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Using GIS to Examine Transportation Connectivity in Saskatchewan

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Abstract

Transportation services (transit, bus, shuttles) in rural areas are critical for connecting to larger urban centers where social and health services are predominantly located. The province of Saskatchewan, Canada, is largely rural, and residents cite a lack of knowledge of what transportation services are currently available. Through conducting an environmental scan, we collected information on types of transport (public and private), modes of transportation, hours of operation, cost, booking, route information, geographic boundary, passenger capacity. This study used GIS to illustrate the transportation connectivity in Saskatchewan, including connectivity between all cities. The results showed that there are significant challenges in connecting rural areas with medium and large urban centers. Many communities do not have any transportation options, and those that do, are costly and restrictive in terms of routes and schedules. The geographical maps show the gaps in transportation connectivity. This information is important for policymakers and industry to show where connectivity can be improved.

Keywords: transportation, rural, GIS, geography

1.0 Introduction

Being unable to drive is associated with loss of independence, social isolation, and depression (Chappell, 2003; Clark & Leipert, 2012; Kitchie, 2004; Saito, Sagawa, & Kanagawa, 2005; Wang & Laffrey, 2001). Residents living in rural areas who cannot drive face particular challenges as there is often a lack of available transportation services, e.g., buses, shuttles, community van, (Dewees, 2000; Gesler & Rickett, 1992). Additionally, prior studies have noted that rural residents have poorer health and lower incomes than urban residents (Allen & Farber, 2019; Lucas, 2012). Studies show that vulnerable populations have difficulty accessing health

care in major cities (where most of the hospitals are) even when living in suburban areas (Boisjoly et al., 2019). Without adequate transportation services, accessing urban centers can be difficult, especially in rural areas where connectivity to urban centers is more challenging due to having fewer transportation services available**.**

In the province of Saskatchewan, approximately 36% of the population live in rural areas (Statistics Canada, 2016a), which is defined as living in areas with less than 1000 residents and/or where the access to key amenities is greater than 5 km (Statistics Canada, 2008). Residents living in rural areas are often less affluent, older, and have limited access to health services (Litman, 2003; Starkey, Ellis, Hine, & Ternell, 2002; Statistics Canada, 2008). This is due in part to greater migration of younger family members to cities, part-time/part-year employment, and living far away from major cities (Hall & Olfert, 2015). The combination of limited transportation options with poorer socioeconomic status and health, and less familial support can result in transport poverty, limiting the ability to travel for important reasons (Allen & Farber, 2019).

Transportation poverty has been compounded in Saskatchewan as several well-established long-distance bus services stopped operating. For example, the Saskatchewan Transportation Company that provided 254 rural communities with transportation to urban centers stopped operating in May 2018 (Saskatchewan Transportation Company, 2017). Similarly, the Greyhound Bus Service (the largest North American intercity bus company) stopped its service in October 2018, and Alsaskbus Services (a private service) stopped its service in March 2018 (The Globe and Mail, 2018). While the primary reason for these service closures was related to financial viability, rural residents who were dependent on these services are now without transportation. Despite the loss of these transportation services, there are still many services available in the province; however, many residents report not knowing what is available nor how all the services connect with each other (Gallagher, Menac, & Keefe, 2007; Jeffery, Bacsu, Martz, Johnson, Novic, & Abonyi, 2011). Having access to this information is necessary for transportation planning.

In Florida, researchers from the University of Florida, in collaboration with the Department of Transportation, developed a user-friendly website with transportation service options in each of Florida's 67 counties (e.g., bus, train. taxi). The website contains information on route distance and location, wheelchair accommodation, age stipulations, and whether an escort is provided. Additionally, there is information on hours of operation, booking process, and cost. The state of Georgia has a similar website providing information on transit and car/van-pool services although there are many counties and communities that are not included (focus is on metro Atlanta and a few outside counties). However, neither of these websites show transportation connectivity, nor have they been used to address transportation gaps.

Prior studies have used Geographic Information Systems (GIS) to develop transportation plans. For example, together with information on travel time, locations, connectivity, operating costs, and profit, GIS has been used to develop high-speed railway plans (Farooq, Xie, Stoilova, & Ahmad, 2019) and transit systems between large cities (Farooq et al., 2018). Using GIS, the purpose of this study is to describe all available transportation services in Saskatchewan and to map their connectivity to and from major cities in order to identify transportation gaps in the province. A secondary objective is to provide information on transportation service routes, service hours, schedules, reservation requirements, and cost.

2.0 Methods

2.1 Protocol

The first step of this study was an environmental scan to capture the necessary information on transportation services, both within and between communities, towns, and cities in Saskatchewan. This research was conducted in 2018. All communities/towns/cities were classified as rural, small, medium, and large population centers based on population counts from the Canadian Census (Statistics Canada, 2016b): rural areas were defined as a population of less than 1,000; small centers with a population of between 1,000 and 29,999; medium centers with a population of between 30,000 and 99,999; and large centers with a population of 100,000 and over (Statistics Canada, 2016b). Additionally, we collected information on the population of each population centre (using Saskatchewan data from the 2016 Canadian Census). Next, we collected information on the mode of transportation options available in these communities/towns/cities (e.g., vans, buses, taxis, shuttles), as well as the types of transportation service, their hours of operation, cost (per kilometer/hour/trip), booking, routes, geographic boundaries and passenger capacity. This information was collected through various sources such as website review (e.g., Google, 211 service directory, town office, and government webpages), social media (e.g., Facebook), and by contacting organizations via phone that offer any type of transportation service. The environmental scan identified 156 rural/small/medium/large population centers.

Information for each community/town/city was entered into a spreadsheet (Microsoft Excel) and segregated by six different regions: North, West Central, East Central, South Central, South East, and South West. The collected data (e.g., websites, social media, and transportation organizations) were compared by two researchers to assess their accuracy, relevancy, and consistency to ensure content validity and to remove duplication (Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003). Data were organized and grouped into four categories consisting of taxi services, private services, volunteer and community driver programs. Private services are private companies (or privately owned) and are profit-driven. Volunteer driver programs are defined as transportation services that are provided by volunteers who donate their time and vehicles, and community driver programs provide transportation services that are subsidized by the government or by community-based organizations.

Subsequently, the spreadsheets were imported into GIS and maps developed, showing all the transportation services and their routes with unique colours, patterns, colors, customized icons, and text size in Saskatchewan. Four GIS maps were produced: a general overview of transportation services in all communities/towns/cities in Saskatchewan; two maps showed the routes and connectivity between population centers for both community and volunteer driver programs, and one map showing areas with no transportation service or only those towns/communities with in-town services only.

2.2 Analysis

Descriptive statistics were calculated for continuous (Mean±SD; range) and categorical variables (frequencies and percent), respectively, to summarize the transportation data (booking information, passenger capacity, types of transportation service, their hours of operation, cost, routes, and geographic boundaries) for the

four population groups (rural/small/medium/large population centers). A one-way ANOVA (Analysis of Variance) was used to compare mean scores between the population groups with respect to number of transportation services (dependent variables). The Bonferroni post-hoc test was used to determine differences between the population centres. Fisher exact tests were used to determine the association between population centers and types of transportation services provided. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 24. ArcGIS version 10.4 was used to display and visualize all available transportation services and routes, and their connectivity in Saskatchewan.

3.0 Results

Of the 156 communities identified in Saskatchewan, 58.3% (91 communities) were classified as rural areas and 39.1% (61 communities) as small population centers, and 2.6% as medium and large population centers, respectively. The two medium population centers are Moose Jaw and Prince Albert while the two large population centers are Regina and Saskatoon. As shown in Table 1, larger population centers have more transportation services compared to small or rural regions. There was a significant difference in the number of transportation services offered between population centers ($F(2, 153)=88.559$, $p<0.001$). The Post-Hoc test shows that large cities have significantly more transportation services than rural areas, small towns, and medium-size cities (with all p values being less than 0.001). Additionally, medium and large centers are significantly more likely to have taxi services and less volunteer-based programs than rural and small population centers ($\chi^2=17.877$, $p=.006$). Approximately 56% of rural communities (51/91) and 13% of small population centers (8/61) had no transportation services.

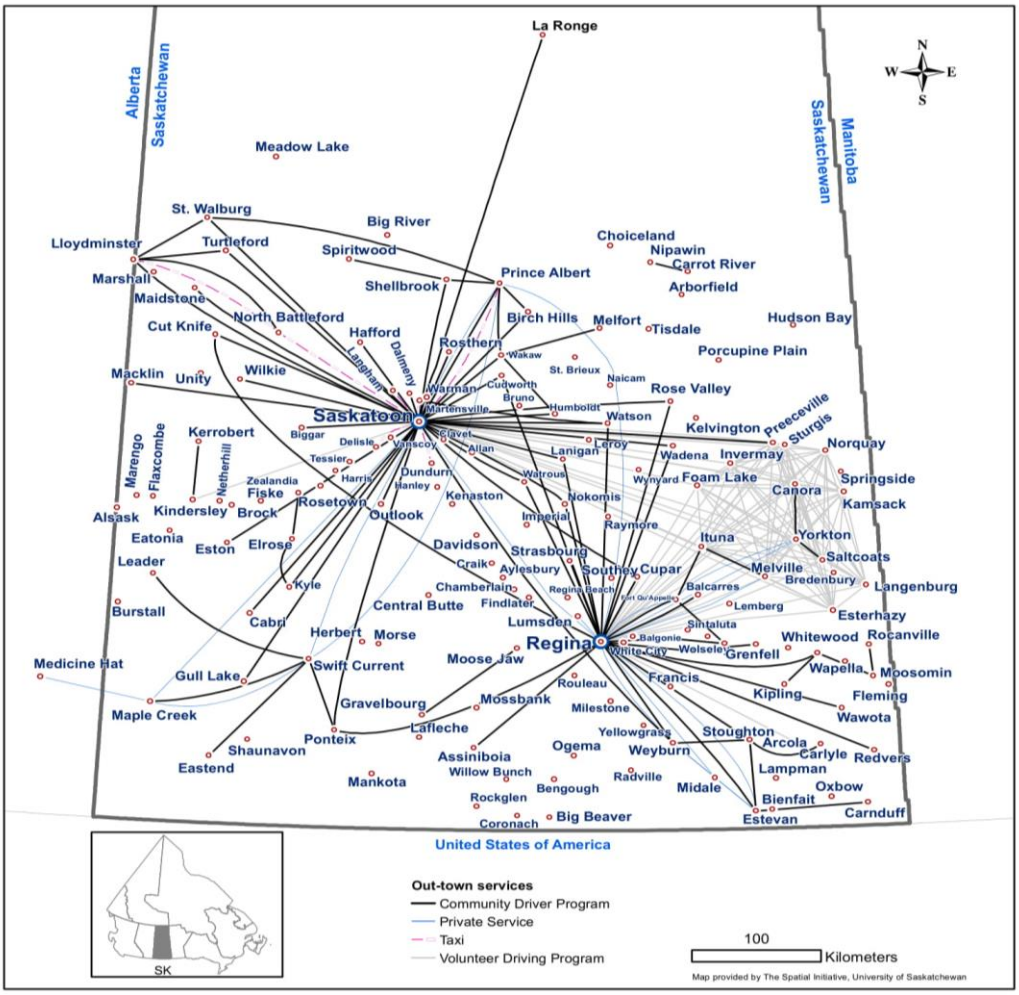
There were various types of transportation services identified in the environmental scan. Transportation services included community driver programs, volunteer driver programs, taxis, and private services. Community and volunteer driving programs only operate in rural areas and small towns, while private transportation and taxi services are found primarily in medium and large population centers. In some major cities (e.g., Saskatoon, Regina, North Battleford), taxis will provide transportation to rural communities. Community driver programs serve 35% of rural regions and 77% of small communities. Volunteer driver programs serve 13% of rural regions and 21% of small towns. Figure 1 shows the routes of all transportation services in the 156 towns/communities/cities.

While transportation services were available to connect large population centers with other large population centres (Saskatoon to Regina; Regina to Saskatoon), there was little connectivity for small and rural regions with medium and large population centers. Figure 2 shows the areas with no transportation services and/or areas with only local transportation. There are 51 rural areas with the average population of 387.79 (range of 10 to 973 people per community) and eight small towns with the average population of 2,079.67 (range of 1,038 to 4,571 people per community) with no service whatsoever. There are also 10 rural and 11 small towns with only local transportation services.

Table 1: *Descriptive Statistics of Transportation Services in Rural/Small/Medium/ Large Population Centers of Saskatchewan*

	N	Population Size	Number of Services	Volunteer Driving Program (%)	Taxi Services (%)	Private Services (%)	Community Driver Program		
							(%)	Cost ($)	Radius (km)
Rural	91	476.8±248.8 10-973	.53±.67 0-3	13.2	1.1	2	35.2	.69/km±.36/km .36-2	172.8±106.4 20-440
Small PC	61	3,463.3±3,930.2 1,033-16,604	1.36±1.1 0-5	21.3	4.9	18.2	77	.75/km±.49/km .40-2.88	176.6±107.6 8-380
Medium PC	2	34,908.0±1,439.7 33,890-35,926	4.0±2.8 2-6	0	100.0	50.0	0	N/A	N/A
Large PC	2	230,741.0±22,111.3 215,106-246,376	10.0±1.4 9-11	0	100.0	100.0	0	N/A	N/A

Figure 1. Transportation Routes and Their Connectivity in Saskatchewan.



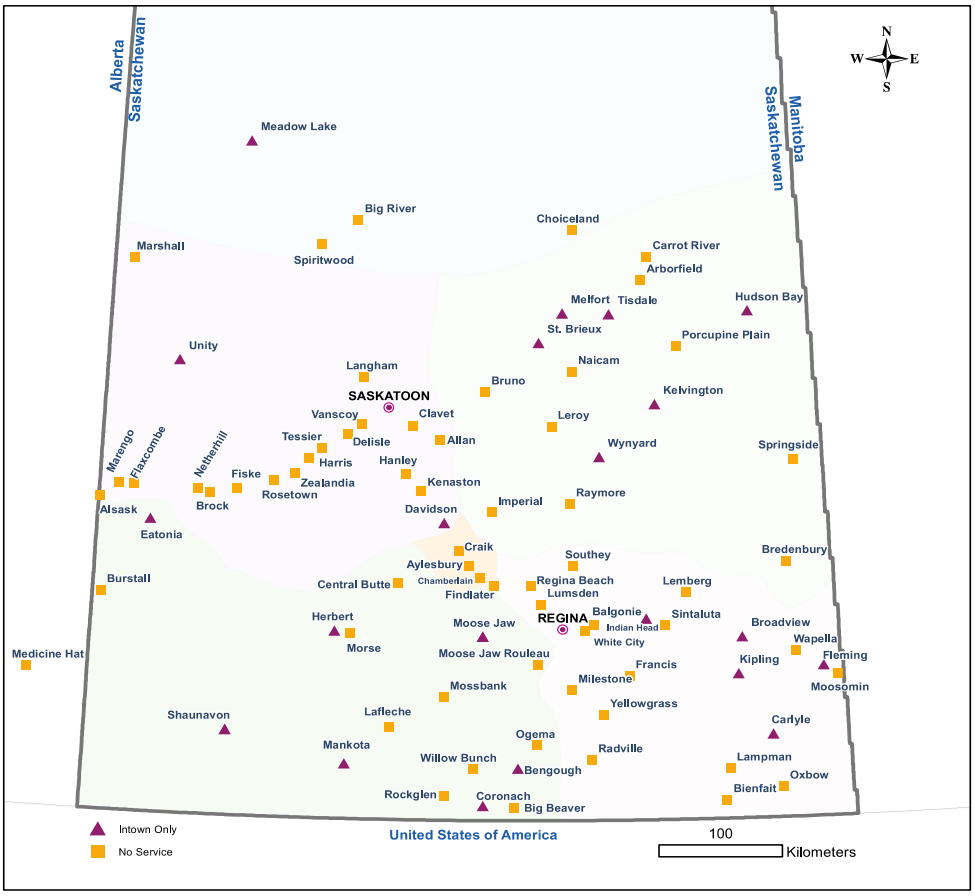
3.1 Community Driver Programs

The routes for all community driver programs are shown in Figure 3. Community driver services in rural communities and small towns consisted of nineteen Handi-van/bus, four Care-a-Van/bus, three Mobility vans/bus, three Dial-a-Van, and one-Wheeler van that offer door to door service, mostly within regular working hours (i.e., 9 am to 5 pm). The vans/buses are run by the community programs (non-profit) and can travel 172 km on average in rural areas and 176 km in small towns (for a round trip). Only 31.5% of rural communities have out-of-town transportation services; however, in 11 small communities (20.8% of small communities), no shuttle can be taken further than 67 km on average (the total distance to do a round-trip). To use this type of transportation, 24-hour advance notice is required. Scheduling is on a first come, first serve basis.

All the community vans and buses have space for walkers and wheelchairs, and all are equipped with an automatic lift. The community vans have seven seats and buses have 12 seats on average. The average cost for using a community van/bus in rural areas is 69¢ per kilometer and 75¢ in small population centers. Eligibility is for those who are 65 years of age and older and persons with disabilities. However, in a few rural communities such as Whitewood, Stoughton, and Rocanville and other small

population centers such as Outlook and Melfort, the vans/buses can be used by all community members, regardless of age.

Figure 2. Rural Areas and Small Population Centers with no Service.



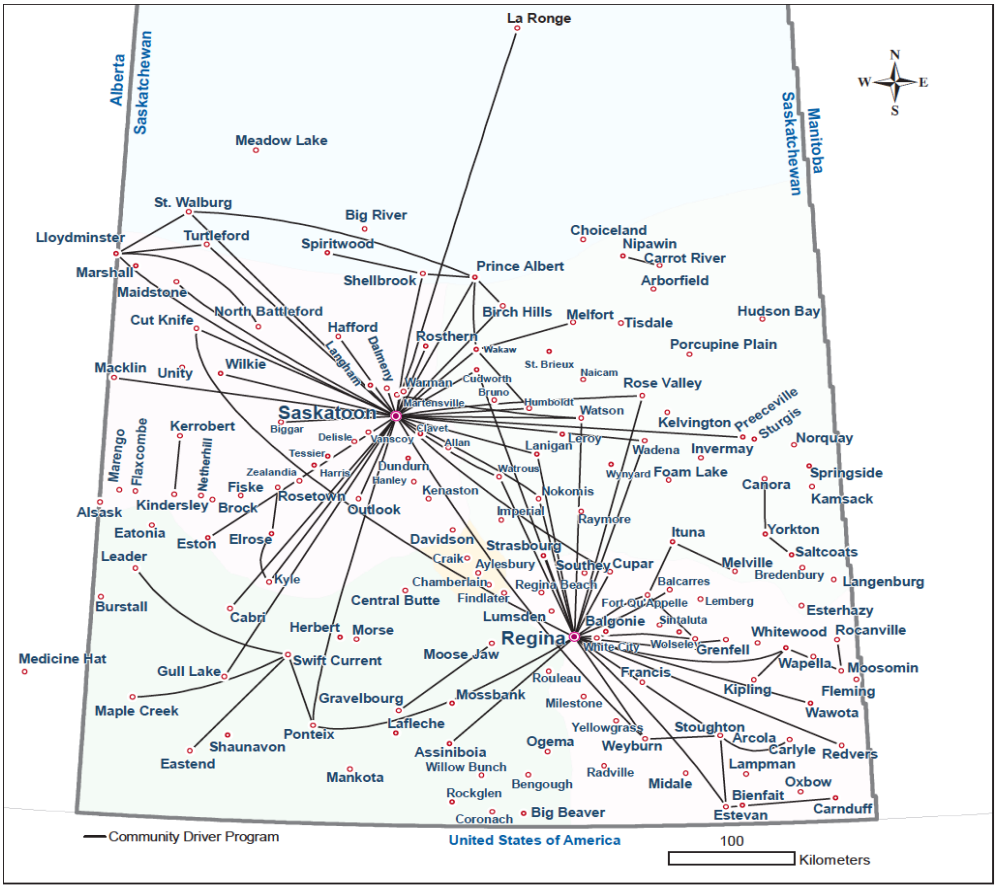
Some rural regions and small towns (e.g., Cudworth, Cut Knife, Dalmeny, Kyle, Wilkie, Preeceville, Saltcoats, Eastend, Gull Lake, Maidstone, Ponteix, Carnduff, and Weyburn) require clients to find their own community van/bus driver. These drivers are required to be paid (unless they are caregivers) and must have a Class 5 driver license, attend an orientation class (to learn how to operate the van/bus) and have their driver records reviewed by the Town Office.

3.2 Volunteer Driving Programs

All volunteer driving programs are operated by the Saskatchewan Health Authority (formerly the Sunrise, Cypress, and Heartland Health Regions) and Arcola Home Care. These volunteer programs offer transport services to clients who have limited mobility or who may have other medical issues. The volunteers at the Cypress and Heartland Health Regions and Arcola home care provide transportation to medical appointments and other activities (e.g., shopping, visiting friends/family, and social activities) while the Sunrise volunteer program offers transportation services only for medical appointments. The Sunrise Health Region, located in Eastern Saskatchewan, has the largest geographical span of the three regions that provide

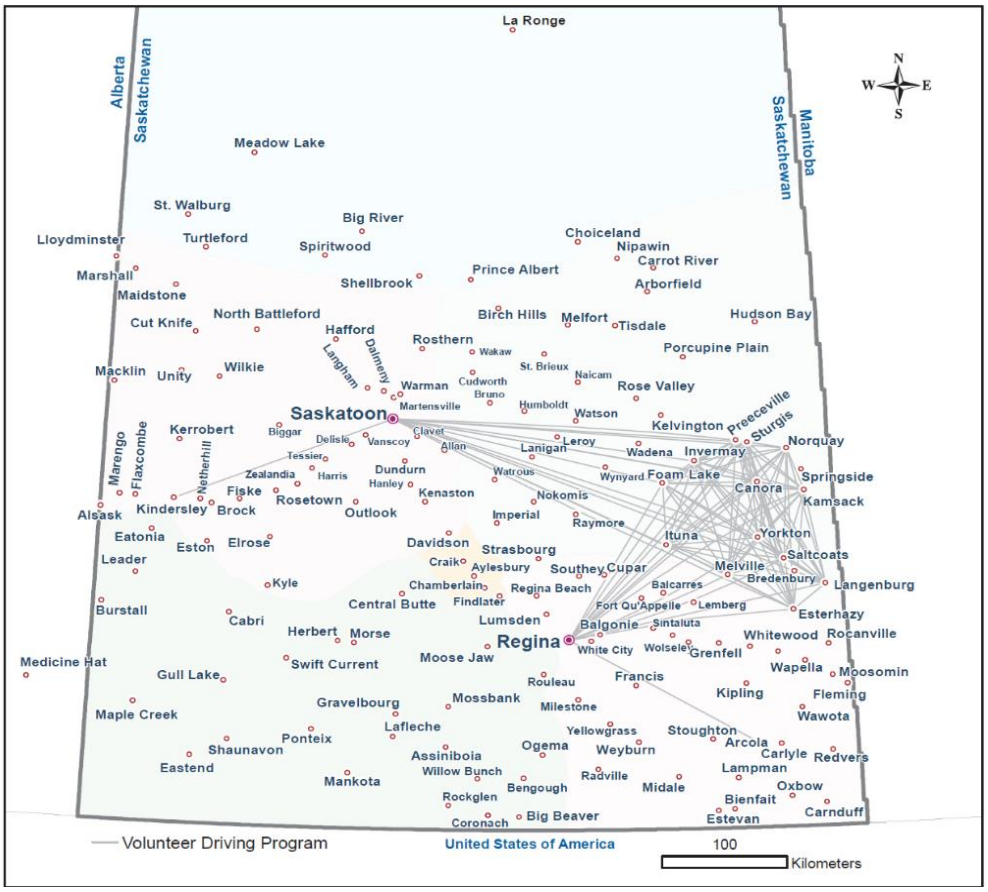
subsidized transportation service. This explains why many of the volunteer services are clustered around Yorkton, both within and outside local communities.

Figure 3. Community Driver Program Routes.



Volunteer drivers use their own personal vehicle and can typically accommodate only clients who can transfer themselves in and out of a vehicle. Clients using a wheelchair are required to rent a van/bus equipped with a lift from the community driver program. As shown in Figure 4, the Cypress Health Region (e.g., Cabri, Eastend, Gull Lake, Herbert, Leader, Maple Creek, Ponteix, Shaunavon, Swift Current, and Mankota**)** offers free local transportation only (in-town) in these rural communities. The Sunrise Health Region offers both in-town and out-of-town services for all their communities (e.g., Yorkton, Melville, Saltcoats, Langenburg, Esterhazy, Ituna, Foam Lake, Invermay, Preeceville, Sturgis, Norquay, Kamsack, and Canora). The cost of trips within the community is $12 for a round trip, and trips outside the community are 43¢ per kilometer. Additionally, drivers must be compensated by the clients for accommodation costs and meals/beverages if they have to stay overnight. They also have the right to refuse service if travel is not recommended by the Highway Hotline or anytime they believe conditions to be unsafe. The Arcola Home Care and The Kindersley Integrated Health Care Facility offer transport within and outside of the community at 43¢ and 45¢ per kilometer, respectively.

Figure 4. Volunteer Driving program Routes.



3.3 Private Transportation Services

Private transportation services are primarily found in medium and large population centers, serving 50% of medium and 100% of large urban cities. Depending on the private providers, they offer transport services either on a predetermined route and on a predetermined schedule or on a flexible route with flexible schedules that depend on passenger requests. The following private services have routes and schedules that are fixed: Rider Express, Mi-Drive Shuttle, and DiCal Transport. Mi Drive Shuttle vans have 12 seats and can connect to Estevan, Midale, Weyburn, and Regina. DiCal Transport vans have 14 seats and operate between Regina and the small towns of Balcarres and Fort Qu'Appelle; as well as cities of Melville and Yorkton. The cost of these three fixed-route transportation services is 29¢ per km on average, ranging from 26¢ to 34¢.

There are other transportation services that provide individualized services with flexible routes. These include: AV Shuttle, Mi-Bus transportation, Door to Door, Wheels on Wheels, Where to Transportation Company, Van De's Accessible Transit, and Driving Miss Daisy. Rider Express, one of the larger private service company, uses vans with 14 seats and provides transport from Swift Current, Prince Albert, and Regina to Saskatoon and vice versa. Flexible-route transport service of AV Shuttle is equipped with wheelchair accessible vans that carry 12 passengers, serving Saskatoon and Prince Albert, Martensville, Warman, Swift Current, and Regina. People who use this service pay a minimum charge of $25 plus $2.12 per

kilometer. Door to Door private mini-vans have six seats and offer in-town service within Maple Creek at $5 (per round trip) and out-of-town rides at 65¢ per km to Swift Current, Medicine Hat, and Saskatoon. Where to Transportation Company, Wheels on Wheels, and Van De's Accessible involve small and medium vehicles with four to six seats, respectively, and operate in Regina providing transportation service within and outside of the city at $1.75 per km. In Regina and Saskatoon, passengers can use Mi-Bus transportation and Driving Miss Daisy for in-town services only. Rides by Mi-Bus busses start at $25 per trip, while the minimum fee for rides offered by Driving Miss Daisy is $8 (for the first minutes) followed by $1 for each additional minute. Mi-bus shuttles can carry a maximum of three wheelchairs and six ambulatory guests, respectively. Driving Miss Daisy has vans that are wheelchair assessible (can carry six passengers) while their cars can carry four passengers where wheelchairs are carried as baggage.

3.2 Taxi Services

Taxi companies such as United Cab, Comfort Cab, Crown Cab, and Regina Cab serve medium and larger population centers (e.g., Saskatoon, Battleford, and Regina) and can take clients to any community within Saskatchewan. Taxi services have an average cost of $3.82 drop rate (the starting meter) on all vehicles plus $1.70 per kilometer. The Society for the Involvement of Good Neighbors (SIGN) transportation program is an individualized service similar to a taxi that provides services to seniors (who are 55 or older) on weekdays. However, this service is only within the town of Yorkton at a cost of $6 per trip segment. Senior Taxi program in Maple Creek also offers in-town rides to the senior residents of this city at $2.50 per trip.

4.0 Discussion

There are significant challenges in connecting rural areas with large urban centers given the limited number of transportation options in rural and small population centers, the operation of a transportation service requiring specific credentials (e.g., Class II drivers' license), and cost. This is a serious problem for many rural residents, especially those with medical conditions or with disabilities, who often must travel to medium and large population centers to access specialized health services. Additionally, most transportation services do not operate on weekends or after regular working hours.

Private services are common in medium and large population centers. While these services are an option for residents living in larger urban centres to access medical services, only a few offer transportation services to rural regions (e.g., DiCal, Rider Express, and Mi Drive Shuttle). Many of the routes and schedules are fixed and are only provided during regular daily operating hours (e.g., 9 am to 5 pm). Additionally, there are some private services which can accommodate residents with physical disabilities; however, most do not and require the resident to be ambulatory. Using this type of transportation is feasible, with an average cost between 26¢ to 34¢ per kilometer travelled. This means a 100 km trip (200 km round trip) would cost between $52 and $68.

Unlike private services in medium and large population centers, transportation services in many rural areas and small population centers only offer in-town transport. Considering that volunteer driver programs are the main form of transportation in many rural communities and small population centers, it is very

difficult for residents to make spontaneous trips for any reason, including emergency medical appointments, to medium and large population centers. While the volunteer driver programs operated by the Saskatchewan Health Authority provide fixed routes with defined times to medium and large population centers, these are only available in certain areas of the province (the Sunrise, Cypress, and Heartland Health Regions). Most communities outside this catchment area rely solely on community volunteers who may have limited availability or who may not have a vehicle required for travel (e.g., wheelchair accessibility).

It is notable that there is a small number of private transportation companies offering rides in rural areas and small population centers in Saskatchewan. A prior study conducted in rural Saskatchewan showed that many residents are concerned that they do not have the finances to afford using transportation services (Jeffery et al., 2011). Saskatchewan is a large province with substantive distance and time required to reach medium and large population centers. The lack of transportation, in addition to rural residents being more isolated, and having poorer health and finances, contributes to the transportation poverty in the province. There is a clear need to make both transportation accessible but also financially feasible, for both the resident and service provider. For instance, the distance between Wilkie and Saskatoon is 163 km; approximately 2 hours. Given the rates of using a taxi, the cost for a one-way trip would be $314 ($618 round trip). This cost is simply not cost-efficient for any rural residents for a day trip into a medium or large population center.

This study shows that rural regions and small population centers have limited transportation options despite accounting for almost 97.4% of the province's geography. This accounts for a population of approximately 255,000; however, this number is likely underestimated. Saskatchewan has a population of 1.1 million (Statistics Canada, 2016a), and data shows that 33% of the population lives in rural areas, and 17% live in small population centres. This would suggest that approximately 550,000 residents live in rural or small population centres in Saskatchewan. Further work is needed to collect transportation information on additional rural communities we may have missed but more importantly, Indigenous communities, as many are located in rural areas. Future studies should also consider using GIS to analyze transportation routes in more detail including by frequency (e.g., perhaps by weighting lines more heavily) and by cost to determine the most abundant travel options. GIS can also incorporate socioeconomic data, as well as health data, to provide a more comprehensive picture of transportation poverty.

5.0 Conclusion

This study showed how GIS could be used to map transportation routes. In Saskatchewan, there is poor transportation connectivity between rural and small population centers with larger centers where many social and health care services reside. Policymakers, researchers, and engineers, should use the study findings to plan and develop transportation services covering areas that are without access. This would result in improved connectivity and potentially reduce transportation poverty.

Acknowledgements

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References

Allen, J., & Farber, S. (2019). Sizing up transport poverty: A national scale accounting of low-income households suffering from inaccessibility in Canada, and what to do about it. *Transport Policy*, 74, 214–223. https://doi.org/10.1016/j.tranpol.2018.11.018

Boisjoly, G., Deboosere, R., Wasfi, R., Orpana, H., Manaugh, K., Buliung, R., El-Geneidi, A. (2018, July). *Accessibility to healthcare via public transport across Canada.* Paper presented at the 98th Annual Meeting of the Transportation Research Board, Washington, D.C., USA.

Chappell, N. L. (2003). *Aging in contemporary Canada*. Toronto: Prentice-Hall.

Clark, K. J., & Leipert, B. D. (2012). Strengthening and sustaining social supports

Dewees, S. (2000). Transportation in rural communities: Strategies for serving welfare participants and low-income individuals. *Welfare Issue Brief. Calverton, MD: Macro International.*

Farooq, A., Xie, M., Stoilova, S., Ahmad, F., Guo, M., Williams, E. D., Gahlot, D. Y., Issa, A. M. (2018). Transportation planning through GIS and multicriteria analysis: Case study of Beijing and XiongAn. *Journal of Advanced Transportation*, Article ID: 2696037. https://doi.org/10.1155/2018/2696037

Farooq, A. Xie, M., Stoilova, S., Ahmad, F. (2019). Multicriteria evaluation of transport plan for high-speed rail: An application to Beijing-Xiongan. *Mathematical Problems in Engineering*, Article ID: 8319432. https://doi.org/10.1155/2019/8319432

Gallagher E., Menac V., & Keefe J. (2007). Age-friendly rural and remote communities: A guide. Retrieved from http://www.phac-aspc.gc.ca/seniors-aines/alt-formats/pdf/publications/public/healthy-sante/age_friendly_rural/AFRRC_en.pdf

Gesler, W. M., & Rickett, T. C. (1992). *Health in rural North America: The geography of health care services and delivery*. New Brunswick: Rutgers University Press.

Jeffery, B., Bacsu, J., Martz, D., Johnson, S., Novik, N., & Abonyi, S. (2011). *The role of social systems in the health of seniors living in rural Saskatchewan: Pilot project report.* Regina & Saskatoon, Saskatchewan, Canada: Saskatchewan Population Health Evaluation Research Unit.

Kitchie, S. S. (2004). Rural elders with chronic disease: Place of residence, social network, social support, and medication adherence. *Dissertation Abstracts International*, *64*(08), 3745.

Litman, T. (2003, June). *Social inclusion as a transport planning issue in Canada*. Contribution to the FIA Foundation G7 Comparison Paper, presented at the European Transport Conference held in Strassbourg, France.

Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy*, *20*, 105–113. http://dx.doi.org/10.1016/j.tranpol.2012.01.013

Rubio, D. M., Berg-Weger, M., Tebb, S. S., Lee, E. S., & Rauch, S. (2003). Objectifying content validity: Conducting a content validity study in social work research. *Social Work Research, 27*(2), 94–104.

Saito, E., Sagawa, Y., & Kanagawa, K. (2005). Social support as a predictor of health status among older adults living alone in Japan. *Nursing & Health Sciences*, *7*(1), 29−36. https://doi.org/10.1111/j.1442-2018.2005.00220.x

Saskatchewan Transportation Company. (2017). Retrieved from https://www.cicorp.sk.ca/publications/saskatchewan_transportation_company

Starkey, P., Ellis, S., Hine, J., & Ternell, A. (2002). *Improving rural mobility: Options for developing motorized and nonmotorized transport in rural areas*. Washington, DC: The World Bank.

Hall, H., & Olfert, R. (2015). Saskatchewan. Retrieved from the State of Rural Canada website from http://sorc.crrf.ca/saskatchewan

Statistics Canada. (2008). *More information on rural area (RA).* Ottawa, Ontario, Canada. Retrieved from http://www12.statcan.ca/english/census06/reference/dictionary/geo042a.cfm

Statistics Canada. (2016a). *Census Dictionary: 2016 Census of Population*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/ref/dict/index-eng.cfm

Statistics Canada. (2016b). *Population Centre and Rural Area Classification*. Retrieved from https://www.statcan.gc.ca/eng/subjects/standard/pcrac/2016/introduction

The Globe and Mail. (2018). *Greyhound cancels most of its routes in Western Canada*. Retrieved from https://www.theglobeandmail.com/canada/article-greyhound-cancels-most-routes-in-western-canada/

Wang, H. H., & Laffrey, S. C. (2001). A predictive model of well-being and self-care for rural elderly women in Taiwan. *Research in Nursing & Health*, *24*(2), 122−132. https://doi.org/10.1002/nur.1015