# OPERATIONAL PLANNING FOR HEALTH TRANSPORT OF OLDER ADULTS IN NEW BRUNSWICK

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## 1 Introduction

Older adults (65+) are highly dependent on personal vehicles for trips that require transportation, especially residents in rural regions, however, the health effects of aging can impact their abilities to safely operate a vehicle over time (Syed & Holland Jr., 2016). In urban locations, non-driving older adults often have access to public transportation services, but those in rural areas have limited transportation alternatives. Although many rural individuals rely on family or friends for activities that require transportation (Hanson & Hildebrand, 2011), older adults may not always have a support system for their transportation needs. This creates a challenge, and an opportunity for transportation engineers/planners to address the gap in the local network.

While the health effects of aging can make it more challenging for older adults to independently drive a vehicle, the health effects of aging can also result in an increased need of accessing healthcare services. The demand for accessible healthcare is a rising issue in Canada as the 'Baby Boomers' cohort ahve reached the age group of older adulthood (65+); a population proportion at an all-time high across Canada. In the case of New Brunswick, where rural residents currently account for half of the older adult population (McGeorge and Bateman, 2017), 20% of residents are above the age of 65 years old, with projections of reaching 31.3% by 2038 (GNB, 2017), the highest rate in Canada. These population increases are progressively impacting local transportation systems, but little is known to what extent. Thus, supporting the need for research to prepare for the existing and growing transportation challenges of older adults.

In many rural areas of New Brunswick, Volunteer Driver Program's (VDP's), "a network of non-profit organizations offering equitable community transportation solutions when no affordable and accessible service is available in a community" (GNB, 2017), provide transportation to healthcare services to individuals, including older adults, and is often one of the most frequent trip types while consuming the most resources (i.e. fewer passengers per ride, longer one-way travel distances than other trip types) (Hanson and Goudreau, 2019). Although VDP's are supporting older adults in reaching a healthcare facility, there is uncertainty on whether these programs can be a sustainable long-term solution for healthcare access. The demand for medical transportation may be greater than what can be offered by VDP's. The New Brunswick Health Plan (2021) discusses goals and objectives to assist older adults in meeting their health needs while staying at home for longer periods but does not discuss how transportation will be provided for their healthcare trips. Additionally, greater part of recent research and policy efforts have focused on reducing costs in New Brunswick (McGeorge and Bateman, 2017) resulting in consolidated healthcare services in urban facilities, thus increasing travel distances and transportation challenges.

Recent work at the University of New Brunswick (Morehouse, 2021) demonstrated the feasibility of using New Brunswick administrative health data accessed through the New Brunswick Institute for Research, Data and Training (NB-IRDT) for health transportation planning purposes. Healthcare data were yet to be analyzed for understanding the temporal characteristics associated with these records, such as healthcare access by time of day, day of week, month of year, and were evaluated in this study. Understanding temporal travel behaviours creates large potential in supporting the development of health transportation initiatives/solutions, including non-emergency medical transportation (NEMT) programs.

## 2 Background

While older adults use transportation for a variety of purposes, including life maintenance trips, work or education trips, and quality of life trips, health trips can be the trips that older adults find difficult to find alternatives for (Hanson and Hildebrand, 2011), which can explain by VDP often have "medical" trips as one of the most frequent trip types (Hanson and Goudreau, 2019). Without adequate travel options to healthcare facilities, older adults may be hesitant in accessing professional health services (Pesata, Geri and Webb, 1999), which can result in decreased health conditions over time and increased health costs for services at later stages at diagnosis.

Older adults in New Brunswick have alternatives to driving a vehicle for a health appointment, including walking, public transit, taxis, dial-a-bus/accessible transport, intercity bus, limited VIA Rail passenger services (Hanson, 2008), and in the case of healthcare, ambulances. The challenge, however, is with a large portion of population residing in rural areas, these services may be unavailable, inefficient by time or service frequency, or are expensive. Additionally, a demand for ambulance services for non-emergency situations can create excessive costs for government policies, withholding limited resources from potential emergency situations.

In the case of older adults who use their ability to independently drive a vehicle for transportation, this increases the proportion of "at-risk drivers" in the transportation system. As the abilities of driving a vehicle can diminish with increasing health effects of aging, greater risks of collisions are present and usually involve more severe injury/fatality rates for older age groups (Littman, 2022). This relationship is typically presented in a "U"-shape graph where the youngest and oldest drivers have the highest collision on an exposure basis.

Furthering the understanding of safety risks with increasing age, older adults self-regulate, including progressively avoiding driving at night, during hazardous weather conditions, and during rush hour periods (Rosenbloom, 2003). They may also avoid the usage of complex intersections, highways, or reduce their operating speed.

Given the difficulties and risks associated with driving a vehicle when experiencing the health effects of aging, driver safety risks are also weighed against the benefits of maintaining mobility. Although a response could include legislating "at-risk drivers" from the roads, this is not a practical solution given existing accessibility issues (e.g. limited public transportation options in rural regions) and would negatively impact the quality of life of older adults. Rather, providing older adults with acceptable mobility options can assist with the improvement of accessibility and the transition of "at-risk drivers" to being passengers. VDPs have emerged in many parts of New Brunswick as this on-demand solution that can benefit older adults, the challenge is that "medical" trips can be one of the largest consumers of volunteer resources in a VDP, which can risk their sustainability if drivers are asked to travel farther and for longer periods of time. A potential solution includes a non-emergency medical transportation (NEMT) program, a transportation service offered to patients and healthcare consumers that cannot meet their transportation needs independently due to personal barriers (Rosenbloom & Valenzuela, 2017), intended for the use of non-emergency related appointments. This system could serve to alleviate some of the medical transport responsibilities of VDP.

Currently, little is understood about the travel behaviours of older adults seeking medical care in New Brunswick. While a variety of data sources are used to understand travel behaviours, oftentimes, these data sources are inadequate to troubleshoot and plan for challenges at specific levels of trip purpose (e.g. health trips). Currently, Canadian datasets utilized primarily for transportation planning only pertain to "Journey to Work" and would not be relevant to those who may be retired, such as many over the age of 65 years. While travel surveys and other methods of data collection have been used to inform transportation planning at city or regional levels, data oftentimes are from a sample and is missing at the rural level. Administrative data provides metrics that could be used for transportation planning in these circumstances.

Administrative healthcare data is developed by provincial governments, containing records for each contact with a healthcare service (Cadarette & Wong, 2015). These records have variables that can be interpreted to determine patient travel distances, origins, destinations, and temporal characteristics. Unlike data sources from a sample, administrative data theoretically provides information in greater detail, with

higher accuracy, and at a relatively lower cost compared to most traditional collection methods. These data can permit an analysis of older adult's health travel behaviours. Morehouse (2021) demonstrated the feasibility of using administrative health data for transportation planning in New Brunswick, though their scope did not include more detailed understanding of the temporal and geographic characteristics of older adult health access.

Understanding temporal travel behaviours for the development of transportation initiatives, including NEMT alternatives, are significant. However, operational planning and forecasting for the demand of transportation alternatives for older adults (e.g. NEMT, VDP's), including those arising from increasing travel demand of an aging population, currently lack sufficient engineering research and technical guidance (Hanson, 2018). Nevertheless, understanding temporal metrics of health travel behaviours provides opportunity for transportation engineers, planners, and healthcare policymakers to minimize the gap and support the development of improved healthcare transportation policies.

More specifically, temporal descriptive statistics for healthcare access can be used to analyse trends and patterns in healthcare transportation utilization and demand over time (e.g. peak hours), allowing engineers to size the transportation system for anticipated demand and allocate resources appropriately. Temporal data can also be used to evaluate the effectiveness of transportation policies and interventions over time, allowing planners to make informed decisions to improve a transportation system.

## 3 Methodology

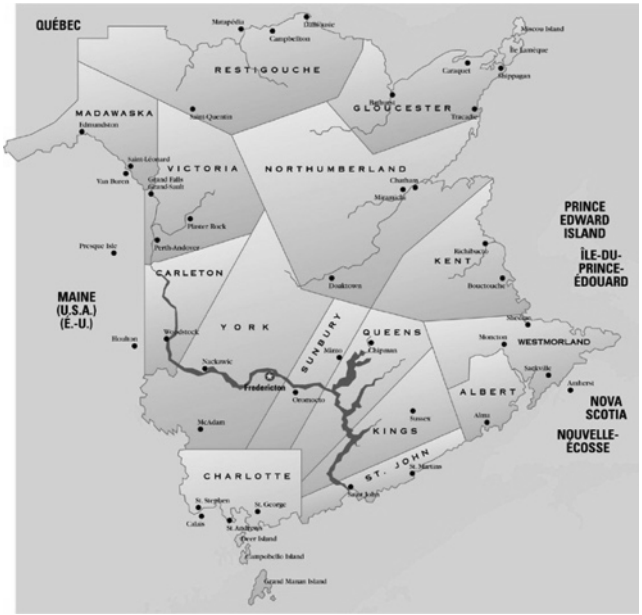
The following section describes the process of using administrative healthcare data from the NB-IRDT to inform operational planning for health transport of older adults in New Brunswick.

### 3.1 Working with Administrative Healthcare Data

The first stage of this study was to attain access to administrative data from the New Brunswick Institute for Research Data and Training (NB-IRDT), a facility permitting researchers access to health record information maintained by the Province of New Brunswick in a way that ensures confidentiality and anonymity of patient information. Several steps were required and facilitated by the NB-IRDT, including a feasibility application, a data access application, and a research ethics board application (REB 2022-098).

Upon approval of applications, "health trips" were assembled at the NB-IRDT by linking health record datasets to citizen and health provider datasets. Geographical variables were used to create nodes while a distance variable was used for trip lengths. Large merging operations were performed with SAS software, while minor tasks were performed with SPSS software, including confirmation that all data were for older adult (65+) health trips in New Brunswick, and that health trips were not duplicated. This was sometimes the case where a patient had multiple diagnosis entries for a singular health trip.

Figure 1: Counties of New Brunswick (GNB 2022)




The calendar years of 2006-2011 were used with the Physician Billing Database, and the fiscal years of 2005-2011 were used for the Discharge Abstract Database (DAD). DAD data captured all health visits to a hospital or health facility, whereas physician billing data captured health trips to a physician office, clinic, or other billing locations. During merging procedures, health records were linked to a Specialty Major Group Code, a physician specialty variable that had 3 outputs: General Practice, Medical

Specialty, and Surgical Specialty. General Practice focus on the prevention and diagnosis of a wide variety of medical conditions (e.g. flu, allergies). Physicians for this specialty provide comprehensive healthcare services to individuals, and when necessary, may be referred to a specialist. Medical Specialty focus on the diagnosis and treatment of a specific medical condition. Lastly, Surgical Specialty focus on the diagnosis and treatment of medical conditions that require a surgical intervention.

Once data were appropriately assembled into health trips, frequency tables, cross classification tables, means, % trips, cumulative % trips, trip factors, figures, and other forms of statistics were generated using SPSS software and Microsoft Excel. Primary goals in developing descriptive statistics were to analyze the temporal travel demands of health trips to support discussion on transportation solutions. Temporal health data were investigated by county origin/destination (Figure 1), Specialty Major, distance, and ambulance code.

**4.0 Results**

There were 368,525 hospital visits and 370,010 hospital discharges assembled from 428,180 hospital records with DAD data for the fiscal years of 2005-2011, and there were 7,048,015 physician visits assembled from 11,170,210 records in the *Physician Billing* Database for calendar years of 2006-2011. These figures represent the health trip frequencies following the linkage of health records to geographic data and the process of data filtration. Health trips were compared to health trips identified by Morehouse (2021) to ensure comparability of results and it was discovered there were 55% more DAD records and 60% more Physician Billing records than observed in their research. Upon further investigation, the large difference in health trip frequencies was due to altering linkage and merging processes with SAS software which likely undercounted the urban areas nearest the health facilities resulting in higher average travel distances than observed in this research. Summary results are provided in Table 1.

Table 1: Health Trips by Specialty Major and Age Group

| Description of Health Trip | | DAD Data | | | Physician Billing Data | | |
|---|---|---|---|---|---|---|---|
| | | **Number of Observations** | **Percent (%) Total Trips** | **Mean (km)** | **Number of Observations** | **Percent (%) Total Trips** | **Mean (km)** |
| General Practice | | 156,915 | 42.5% | 22 | 4,596,890 | 65.2% | 21 |
| Medical Specialty | | 47,975 | 13.0% | 65 | 1,317,130 | 18.7% | 38 |
| Surgical Specialty | | 163,635 | 44.4% | 43 | 1,134,000 | 16.1% | 36 |
| Total | | 368,525 | | | 7,048,020 | | |
| General Practice | 65-69 | 21135 | 13.5% | 26 | 1,144,645 | 24.9% | 23 |
| | 70-74 | 25030 | 16.0% | 25 | 1,011,845 | 22.0% | 22 |
| | 75-79 | 30510 | 19.4% | 23 | 929,750 | 20.2% | 20 |
| | 80-84 | 33465 | 21.3% | 21 | 764,265 | 16.6% | 20 |
| | 85-89 | 28105 | 17.9% | 20 | 496,670 | 10.8% | 19 |
| | 90+ | 18670 | 11.9% | 19 | 249,715 | 5.4% | 22 |
| | Total | 156,915 | | | 4,596,890 | | |
| Medical Specialty | 65-69 | 13255 | 27.6% | 83 | 353555 | 26.8% | 42 |
| | 70-74 | 11785 | 24.6% | 83 | 316375 | 24.0% | 41 |
| | 75-79 | 10500 | 21.9% | 78 | 277830 | 21.1% | 39 |
| | 80-84 | 7760 | 16.2% | 70 | 211335 | 16.1% | 34 |
| | 85-89 | 3700 | 7.7% | 56 | 116000 | 8.8% | 30 |
| | 90+ | 975 | 2.0% | 42 | 42040 | 3.2% | 27 |
| | Total | 47,975 | | | 1,317,130 | | |
| Surgical Specialty | 65-69 | 42210 | 25.8% | 46 | 299955 | 26.5% | 39 |
| | 70-74 | 40420 | 24.7% | 45 | 273340 | 24.1% | 38 |
| | 75-79 | 36830 | 22.5% | 43 | 241090 | 21.3% | 36 |
| | 80-84 | 26690 | 16.3% | 40 | 182240 | 16.1% | 34 |
| | 85-89 | 13045 | 8.0% | 39 | 100285 | 8.8% | 32 |
| | 90+ | 4440 | 2.7% | 39 | 37080 | 3.3% | 31 |
| | Total | 163,635 | | | 1,134,000 | | |

The data in Table 1 show that older adults in New Brunswick travel most often for General Practice visits to a physician and travel farthest to Medical Specialties at a hospital. The data in Table 2 show that typically the most rural counties had the highest mean travel distances and that the number of observations is commensurate with the population of those 65 years and older.

Table 2: Health Trips by Origin County

| Origin County | Pop. 65+ (2011) | | DAD Data | | | Physician Billing Data | | |
|---|---|---|---|---|---|---|---|---|
| | | | Number of Obs. | Percent (%) Total Trips | Mean (km) | Number of Obs. | Percent (%) Total Trips | Mean (km) |
| Albert | 4615 | 4% | 14,630 | 4.0% | 23 | 254,725 | 3.6% | 18 |
| Carleton | 4235 | 3% | 14,500 | 3.9% | 54 | 249,365 | 3.5% | 37 |
| Charlotte | 4735 | 4% | 15,720 | 4.3% | 59 | 288,790 | 4.1% | 44 |
| Gloucester | 14495 | 12% | 41,120 | 11.2% | 62 | 788,240 | 11.2% | 37 |
| Kent | 5990 | 5% | 15,760 | 4.3% | 56 | 310,470 | 4.4% | 36 |
| Kings | 9825 | 8% | 23,420 | 6.4% | 34 | 569,940 | 8.1% | 27 |
| Madawaska | 5885 | 5% | 17,735 | 4.8% | 25 | 336,160 | 4.8% | 22 |
| Northumberland | 9050 | 7% | 30,070 | 8.2% | 57 | 530,845 | 7.5% | 35 |
| Queens | 2710 | 2% | 7,790 | 2.1% | 62 | 164,915 | 2.3% | 40 |
| Restigouche | 6650 | 5% | 22,165 | 6.0% | 57 | 389,730 | 5.5% | 33 |
| Saint John | 12595 | 10% | 33,505 | 9.1% | 11 | 770,235 | 10.9% | 11 |
| Sunbury | 2875 | 2% | 8,950 | 2.4% | 28 | 178,900 | 2.5% | 27 |
| Victoria | 3440 | 3% | 12,035 | 3.3% | 63 | 219,385 | 3.1% | 38 |
| Westmorland | 22255 | 18% | 69,910 | 19.0% | 20 | 1,222,285 | 17.3% | 16 |
| York | 14255 | 12% | 41,215 | 11.2% | 32 | 774,030 | 11.0% | 21 |
| Total | 123,610 | 100% | 368,525 | | | 7,048,015 | | |

### 4.1 Temporal Descriptive Statistics (Hospital data only) for Health Trips in 2005-2011

Appointment arrival/discharge times were generally not recorded for Physician Billing health trips, therefore hourly information was only available for hospital admissions. In Figures 2 through 5, DAD health trips were put into temporal bins and divided by the total days in the study period (2191 days) to obtain daily averages of New Brunswick hospital admissions and discharges per day. Primary temporal admission results were found through a specialty major lends, whereas main discharge findings were found on an hourly level. The total provincial average daily admissions and discharges for those aged 65+ in New Brunswick were found as 168 and 169 respectively.

Figure 2: NB Average Daily Hourly Admissions

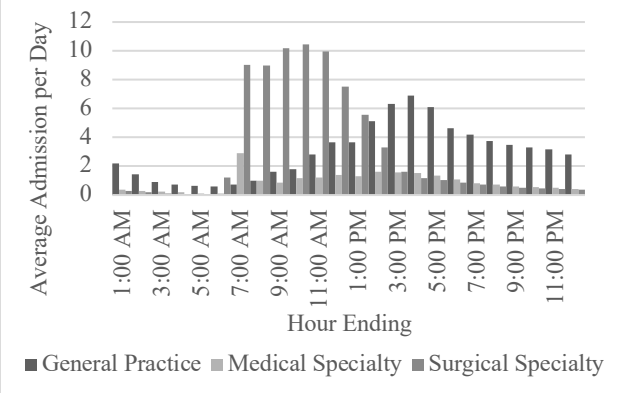



Figure 3: NB Average Daily Hourly Discharges

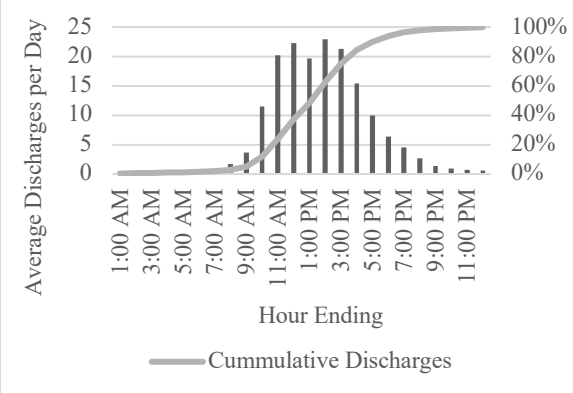


Figure 4: NB Average Daily Weekly Admissions

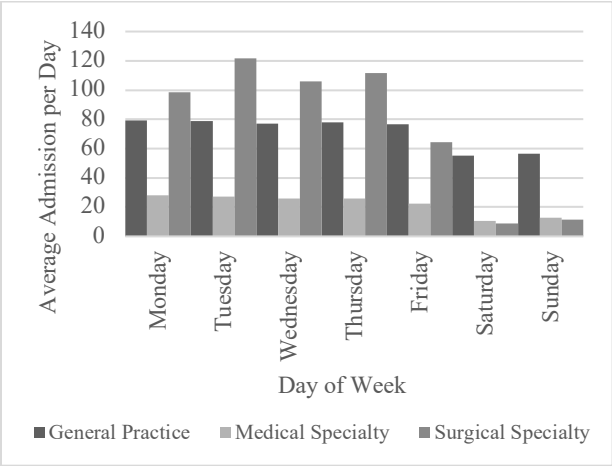



Figure 5: NB Average Daily Monthly Admissions

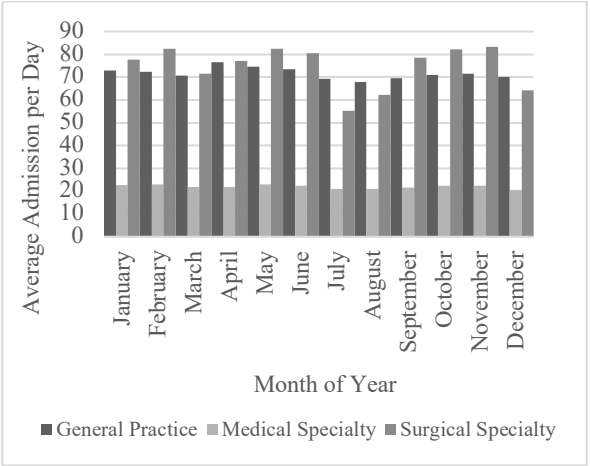



Figure 2 shows admission hours were generally during the daylight hours with 55% of total trips in the period of 8 AM – 4 PM, and 78% of total trips in the period of 6 AM – 6 PM. The fewest admissions were late night and early morning (3 AM – 6 AM). Figure 3 shows that health discharge times exhibited a normal distribution with a peak around 1:00 PM. These discharges generally correspond to normal physician work hours. It was observed that 81% of discharges were during the period of 8 AM – 4 PM, 95% of discharges were found in the period of 8 AM – 8 PM, or 92% of discharges were found in the period of 6 AM – 6 PM.

As illustrated in Figure 4, there were visible variations in peak times for different types of health visits. General Practice admissions displayed a normal distribution with peak hour admissions occurring midafternoon. Whereas, Surgical Specialty and Medical Specialty admissions were found busiest in the morning, and progressively becoming less busy throughout the day. These findings were significant as distinct travel behaviours were found for different types of health trips, thus, improving the understanding health travel behaviours. An additional remark includes the jolt in Medical Specialty admissions between 6 AM – 7 AM. This may be caused by health trips taking place the day before for a morning opening appointment with a physician.

Admission trends also varied when considering the type of health visit over a day of week and month of year analysis in Figure 4 and 5. For a day of week analysis, Surgical Specialty admissions were found largest in Specialty Major frequency, being the busiest on Tuesdays and Thursdays, and falling most considerably on the weekend. Medical Specialty and General Practice admissions were more constant throughout the weekdays, with small reductions over the weekend. In terms of monthly analysis, General Practice and Surgical Specialty admissions followed a similar trend with high admission peaks in February, May and November, and low admission peaks in July, August, and September. Medical Specialty admissions remained approximately stagnant over each month. Additional remarks include very similar day of week and month of year discharge trends when compared to admission results.

Connecting health provider destinations and citizen origins, it was found that health trips were less common with increasing distance, with 57% of all health trips between 0 – 25 km, and 18% between 26 – 50 km. Distance admission results were compared by Specialty Major and is displayed in Table 3.

Table 3: DAD Health Admissions by Travel Distance (km)

| Travel Distance Bins (km) | Percent (%) Specialty Major Health Trips | | | Total |
|---|---|---|---|---|
| | General Practice | Medical Specialty | Surgical Specialty | |
| 0 - 25 | 29.3% | 5.3% | 22.7% | 57.2% |
| 26 - 50 | 8.5% | 1.8% | 8.1% | 18.4% |
| 51- 100 | 4.1% | 2.2% | 8.7% | 15.0% |
| 101 - 150 | 0.31% | 1.7% | 2.9% | 4.9% |
| 151 - 200 | 0.09% | 0.64% | 0.80% | 1.5% |
| 201 - 300 | 0.23% | 0.81% | 0.83% | 1.9% |
| 301+ | 0.06% | 0.61% | 0.32% | 1.0% |
| Total | 42.6% | 13.0% | 44.4% | 100.00% |

**4.2 Hospital Admissions by Ambulance**

It was not possible to determine the mode of transportation for people admitted to hospitals or visiting a physician's office, except in the case of hospital admittance by ambulance. This is an important section of analysis to assist in determining the demand for alternative solutions (e.g. NEMT), as anecdotally there have been reports of the use of ambulance services for non-emergency health transportation needs (CBC, 2018). Figures 6 through 9 presents NB average daily DAD frequencies of health admissions by ambulance for the fiscal years of 2005-2011.

Figure 6: NB Average Daily Hourly Ambulance Admissions

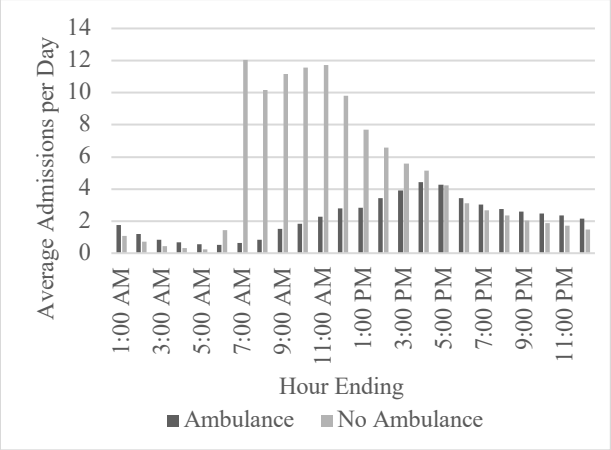



Figure 7: NB Average Daily Hourly Ambulance Admissions by Age Group

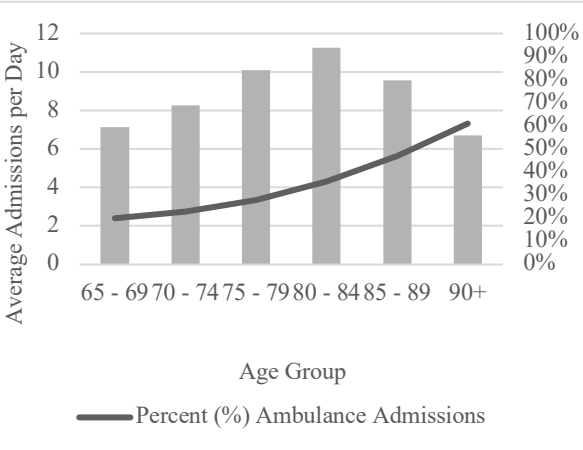


Figure 8: NB Average Daily Ambulance Admissions by Specialty Major

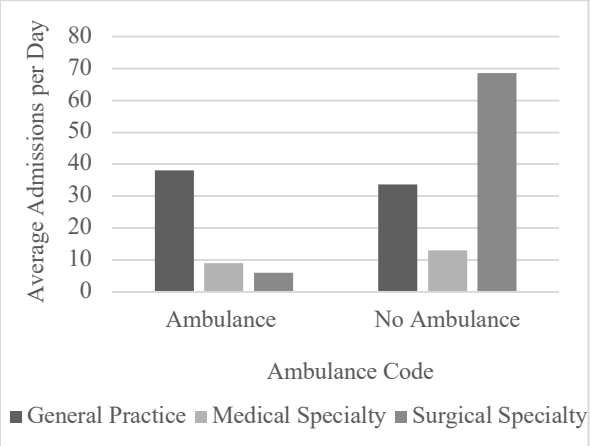



Figure 9: NB Average Daily Ambulance Admissions by Entry Code

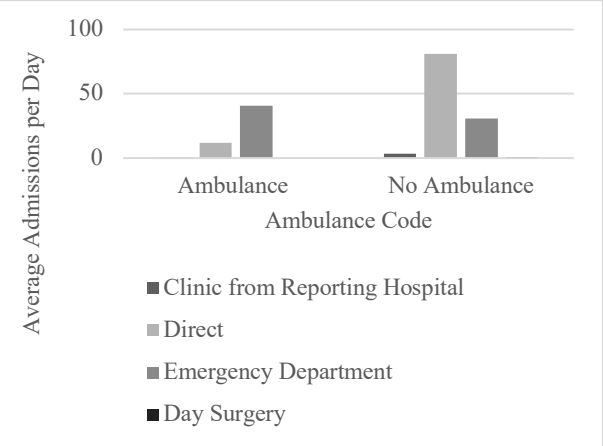



Figure 6 shows hourly admissions by ambulance appear to follow a normal distribution, where the peak hours were found late afternoon, while non-ambulance admissions were highest in the morning and decline over the day. Ambulance health visits did not vary by weekday (Average = 56 trips/day) but reduced by roughly 10 admissions per day on the weekend. Correspondingly, admissions were not markedly different on a monthly basis. Figure 7 shows admission percentages by ambulance increase with increasing age. The age group of 80 – 84 years had the largest daily ambulance frequency, but it is important to recognize the samples of these age groups. For example, 61% of all hospital admissions with a patient over the age of 90+ used an ambulance, compared to 36% for the 80 – 84 age group.

Figure 8 shows ambulance admissions were generally by the Specialty Major of General Practice, thus, having similar temporal admission behaviors to General Practice trends in Figure 2. Observing Figure 9, ambulance health visits routinely entered the hospital directly, or by emergency department. Since direct admissions oftentimes occur following a consultation with a doctor, it is possible that some of these ambulance trips (Average = 12 trips/day) could be for non-emergency related events, though further work is needed to analyse these entries with confidence. Findings would support the potential for NEMT.

**4.4 Discussion of Service Delivery Model for NEMT**

Non-profit & volunteer driver programs have emerged as cost-effective and more accessible options for many people in New Brunswick, including rural older adults. To provide adequate accessible health transportation for the future, this service model (door-to-door transportation services with automobiles) has an important role to play, though it is necessary to address some of the major human resource challenges faced in volunteer driver models. This can include a small volunteer pool and the ability to retain that pool, as the system relies on a volunteer's goodwill to keep a system in operation. Volunteers can get overworked and overburdened, therefore this driver pool needs to be supplemented, or in some cases, replaced by a paid staff. Hospital admissions are highest early in the morning (7 AM), and one way travel distances can be extensive (24% are greater than 51 km one way, 1% are greater than 300 km one way), meaning early morning travel and long distances. In some cases (e.g. Charlotte County, Queens County), average one-way travel distances to a physician are greater than 40 km. Providing this transportation routinely is a substantial ask of a volunteer and may be difficult to be made independently by an older adult or to be provided by friends and family.

The types of NEMT service delivery models will depend on the service area. For example, counties with hundreds of daily admissions in a densely populated area with low average travel distances, such as Saint John, there might be economies of scale to justify promoting public transit and private taxi as the primarily alternatives for non-driving older adults. Conversely, counties with lower numbers of daily

admissions in a sparsely populated area with high automobile dependence and long one-way travel distances might be best served by a non-profit or volunteer driver solutions given the unavailability of public transportation and prevalence of private vehicles. A car-based non-profit NEMT program would be employed in this scenario as it remains consistent with existing older person mobility trends from the Canadian Community Health Survey on Health Aging 2008 – 2009 and is further supported from temporal admissions results in this study.

The administration for a non-profit NEMT service would be an important consideration for the program and could involve several key stakeholders, including health authorities, government agencies and policymakers, and community-based organizations. Health authorities could assume the responsibility for NEMT to hospitals, staffed by those in the healthcare system. A non-profit community-based organization, such as the Canadian Cancer Society of the Red Cross, could also provide this service but may be more suitable for physician office appointments, as these trips tend to be shorter distanced and trips beyond the health trip may be requested during a service. For existing VDP's in New Brunswick, they could be supported to hire staff for longer distance, early morning health transportation, and freeing volunteer resources for shorter trip-making.

## 5 Conclusions and Next Steps

This research demonstrated the value of using administrative health data from the NB-IRDT to inform operational planning for the accessible health transport of older adults. Using the database, the study developed temporal descriptive statistics of healthcare access and proposed strategies for planning an accessible and sustainable NEMT program for older adults. Overall, this research demonstrated that administrative health data in New Brunswick can be used to determine the temporal and geographic aspects of older adult access of hospitals and to visit physicians, though time of day data were not available for physician visits. The data showed observable daily, monthly, and hourly trends that can be used to support system planning. It was not possible to determine the non-emergency use of ambulances with confidence, though questions remain about how patients brought in by ambulance can return home. Further research is needed to quantify how many older patients require transportation for appointments and how they are currently meeting their transportation needs. There is also a need to record hourly admissions of physician billing trips, understand utilization of ambulances for non-emergency events, and if older adults need transportation to other destinations following a health appointment, such as a trip to the pharmacist for prescriptions. Further opportunities exist to employ optimization and simulation to support network development.

## 6 Acknowledgements

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Author contributions: Barry Riordon: preparation of final manuscript, descriptive statistics development, health planning recommendations, and development of a use-case operational model. Trevor Hanson: supervision, projection conception, editing of final manuscript.

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