the locations they will travel to (Kowalski et al., 2014). While many people remain competent drivers into late age, with age the likelihood that they will become impaired by a medical issue and lose their automobility increases.

Edmonton seniors who are driving less or who have stopped driving must find other ways to satisfy their travel needs. Some may look to friends and family to drive them, while others may pay for a taxi or private network provider to transport them. These methods have their limits in terms of meeting travel needs (Bascu et al., 2012). Being dependent on others for rides can put strains on relationships, and the costs of paying for a chauffeured ride can also limit mobility. As seniors are often on a fixed income, if they do not drive, we anticipate them relying at least in part on mass transit to complete their medical, essential, and social trip needs. Alberta non-driving seniors reported relying on friends and family to help them complete their medical, essential, and social trips more than their automobility-enabled peers (Dobbs et al., 2018, p. 9).

While paratransit and alternative transit services, such as Edmonton's Disabled Adult Transit Service (DATS) helps those with disabilities, this service cannot replace good mass transit accessibility. Firstly, specialized services cost more per trip than mass transit to operate. Secondly, many seniors with reduced automobility are not likely to qualify for programs like DATS where eligibility is case-by-case and based on physical disability (City of Edmonton, 2016).

The City of Edmonton is currently undertaking a review of its transit service, looking to increase frequency and speed in high-demand areas, while reducing service to other lower demand areas (City of Edmonton, Bus Network Redesign). Edmonton's prior metric for transit service was to have a bus stop within a 400 meter radius of each residence. However, as part of Edmonton's work towards shifting travel modes away from the private automobile they conducted a great deal of public engagement on the mass transit system, culminating in the Transit Strategy approved by Council in 2017 (City of Edmonton, Transit Strategy). In consideration of these changes, it seems prudent to explore the transit accessibility that currently exists for seniors in Edmonton. The draft routes proposed continue to rely on proximity of a stop as a performance measure (City of Edmonton, Transit Strategy).

Merely having proximity to a bus stop does not equate to good accessibility in meeting important transportation needs. The transportation planning terms, the proximity to a bus stop from your residence creates a good origin point, but without fast connections to destinations also close to mass transit, the attractiveness of the system is limited. For instance, seniors living in low-density residential areas usually have transit services that are focused on rush hour work commutes to employment centres like the traditional central business district rather than broad

access to a variety of destinations (Turcotte, 2012, p. 12). This means that while they can access the network, it may not connect them to the destinations they need to access.

Transit accessibility is a measure of how well seniors in Edmonton can use transit to fulfill their travel needs. This project analysis focuses on three trip types defined by the MARD Centre: medical, essential, and social. While the precise answer would vary greatly from individual to individual, we can use the network analyst tools in ESRI to determine service areas in Edmonton and extrapolate the coverage of proxy locations. This will answer my primary research question: where is there mass transit service area coverage that allows seniors to meet their transportation needs for medical, social, and essential trips at all service levels (Peak, Off-peak, Weekend)?

Methodology

Georeferencing and Data Cleaning

The first step of this analysis was generating point layers for origins and destinations. For origins, the respondent data from the MARD Centre had postal codes for each entry. After selecting entries only where age was 65 years or more, and location was Edmonton, each respondent location could be approximated by postal code.

Postal code data from Canada Post included a point file with Enhanced Postal Codes. Each postal code had multiple entries, but from the metadata showed that one entry for each was considered the best representation. Selecting by attribute in the table where SLI = 1, the resulting shapefile was saved. It was projected into the NAD 1983 3TM 114 and then clipped to the City Boundary file from the City of Edmonton Open Data. Then this file was used to run a relational join, generating origin points from the MARD data that fell within the Edmonton boundary. Using data from the MARD survey, the origin points could be categorized by whether the individual had experienced transportation deficiencies in the past six months.

Drawing on the framework from the Medically At-Risk Driver centre at the University of Alberta, three trip types were important to the analysis: medical, essential, and social. A destination point proxy was selected for each of them to generate coverage areas.

Medical trips can best be modelled with the proxy of family physicians who coordinate most general medical issues for their patients. The College of Physicians and Surgeons of Alberta had a listing of providers in Edmonton, and this was converted into a spreadsheet with the postal code data in a separate column. The entries where the address was a post office box were removed, as those locations would not be valid service or destination points. Then using the enhanced postal point data from Canada Post, filtered to one point per postal code, a relational join was run to match each physician with a point shapefile based on the complete postal code.

Essential trips were modelled from grocery store locations pulled from Google Earth with x,y coordinates. Using the coordinate conversion tool they could be converted to points in NAD 1983 3TM 114 as well. The projected data included points outside Edmonton's city limits, so the resulting shapefile was clipped to Edmonton. Since the analysis was using grocery stores as a proxy for essential services, only major chains were kept, such as Walmart Supercentres, Safeway, Sobey's, No Frills, and Superstores. These locations could be relied on to have all the grocery products unlike convenience stores or specialty shops that may only satisfy some needs.

The Edmonton Open Data set included the locations of Senior Centres which could function as a proxy for social trips. From the literature, these trips are the hardest to model since they include trips to see friends and family, attending religious services, and participating cultural events; all of which are highly individual (Dobbs et al., 2018). The Senior Centres, though, ensure that a basic social service is accessible for seniors in Edmonton. The data was re-projected into NAD 1983 3TM 114 for the network analysis.

Generating and Merging Service Areas

Taking the transit network data from the City of Edmonton through the Open Data catalogue, the ArcGIS network analysis tool was used to create a transit network for the three distinct service levels: Peak (weekday), Offpeak (weekday), and Weekend.

Each destination point proxy was loaded into each service level with a 200 meter tolerance. This removed some destination points from the service area generation as they were further than 200 meters from the transit network. While Edmonton currently has a standard of 400 meter radius coverage for bus stops in residential areas, the 200 meter distance is more accurate for a senior population in terms of how comfortable they would be in walking from a bus stop to their final location (Azmi, Karim, & Amin, 2012). The transit network did not include any measure of time, however, and merely gave measurement in distance.

Transit speeds are based on the time busses are stopped to process payments/issue transfers, the frequency of stops needed, as well as the general impacts of the road system such as congestion and traffic controls. Not all routes have the same speeds as they have different stop spacing and road conditions, as well as the number of people boarding and alighting will vary. For this analysis, given that most of Edmonton Transit Services routes would fall under the metro local category, as defined by Boyle (2013, p.8) a weekday trip would be 24 km/h (14.9 mph *1.60934 kph/mph = 23.98 km/h) and for weekend trips, 25.6 km/h (15.9 mph *1.60934 kph/mph = 25.59 km/h). To allow for consistency, a travel speed of 25 km/h was used to model all service levels despite the noted variability in speed. This was a measure of 12,500 meters to represent a 30 minute transit trip.

Using the dissolve tool, the 30-minute service area for each trip type in each network was saved into its own polygon shapefile, resulting in a total of 9 service area polygons. A new field was added to each attribute table with a 'weight' of 1. Then a spatial join was run for medical, essential, and social trips, and the field calculator used to find out where service areas

overlapped by adding the weights together in process similar to a suitability analysis, though without the need to place unique weights on the layers. Then a final map was produced adding up each of the nine layers by weight to represent the areas of Edmonton within a ‘30 minute’ travel window of each trip type in each service level (Figure 7).

Since the transit file includes ETS routes outside the city, the shapefiles for some service areas extended beyond the city boundary, but were clipped to reflect the focus on Edmonton and keep the figures legible. The benefit of choosing service areas based on destinations, rather than closest facility based on origins, is that it better reflects the use of transit. Individual schedules vary, and it is difficult to account for the times that specific people would want to access specific services.

The service area mapping reveals more about transit accessibility in Edmonton than other tools, such as closest location. Closest location would only tell us about the specific needs of a person at a single origin point, while service areas give a better visualization for citizens generally. It also allows for quick comparisons with census data to explore if high transit accessibility areas correlate with the concentrations of senior populations in Edmonton. The closest location network analysis would be a strong analytic tool if transit service was consistent rather than varying across time through the day.

Analysis and Findings

The census data for Edmonton shows that the population of seniors concentrates at the edges of the city, with peaks in areas with mobile park homes such as along the river valley in the southwest and the northeast of the city (Figure 1). The origin points for each Edmonton senior included in the MARD data were placed against this background, and then categorized by whether they had experienced a transportation deficiency (not completed a needed trip) in the past six months. Of the 218 Edmonton seniors surveyed, 33 or 15% were unable to complete at least one medical, essential, or social trip. The respondents are spread throughout Edmonton, as are the reports of unmet transportation needs for the respondents. This suggests that the transportation needs of seniors do not have a strong relationship to space alone.

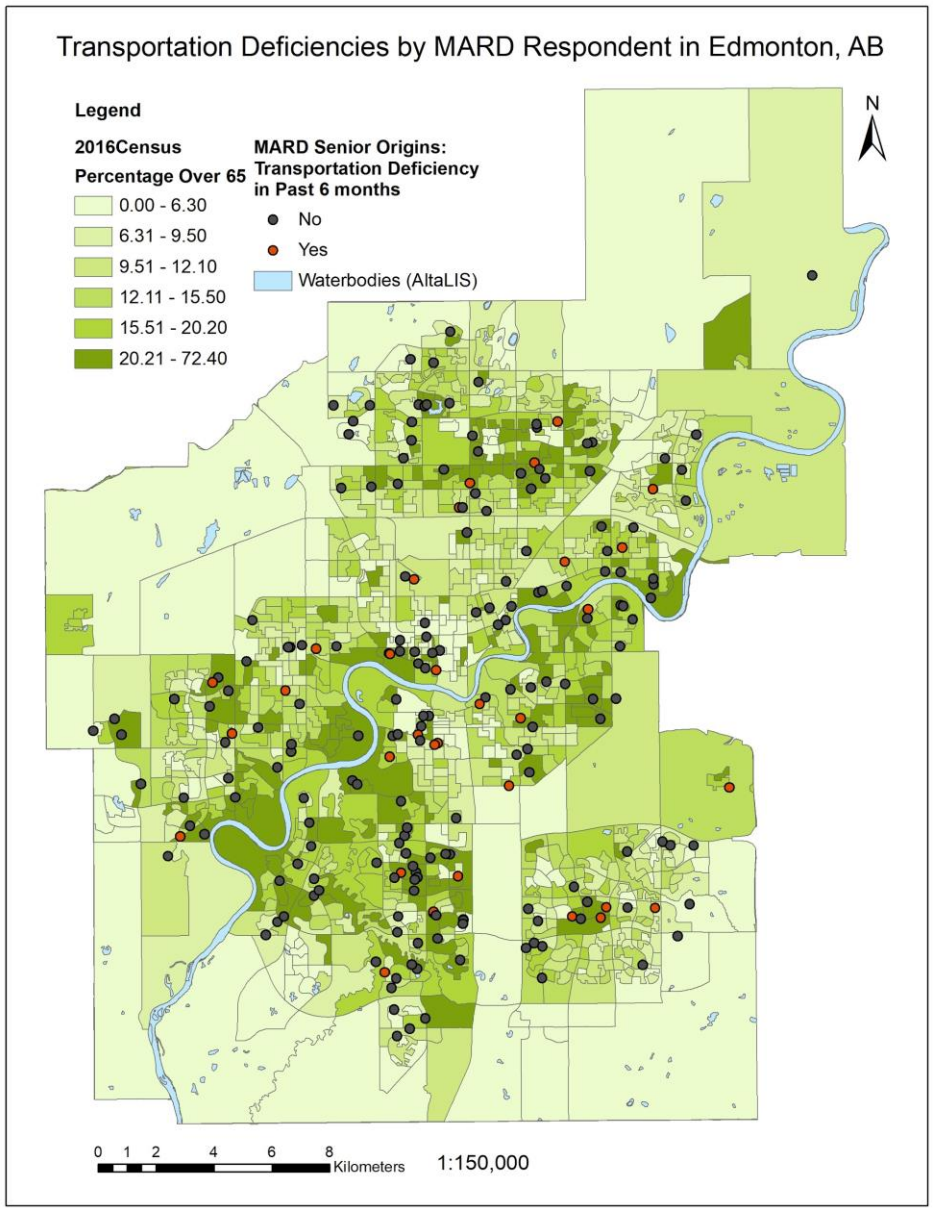

Figure 1: The distribution of respondent senior origin points from the Medically At-Risk Driver Centre Provincial Transportation Needs Survey in Edmonton, AB against the percentage of population that is over the age of 65, shown by quantile.

Based on the provincial summary, there seemed to be a correlation between driver status and transportation deficiencies (Dobbs et al., 2018). In exploring whether driving behaviour was related to the experience of transportation deficiencies in Edmonton, a chi-squared test for independence was run.

Of the 218 MARD survey respondents in Edmonton, 157 said they currently drive, 60 responded they had ceased driving, 1 respondent said they had never driven. To meet the assumptions of the chi-square test, the non-drivers were consolidated into one classification. Using the

independent variable of driving status and the dependent variable of having experienced a transportation deficiency for either a medical, social, or essential trip in the past 6 months, the following null and alternative hypotheses were formed:

H_O = Ability to drive and experience of transportation deficiency are unrelated in Edmonton, AB.
H_A = Ability to drive and experience of transportation deficiency are related in Edmonton, AB.
$\alpha = 0.01$ (99% confidence)

F(o)	No Deficiency	Transportation Deficiency	Grand Total
Current Driver	145	12	157
No longer/ Never Drove	40	21	61
Grand Total	185	33	218

F(e)	No Deficiency	Transportation Deficiency	Grand Total
Current Driver	133.2	23.8	157
No longer/ Never Drove	51.8	9.2	60
Grand Total	185	33	218

The chi-square test of independence revealed a significant relationship between driving status and transportation deficiencies ($p < 0.001$). Having the ability to drive a car in Edmonton is related to the experience of unmet transportation needs.

Transit Inaccessible Points

As part of the network analysis in ArcMap, destination points needed to be loaded with a threshold to determine if the point is connected to the transportation network. As described in the methodology section, a 200 meter threshold best reflected the reduced personal mobility of seniors, and makes sense given the high rate of mobility aid usage found in Alberta (Dobbs et al., 2018). However, this threshold resulted in some of the destination point proxies for the medical, essential, and social trips being deemed inaccessible by transit and were therefore excluded from the generation of service areas. This resulted in the total number of viable locations shrinking. While this would be done independently for each transit service level (peak, offpeak, and weekend), figures 2 through 4 show the inaccessible points on the weekday peak transit level, which is generally the highest level of service (Turcotte, 2012).

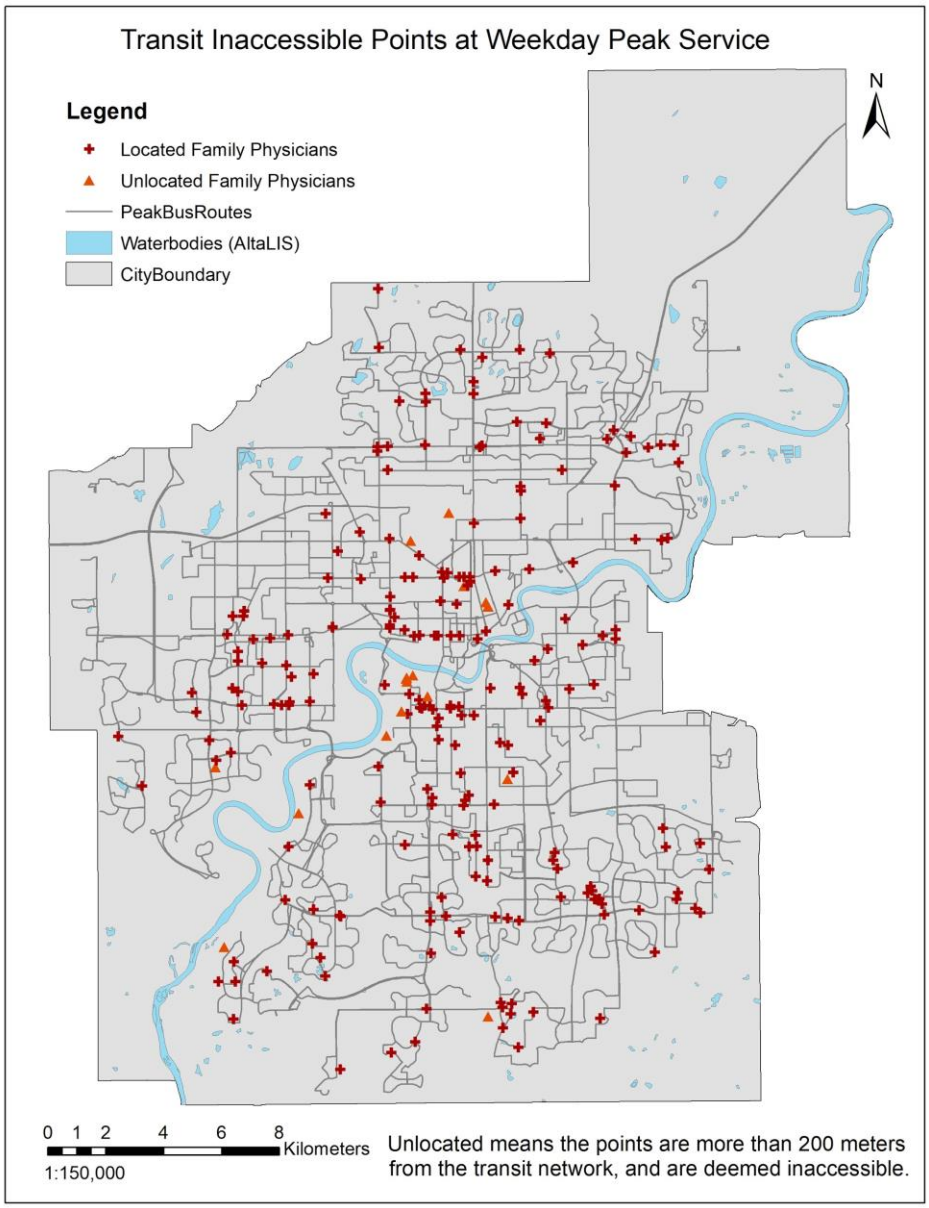

Figure 2: The distribution of Family Physicians from the College of Physician & Surgeons of Alberta data. 24 out of 255 (9%) Family Physicians were 'unlocated' (inaccessible by mass transit with a 200 meter threshold) in the weekday peak transit service.

Overall, there are plenty of Family Physicians in Edmonton, AB as shown in Figure 2. While the locations have clusters near hospitals such as in Mill Woods near the Grey Nuns hospital in the southeast of the city, the University and Royal Alexandra hospitals in the centre of Edmonton, and the Misericordia hospital in the west end, no one area seems overly deprived. Most inaccessible destinations have an accessible alternative relatively close by. Looking at the census data in Figure 1, several dissemination areas along the river in the southwest and one area in the northeast are in the highest quantile of senior population concentrations and have no destinations within them.

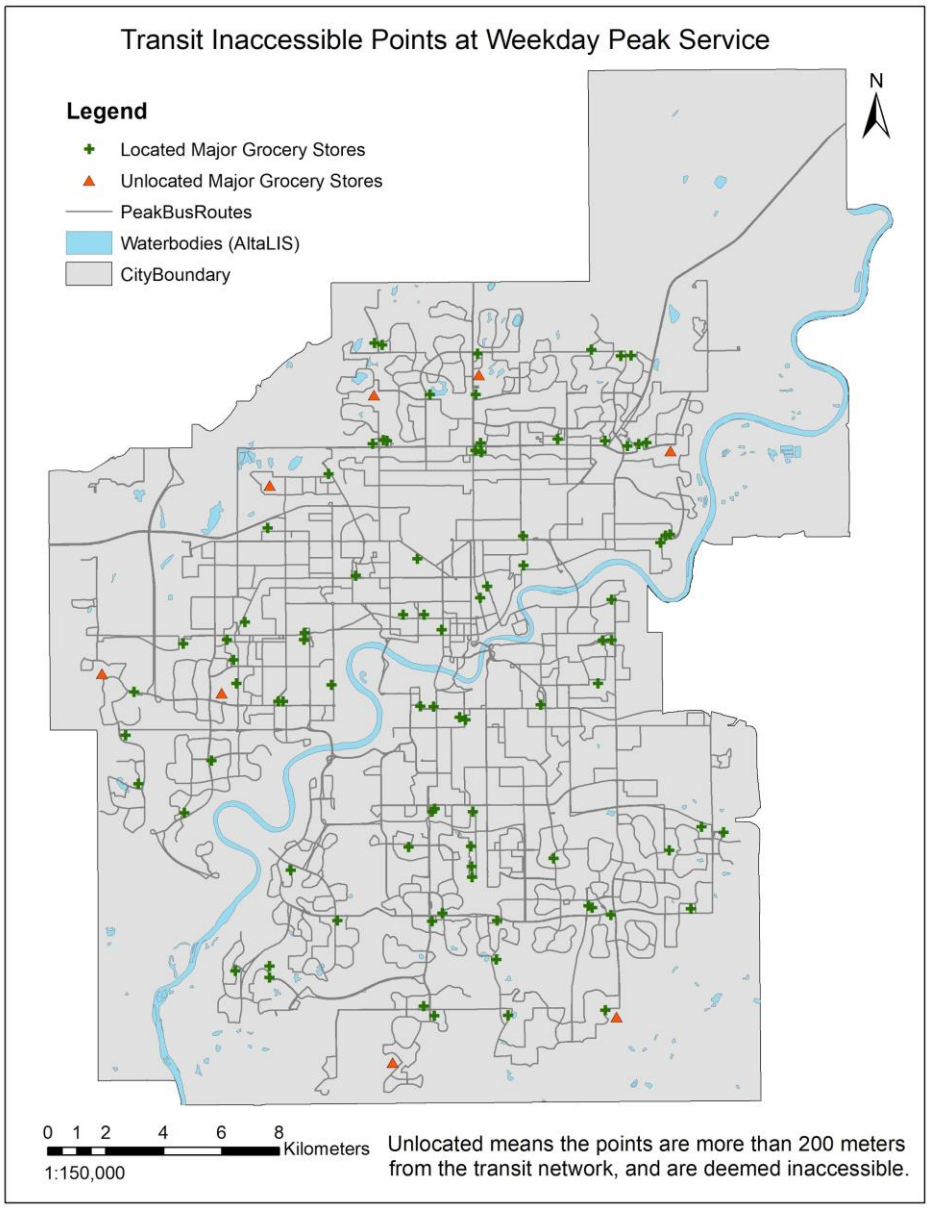
Transit Inaccessible Points at Weekday Peak Service
Legend
Located Major Grocery Stores
Unlocated Major Grocery Stores
PeakBusRoutes
Waterbodies (AltaLIS)
CityBoundary
N
0 1 2 4 6 8
Kilometers
1:150,000
Unlocated means the points are more than 200 meters from the transit network, and are deemed inaccessible.

Figure 3: The distribution of Major Grocery Stores from Google Earth data. 8 out of 93 (9%) stores were ‘unlocated’ (inaccessible by mass transit with a 200 meter threshold) in the weekday peak transit service.

Like the family physicians, there is a tendency of major grocery stores to cluster as seen in figure 3. Given there are far fewer major grocery location in the city overall, though, this poses some concern. Grocery stores tend to collocate to better compete with one another for market share, which does not generate the best coverage of a city. Even where both are accessible by transit, when generating the service areas, it would not increase total coverage of the city. These locations would give citizens close to them a choice of location, while other areas potentially have no coverage. Relatively few stores are accessible by transit, though the ones that are pose a particular concern as they are placed around the edges of Edmonton as these are areas with high proportion of seniors as seen in Figure 1. Given the form of suburban development in Edmonton, this inaccessibility is likely because they are placed far back from the road to accommodate parking rather than close to the road to facilitate mass transit users.

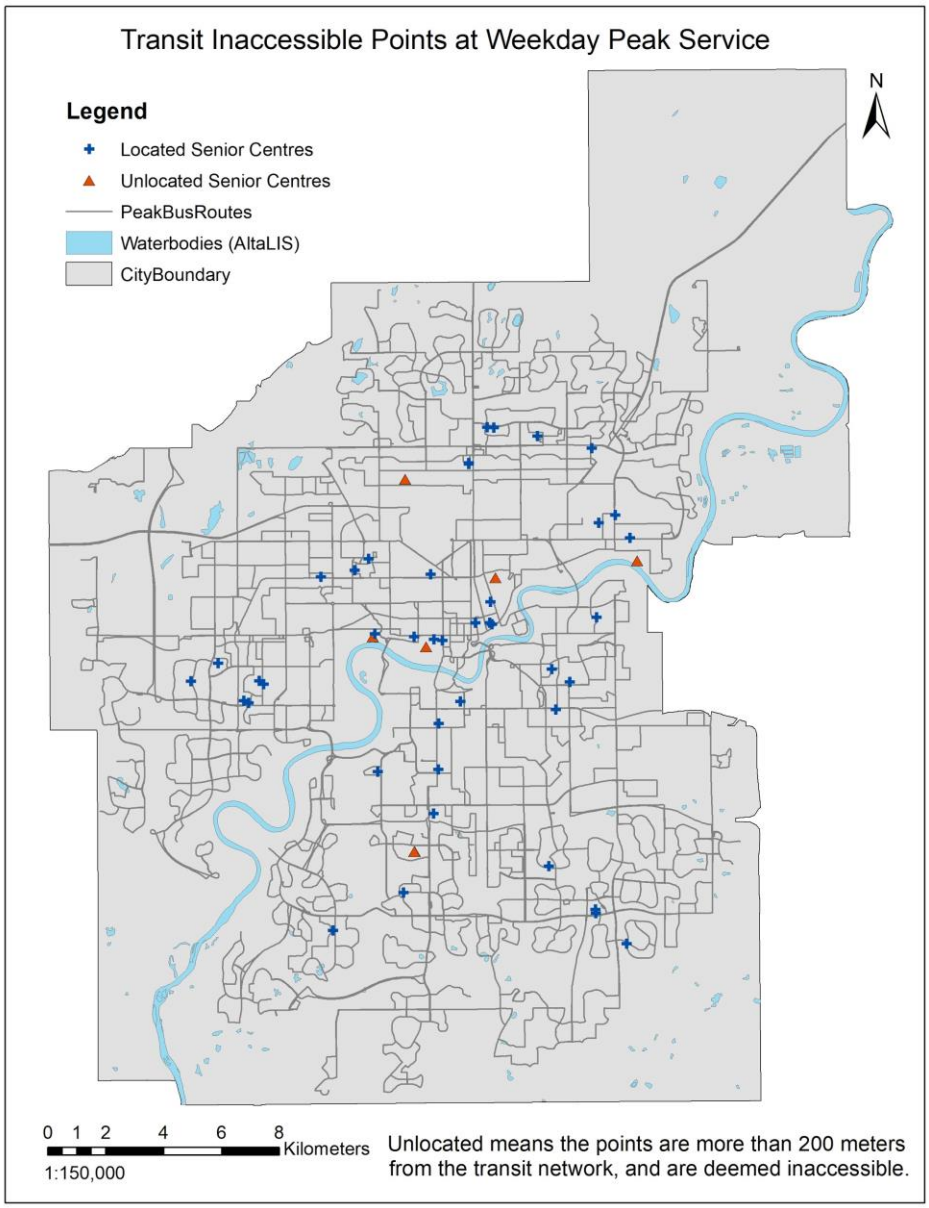

Figure 4: The distribution of Senior Centres from the City of Edmonton Open Data Catalogue. 7 of 49 (14%) centres were 'unlocated' (inaccessible by mass transit with a 200 meter threshold) in the weekday peak transit service.

Senior centres in Edmonton are focused towards the centre of the city as seen in figure 4. This isolates seniors living on the edge of the city from accessing them. In terms of the transit inaccessible locations, several are in the core of the city where we would expect the fullest transit coverage. This might mean that when someone switches from a car to transit they will not be able to continue attending the centre they currently access if they live downtown.

7 of the 49 seniors centres (14% of possible destinations), 8 out of 93 major grocery stores (9% of possible destinations), and 24 out of 255 family physicians (9% of possible destinations) were deemed inaccessible by the network analyst tool using the 200 meter threshold on the peak

weekday transit network model. For seniors without access to a personal vehicle, these inaccessible locations represent a shrinking number of opportunities to meet their needs in Edmonton independently. These locations, even though they may be closest in terms of the road network, would therefore not be well suited to the users of mass transit. This means seniors in the city centre may have to travel farther to access a destination on transit, and change their service providers, if they lose their automobility.

Transit accessibility also relies on the origin point, however. While the focus of the analysis was on destination points, the same threshold was applied to the origin points as seen in figure 5.

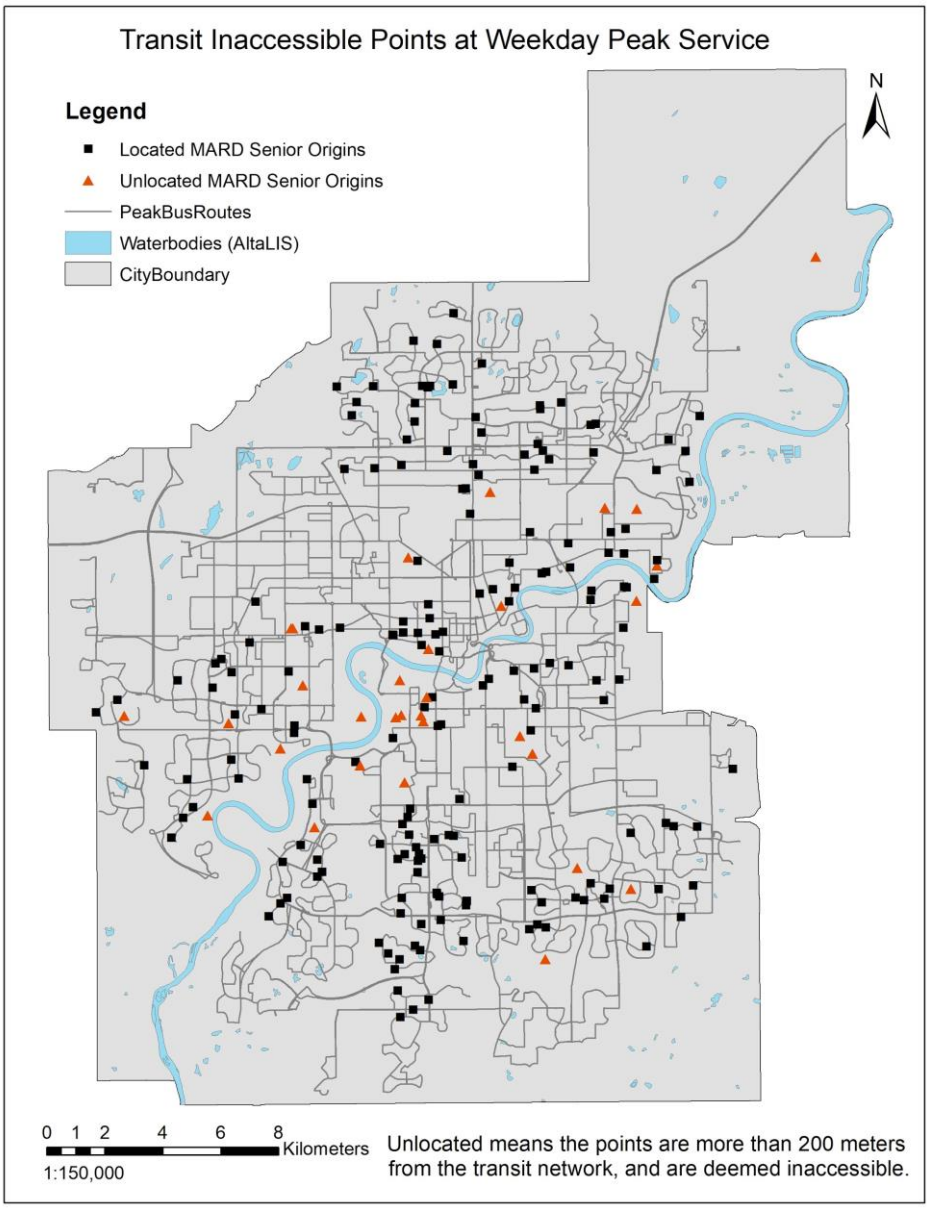

Figure 5: The distribution of origin points from the MARD Centre (Alberta Provincial Transportation Needs Assessment 2016-2017). 31 of the 218 (14%) respondents were 'unlocated' (inaccessible by mass transit with a 200 meter threshold) in the weekday peak transit service.

Of the 218 respondent origin points, 31 (14%) were found to be more than 200 meters away from the peak transit network. Much like the senior centres and family physicians, many of these points are in the centre of the city where we would anticipate good levels of transit service. For seniors in these areas, even if their destinations are accessible, they may have to overcome barriers in getting to the bus network.

Service Areas

With the 30 minute service areas generated, a map was created for each trip type, as shown in figure 6. These polygons represent the catchment area for the destination points with 200 meters of the transit system. The variation in each shows the amount of change in the mass transit system between service periods. Lighter colours represent where service area polygons overlap. Individuals living within the lightest colour areas, where ArcMap shows a value of "3", can get to one of the associated destination points at all times transit is operating.

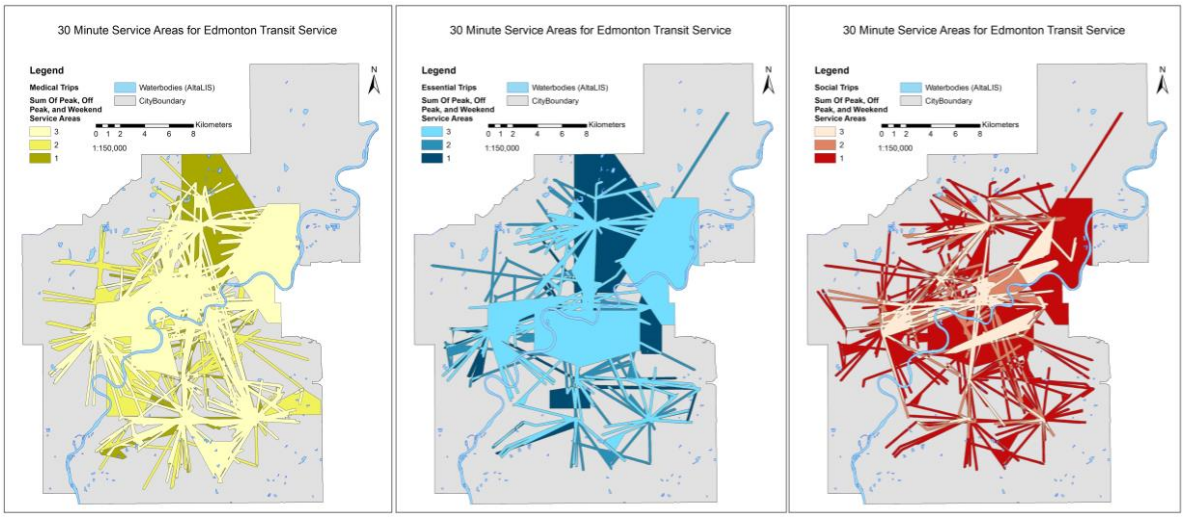

Figure 6: The service area coverage for medical, essential, and social trips in Edmonton where "3" is access at all three service levels and "1" is access at only one level of service.

Given the number of family physicians as seen in figure 2, the strong coverage for medical trips makes sense. The connection running up to the northeast for essential and social trips does not appear on the medical service area. This shows the weaknesses of using proximity between a residence and a bus stop as a measure of accessibility. While the transit network runs to the northeast, individuals boarding there would not be able to connect to a medical destination within 30 minutes of travel, meaning they do not have equal medical accessibility when relying on mass transit for mobility. Since one of the census dissemination areas in the northeast is in

the highest quantile of seniors as a percent of the population due to the location of a mobile home park, this gap is concerning.

The essential trips have the same general shape of coverage as the medical trips, though with reduced coverage north of the river and increased coverage south. It is the social trip coverage that has the starkest gaps, though. When these three images are combined (figure 7) the limited coverage of social destinations has the biggest impact in determining which areas had full transit accessibility for seniors in this analysis.

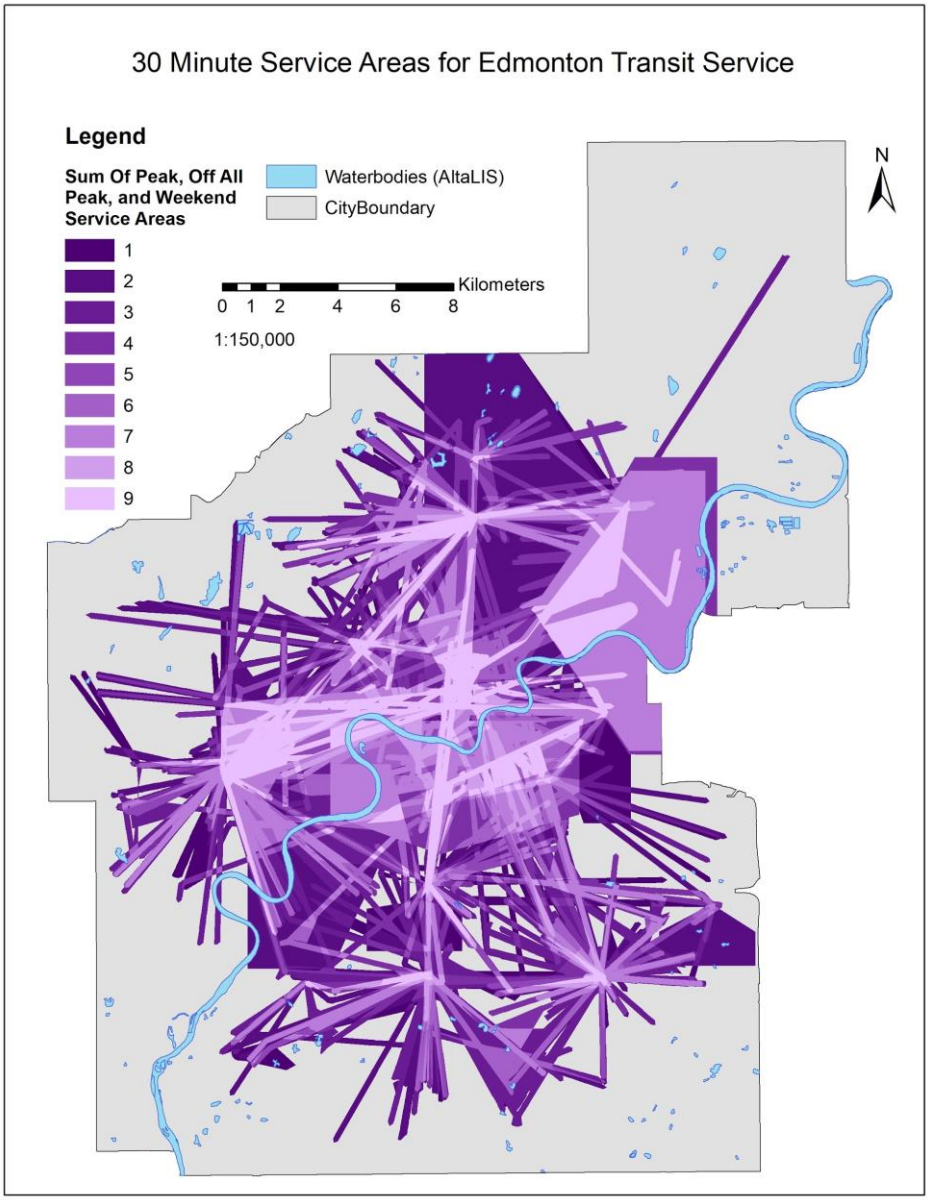

Figure 7: The final measurement of transit accessibility in Edmonton created by combining the results of each 30 minute service areas polygon for each destination proxy point. Visually, the sum of all three images in Figure 6. “9” is full access, and “1” is coverage for one trip type at one service level.

The sum of all three trip type service areas at all three levels of mass transit service, as seen in figure 7 show that there are pockets of full transit accessibility at transit centres in Edmonton. In the areas with a value of 9 a senior citizen could meet all three trips on mass transit at any level of service. In spaces with a value of 1, they would be able to complete only one trip type at one service level within thirty minutes. Outside the 30 minute service areas, residents may have a transit stop close to their home, but the network does not sufficiently connect them to their medical, essential, and social trip needs. This would result in them relying on automobile transportation, provided either by friends or by private companies if they cannot drive themselves.

Edmonton seniors living in areas with partial transit accessibility must plan transit trips to avoid becoming stranded. This may increase their social isolation, prevent them from completing grocery shopping trips, or limit their opportunities to attend medical appointments. In terms of the area covered by each value in figure 7, the mode of coverage distribution is 7 as seen in Table 1.

Since the major constraint is social service area coverage, it is likely this value of 7 reflects locations where medical and essential access is adequate, but social accessibility is low. In terms of Age Friendly Edmonton, this social access deficiency poses a significant risk to the goal of ensuring seniors populations remain healthy. Social connections are important to mental health (Dobbs et al., 2018).

Access value (Figure 2)	Area ($km^{2)}$
9 (Full accessibility – all trips)	39.2
8	14.9
7	76.0
6	25.4
5	19.9
4	36.6
3	47.6
2	53.7
1 (Minimal accessibility)	15.4
Outside all service areas	371.1

Table 1: The total area in each service level over Edmonton as seen in Figure 7.

This analysis gives a different framework for conceptualizing the value of mass transit in supporting seniors to complete their transportation needs without relying on automobility. It focused on destinations rather than origins to measure transit accessibility. The value of this analysis is subject to limitation from individual behaviours and source data quality.

Limitations

The basis of this spatial analysis is the transit network, and most limitations of this analysis originate from the gaps in the transit source data. Edmonton Transit Service has routes that run only during the summer months. When post-secondary institutions are closed during the fall and winter terms for reading weeks, as well as over the summer when enrollment drops, service levels also drop. These temporal changes were not in the transit files generated from open data. The transit model is a snapshot of service at the time the data was prepared for network analysis.

The service areas reflected a standard rate of travel of 25 km/h, while travel speeds for busses are known to vary according to multiple factors (Boyle, 2013). All bus stops are considered equal in this analysis. The model does not account for other trip selection preferences such as frequency of route, directness of travel, or the infrastructure of stops such as having a bench or shelter. In particular, waiting is more comfortable for seniors if they have a safe and comfortable place to sit, especially if they have a biophysical limitation or rely on a walking aid.

The model excluded destinations more than 200 meters from the transit network, which may mean there are better accessibility levels for seniors willing to walk farther from the bus. The reduced tolerance, however, seem relevant given Edmonton's identity as a winter city. The willingness to walk drops off in cold and dark environments. Additionally, when parts of the pedestrian network are not cleared of snow and ice they can become insurmountable barriers to people with personal mobility challenges.

This analysis also treats each physician, grocery store, and senior centre as equal in the sense that provided one opportunity exists within the 30 minutes travel time projection the need is considered satisfied. It is acknowledged that people may prefer specific service providers, however. A doctor further away that has better scheduling options, or a further trip to a store with lower produce prices would potentially be worth additional travel time costs. Having a closer option, though, increases the security in being able to meet individual transportation needs if the cost-benefit analysis changes.

The limitation of the destination points is that the sources may not have been comprehensive. While most businesses choose to ensure they can be found on resources like Google Maps, or in their professional association listings, there may be delays in refreshing the data that could reduce its accuracy.

MARD Centre Data Limitations (Alberta Provincial Transportation Needs Assessment 2016-2017)

In their analysis of the MARD data, Dobbs et al. acknowledge that while the sampling method was random, there are some data features to be considered as potential limitations (2018). Firstly, the sample overrepresented women, though this may correlate with the tendency of women to live longer than men in North America. Since calls were made to landlines, only those who were at home could be polled, and individuals with only a cell phone were structurally excluded from the survey. Given the focus of this analysis on service areas and destinations, this is not anticipated to have a significant impact. The number of respondents in Edmonton, however, was not large enough to run additional regressions about the relationship of the service areas and the experience of unmet transportation needs.

Future Analysis

This analysis could be run using different thresholds for the transit system, with different travel distances, or using other data sets to generate a more complete transit system, such as pedestrian connections. The decisions made for this analysis were based on the understanding of senior mobility in Edmonton through academic and grey literature. Other sources could justify changing the design of the service area calculations which would impact the resulting analysis.

As Edmonton implements a Smart Fare system, fine grained origin and destination data for seniors can be collected. It is important to note, however, that such data will only capture the trips taken and not those postponed or cancelled based on insufficient transit accessibility.

Policy Implications

In areas with low transit service and high concentrations of senior citizens, the city may need to consider adding service to ensure those seniors do not become socially isolated or disengaged from their communities. This could be done through an extension of DATS eligibility, a senior rate for taxi services, or through funding agencies that provide volunteer-run paratransit services.

Volunteer-based agencies may also be able to use this analysis to generate business cases to extend or expand their transportation programs. In some cases, provincial funding may be an option for programs like Meals on Wheels that bring either food or groceries to people unable to access them on their own.

Given Edmonton’s commitment to being an age-friendly city, it cannot leave seniors trapped in their homes or dependent on friends and family. In Saskatchewan, another prairie province, seniors spoke of how isolating it was to be dependent on friends and families for rides (Bascu et al., 2012). The willingness or ability of these informal transportation arrangements is finite.

Individuals in the baby boomer generation, as well as seniors just beginning to feel they should reduce their driving, may find this analysis helpful in selecting a new residence where they can age-in-place. That is a home where they can plan to continue their employment, volunteer, social, medical, and essential trip commitments independently through the use of mass transit so future reductions in automobility do not isolate them in their residence.

Conclusion

What this analysis shows is that the distribution of origin points is less impactful that the connections to destinations in the transit system. If Edmonton wishes to achieve its goals of mode shifting away from the automobile and being an age friendly city, then the measure of transit accessibility matters more than the proximity of a bus stop close to residences. The network needs to have destinations close to the transit system with service that can capture a large portion of Edmonton across all service levels.

It is also important to focus on transit not just during peak times, like the rush-hour commute, but on the service throughout the day and week. For seniors to feel confident using transit they need to be able to plan and complete a return trip. They may also feel more comfortable using transit during off-peak times when there is more time to ask for assistance from the operator. Full transit accessibility across all time periods means that seniors can volunteer, shop, attend medical appointments, visit friends, and work with greater flexibility and confidence, fulfilling the stated goals of an Age Friendly Edmonton.

Unmet transportation needs correlate with social isolation, decreased health and well-being, and reduce the opportunities seniors have to remain active participants and contributors to their communities. If Edmonton does proceed with reducing the coverage of areas with low ridership as part of its revisions to its transit services, this could create an increase in forgone transportation. In order to keep seniors without automobility independent and connected to the city, additional funding may be needed. Areas found with high unmet needs or low transit accessibility would likely see a higher return on investment for volunteer driver services or other paratransit extensions.

For members of the baby boomer generation contemplating their lives with less driving or a time without a car, they may wish to locate in parts of their city that have robust transit service rather than remain in an autocentric neighbourhood unable to both age-in-place and retain their mental and physical health.

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