



Multiple Sclerosis Clinic Utilization is Associated with Fewer Emergency Department Visits

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ABSTRACT: *Objective:* Alberta is a Canadian province with a high prevalence of multiple sclerosis (MS). In this ecological study, we examined group differences in health care utilization among persons with MS (pwMS) living within different regions of the province. *Methods:* pwMS were identified from provincial administrative databases spanning 2002–2011. Utilization of health care services was determined for a 2-year period (April 2010–March 2012). Residential postal codes placed patients into their provincial health care zones. As data were provided to the investigators in an aggregated form, tests of statistical significance and confounding were not performed. *Results:* In total, 11,721 pwMS were identified. During the 2-year observation period, 96.2% of pwMS accessed a family physician and 57.1% accessed a neurologist. Nearly all (99.0%) pwMS who received neurologist care in Calgary visited an MS clinic, in contrast to Edmonton where a larger proportion (34.8%) received solely community neurologist care. More pwMS living in Edmonton accessed the ED (41.1%) compared to Calgary (35.7%), and the rate of visits per pwMS was higher in Edmonton (1.07/pwMS) than in Calgary (0.81/pwMS). The frequency of inpatient admissions was similar. *Conclusions:* Over 2 years, most pwMS accessed primary care and over half saw a neurologist. Despite a similar frequency of inpatient admissions, the frequency of ED visits by pwMS was higher in Edmonton compared to Calgary, where more patients received MS clinic care. Although this exploratory study is subject to several limitations, our findings suggest that specialized MS clinics may reduce costly ED visits.

RÉSUMÉ : L'utilisation des centres de traitement de la sclérose en plaques associée à un nombre moindre de consultations au service des urgences. *Objectif :* La prévalence des cas de sclérose en plaques (SP) est élevée en Alberta, province canadienne. L'étude écologique dont il est question ici visait à examiner les différences entre les groupes quant à l'utilisation des soins de santé chez les personnes vivant avec la SP dans différentes régions de la province. *Méthode :* Les cas de SP ont été relevés dans des bases de données administratives provinciales et portaient sur la période de 2002 à 2011, tandis que l'utilisation des services de santé, elle, portait sur la période d'avril 2010 à mars 2012 (2 ans). La répartition des patients selon leur zone sanitaire respective dans la province reposait sur les codes postaux de leur lieu d'habitation. Comme les données fournies aux chercheurs l'ont été sous forme cumulative, aucun test de la signification statistique ou de facteurs parasites n'a été réalisé. *Résultats :* Au total, 11 721 cas de SP ont été relevés. Au cours de la période d'observation d'une durée de 2 ans, 96,2 % des personnes atteintes de SP ont pu consulter un médecin de famille, et 57,1 %, un neurologue. Presque toutes celles (99,0 %) qui ont reçu les soins d'un neurologue à Calgary sont allées dans un centre de traitement de la SP, contrairement à celles vivant à Edmonton où une proportion plus importante de patients (34,8 %) n'ont reçu que les soins d'un neurologue en milieu communautaire. Ainsi, plus de personnes vivant avec la SP à Edmonton (41,1 %) qu'à Calgary (35,7 %) se sont rendues au service des urgences (SU), et le taux de consultation par malade atteint de la SP était plus élevé à Edmonton (1,07/SP) qu'à Calgary (0,81/SP). Toutefois, la fréquence des hospitalisations était comparable. *Conclusion :* Au cours de la période de 2 ans, la plupart des personnes vivant avec la SP ont eu recours à des soins primaires et plus de la moitié, à des soins spécialisés en neurologie. Malgré une fréquence comparable des hospitalisations, la fréquence des consultations au SU pour la SP était plus élevée à Edmonton qu'à Calgary, là où un plus grand nombre de patients ont pu recevoir des soins dans un centre de traitement de la SP. Bien que plusieurs points faibles viennent atténuer la portée de cette étude préliminaire, les résultats donnent à penser que ce type de centre peut réduire le nombre de consultations coûteuses au SU.

Keywords: Multiple sclerosis, Health care utilization, Emergency department, Multiple sclerosis clinic, Multidisciplinary care

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INTRODUCTION

Multiple sclerosis (MS) is a chronic, disabling, inflammatory, and degenerative disease of the central nervous system. The pathogenesis of MS is multifactorial with both genetic and environmental influences.^{1,2}

The economic impact associated with MS is substantial, with annual Canadian health sector costs from MS projected to reach 2 billion dollars by 2031.³ Although rates of inpatient hospitalizations have been decreasing over the past two decades, they remain elevated relative to the general population.⁴ Emergency

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department utilization is also increased in persons with MS (pwMS); newly diagnosed pwMS are twice as likely to present to the ED compared to healthy controls,⁵ and another small study showed that nearly half of pwMS visited the emergency department over a 3-year period.⁶

Despite increased health care utilization, pwMS living in Canada are more likely to report that they have unmet health care needs.⁷ Health outcomes are strongly linked to primary care access,⁸ and integrated multidisciplinary MS clinics (MSC) are considered the gold standard for MS care, both in the setting of active relapsing disease and in progressive MS where patients encounter evolving symptomatology such as lower urinary tract dysfunction, dysphagia, and concerns with mobility.⁹ Multidisciplinary care has demonstrated survival benefit in other chronic neurological conditions such as motor neuron disease.¹⁰ MSC care appears to improve medication adherence and persistence and possibly decrease MS-related hospitalization rates.¹¹ Furthermore, access to nurses specialized in MS care has been previously demonstrated to reduce ED utilization.¹²

Alberta is a Canadian province with a population of 4.4 million¹³ and one of the highest rates of MS in the world.^{14–16} Neurology care for pwMS in Alberta is provided by either an MSC neurologist or a community neurologist (CN). The majority of pwMS residing in Calgary are managed by Calgary MSC neurologists, whereas delivery of neurologist care is more varied in other areas of the province. In the current study, we utilized provincial administrative databases to describe where pwMS in Alberta receive health care and compared the frequency of ED visits and inpatient admissions in Alberta's two largest urban communities where MS care differed markedly.

METHODS

Setting and Design

This is an ecological study performed in Alberta, Canada which examined group differences in health care utilization among pwMS living within different regions of the province. Alberta is distributed between three regions: two urban regions, Calgary and Edmonton, and the rest of the province, which is largely rural. Health care is administered by the same publicly funded health system throughout Alberta. There are three MSCs in the province, located in Calgary, Edmonton, and Red Deer (a small city which lies between Edmonton and Calgary). Within the province of Alberta, MSCs are defined as clinics where pwMS receive multidisciplinary care from subspecialist neurologists, physiatrists, nurses, and allied health professionals. Patients enrolled in MSCs have daytime telephone access to specialized MS clinic nurses, who provide patient education and address most concerns regarding medication management and symptoms. Rehabilitation and counseling are also available.

All Alberta residents are assigned a lifelong, unique, personal health care number which is linked through provincial administrative databases to all hospital admissions, physician visits, prescription dispensations, laboratory investigations, and diagnostic imaging. Using administrative data, pwMS were retrospectively identified. Primary care visits, neurologist visits (stratified into MSC and CN), emergency department visits, and inpatient admissions in different regions of the province were described.

MS Case Definition

MS cases were identified during a 9-year ascertainment period (April 2002–March 2011) using International Classification of Diseases Ninth or Tenth Revision (ICD-9/10) diagnostic codes for MS (340/G35). Patients were classified as having a diagnosis of MS if they had either (i) a confirmed inpatient diagnosis, (ii) a confirmed diagnosis at an MS clinic, or (iii) ≥ 3 outpatient codes claimed for a diagnosis of MS. This is similar to an administrative data case definition which was previously used to study the incidence and prevalence of MS in Alberta.¹⁴

Administrative Data Linkage

Confirmed MS cases were linked using the patient's unique Alberta Health Care Number to numerous administrative databases. Residential postal codes were used to place pwMS into their provincial health care zones (<https://www.albertahealthservices.ca/ahs-map-ahs-zones.pdf>). Health care zones other than "Calgary" and "Edmonton" were classified as "Other." The "Other" category captures smaller cities and rural regions. As data analysis was performed at the group level, pwMS were not reclassified if they travelled outside of their health care zone to receive care (i.e. the number of pwMS living within each health care zone and the number of health care visits by pwMS within a given health care zone were estimated separately).

Primary Care and Neurologist Visits

Physician billing data during a 2-year period (April 2010–March 2011) were used to identify visits to general practitioners and neurologists. Neurologists were identified as working within an MS clinic, or not. For this report, pwMS who had any care delivered by an MSC neurologist were considered to have access to MSC resources, even though in some cases ED visits and hospitalizations may have preceded neurologist and MSC care. Given that only five communities in Alberta have practicing neurologists (Edmonton, Calgary, Red Deer, Lethbridge, and Medicine Hat) most rural patients travel outside of their health zone to receive care. Accordingly, the frequency of neurologist visits in the "other" category (which contains smaller cities and rural centers) could not be reliably determined and is not reported.

Emergency Department Visits

Visits to the emergency department were captured through the Canadian Emergency Department Information System (CEDIS) Presenting Complaint List (PCL) dataset within the National Ambulatory Care Reporting System database. The CEDIS PCL is a standardized list used to capture patient reasons (symptoms and presenting complaints) for seeking emergency care.^{17,18} Every patient visiting an emergency department in Alberta is assigned a presenting complaint by medical staff (typically nursing triage) at the time of presentation. CEDIS PCL is then linked to the corresponding ICD-10 codes. The number of ED visits was stratified according to health care zone.

Hospital Admissions

The absolute number, frequency, and duration of inpatient admissions in the 2-year period were determined and stratified by

the health care zones. The speciality of the admitting physician and ICD-10 code for admitting diagnosis were additionally reported.

Statistical Analysis

Aggregate data were reported by the Physician Learning Program (PLP). The PLP is a provincial, physician-led organization which generates actionable clinical information to advance evidence-informed practice (<https://albertaplp.ca/>). Data were collected and analyzed by the PLP with the goal of identifying practice gaps, unmet care needs, and opportunities to improve care for pwMS. Neurologists with an interest in caring for outpatients with MS also had the option of receiving a report that described the population of pwMS seen in their practice. Data were stratified by age, sex, the health care zone where the pwMS lived, and where the neurologist practiced. Descriptive statistics including mean, median, and standard deviation were reported where appropriate. As original data were not available to the investigators, tests of statistical significance were not performed.

Ethics Approval

The Calgary Health Research Ethics Board determined that patient and neurologist consent were not required for aggregate reporting.

RESULTS

Demographics

During the 9-year ascertainment period (2002–2011), 11,721 unique pwMS were identified. Approximately three-quarters of pwMS were female (71.7%). The mean age of pwMS was 50.3 years (SD \pm 13.6) and the majority (51.3%) were between the ages of 46–65. The geographical distribution of pwMS was split fairly evenly between Calgary (33.3%), Edmonton (34.8%), and other (31.8%) health care zones.

Primary Care

Nearly all (96.2%) pwMS accessed primary care during the 2-year study period, for a total of 175,479 visits. The average number of visits during the study period per pwMS was 15.6 (SD \pm 15.7). The proportion and average number of visits was similar between geographic health care zones (Table 1). More than half (53.6%) of patients visited a primary care physician more than 10 times during the 2-year period. The most common billing codes claimed by primary care physicians were “multiple sclerosis” (20,873 claims), “general symptoms” (7,464 claims), and “depressive disorder, not elsewhere classified” (6,331 claims).

Neurologist Care

More than half of pwMS (57.0%) saw a neurologist during the 2-year study period. Among pwMS who saw a neurologist, 70.2% were seen exclusively by an MSC neurologist, 21.9% were seen exclusively by a CN, and 7.9% were seen by neurologists from both settings. Nearly all (99.0%) pwMS who received neurologist care in Calgary visited an MS clinic neurologist, in contrast to Edmonton where a large proportion (34.8%) received solely CN care. Patients attending a CN tended to be slightly younger (mean age 46.3 vs. 48.1 years) and visited a neurologist

Table 1: Health care utilization of pwMS living in Alberta during a 2-year period (April 2010–March 2012) stratified by geographic health care zone

	Calgary (n = 3,908)	Edmonton (n = 4,082)	Other (n = 3,731)	Total (n = 11,721)
Primary care				
Any visits (%)	96.0	95.9	96.7	96.2
Total visits	53,726	60,022	61,731	14,635
Mean no. of visits per pwMS (\pm SD)	14.3 (13.4)	15.3 (17.1)	16.5 (n/a)	15.6 (15.7)
Neurologist care				
Any visit (%)	76.2	74.8	n/a [‡]	57.1
MSC visit* (%)	99.0	65.2	n/a [‡]	83.5
CN only* (%)	1.0	34.8	n/a [‡]	16.5
ED visits				
Any visits (%)	35.7	41.1	6.8	28.4
Total visits	3,179	4,368	549	8,096
Mean no. of visits per pwMS	0.8	1.1	0.2	0.7
Inpatient admissions				
Any admission (%)	20.0	21.4	23.2	21.5

MSC = multiple sclerosis clinic; CN = community neurologist; ED = emergency department; pwMS = persons with multiple sclerosis.

*Proportion of pwMS that visited a clinic among the population who saw a neurologist during the study period.

[‡]Estimates not reliable due to frequent travel outside of health zone.

less frequently than patients attending an MSC (mean visits per year per patient, 1.5 visits vs. 3.3 visits).

ED Visits

In total, 3330 pwMS visited an ED during the 2-year period, for a total of 8096 visits. On average, pwMS who presented to ED visited 1.8 times (SD \pm 1.5) during the 2-year period, with an upper limit of 18 visits. ED visits stratified by gender were similar to the underlying population distribution, with visits by female pwMS accounting for 69.9% of total ED visits. The proportion of pwMS who visited the ED during the study period was higher in Edmonton compared to Calgary (41.1% vs. 35.7%). The average number of visits per pwMS was also higher in Edmonton relative to Calgary (1.1 vs. 0.8). ED visits were substantially lower in other health zones (Table 1). The most common CEDIS presenting complaints for pwMS visiting the ED were abdominal pain (12.0% of total visits), shortness of breath (8.0%), sensory loss/paresthesias (7.1%), and headache (6.5%). Approximately one quarter (23.7%) of ED visits resulted in admission to hospital.

Inpatient Admissions

In total, 2522 pwMS (21.5%) were admitted to hospital during the 2-year period for a total of 4536 hospital admissions; admission from an emergency department accounted for 2419 (53%) admissions. Among patients admitted to hospital, more than one-third (37.4%) were admitted to hospital more than once over the

2-year period. Hospital admissions stratified by gender were similar to the underlying population distribution, with 71% of admissions accounted for by female pwMS. The average age of pwMS admitted to hospital was 52 years (SD \pm 1.52). The average number of hospital admissions per pwMS was similar between Calgary, Edmonton, and other health care zones (Table 1). The most common reasons for admission to hospital were “multiple sclerosis” (44.0%), “urinary tract infection” (21.4%), and “benign hypertension” (6.6%). Nearly half (44.4%) of pwMS were admitted under a primary care physician or hospitalist, with 11.1% of pwMS being admitted to internal medicine and 7.1% of pwMS admitted to a neurology service. There were 191 admissions to ICU, comprising 4% of total hospital admissions among pwMS. The most common reasons for admission to ICU were “pneumonitis due to food and vomit” (16.0%), “urinary tract infection” (13.7%), and “septic shock” (9.9%).

DISCUSSION

Understanding patterns of health care utilization among pwMS is critical to the provision of cost-effective and high-quality health care. In our study, only 57% of pwMS accessed a neurologist during the 2-year period. This is disproportionately lower than estimates reported out of Switzerland (89%),¹⁹ which also has a universal health care system, and to the USA (72.2%).²⁰ Due to limitations in our study design, we were unable to determine the proportion of rural pwMS seen by a neurologist; future studies should examine this as a potential barrier to neurologist care in Alberta. Previous studies have demonstrated that living in a rural area, low socioeconomic status, longer duration of disease, and advanced disability are associated with not seeing a neurologist in pwMS.²⁰ Access to neurologist care is important, as pwMS who see a neurologist are more likely to receive disease-modifying therapies (DMTs), be referred to urology, or receive physical or occupational therapy.²⁰ Patients additionally perceive MS care to be superior when it is delivered by a neurologist relative to other physicians.²¹

Among pwMS who saw a neurologist in Calgary, nearly all (99.0%) were seen in an MSC in contrast to Edmonton where only 65.2% were seen in an MSC. In addition to the benefits of multidisciplinary care, theoretical concerns regarding general neurologist comfort with DMTs have been raised as potential argument for MS subspecialty care.²² Although a 2009 Ontario study examining DMT prescribing patterns did not detect any significant differences between MSC and CN neurologists,²² most currently used DMTs have only become available in Canada since 2009. It is plausible that CN uptake of newer DMTs may lag behind that of MSC neurologists.

Our findings suggest that care in an MSC is associated with a reduction in ED visits. In contrast to Calgary, where 99.0% of pwMS receive their neurology care from an MSC neurologist, a larger proportion of pwMS living in Edmonton accessed the ED (41.1% vs. 35.7%) and had more frequent ED visits (1.07/pwMS vs. 0.81/pwMS) over the 2-year period. If these findings represent true differences, this translates into a meaningful reduction in ED visits; a 5% difference in ED visits has previously been reported as a clinically meaningful difference in the Canadian setting.²³ Although our results suggest that ED use was high among both urban populations of pwMS, it is possible that bias was introduced by overlapping time frames for MS case ascertainment and

enumeration of ED visits. Ideally, ED visits which occurred prior to the diagnosis of MS would have been censored; this is particularly important given emerging evidence for an MS prodromal period which is associated with increased health care utilization.²⁴

Fewer ED visits among pwMS in Calgary may be due to the availability of daytime telephone nursing access to address patient concerns as well as education, rehabilitation, and counseling which may have reduced the need for urgent care. Most patients present to the ED by their own accord, rather than by direct physician referral²⁵ and prior studies have demonstrated that most pwMS presenting to the emergency department come with MS-related issues such as concerns about new neurologic complaints, worsening pre-existing symptoms, or MS-related complications.²⁶ Even among patients presenting with a new neurologic symptom, approximately one-third have alternate explanations for their symptoms such as urinary tract infection, which may in fact be indirectly due to MS.²⁶ Telephone access to specialized MS nurses who can triage patients according to established algorithms allows for pwMS patients with mild relapses or pseudorelapses to be treated as outpatients.¹²

Approximately one-fifth of pwMS were admitted to hospital during the 2-year study period. Less than half of the hospitalizations were coded as being directly related to MS, with urinary tract infections being the second most common reason for admission to hospital and aspiration pneumonia being the most common reason for admission to intensive care. Neurogenic bladder, dysphagia, and weak respiratory muscles make pwMS at higher risk of these secondary conditions. Previous studies have also reported that pwMS are more likely to be admitted to hospital with an infection than the general population and are significantly more likely to have infection-related mortality.²⁷ Infection-related ED presentations are more common in patients with a higher severity of MS, particularly those with ambulation impairment to the level of requiring a cane.²⁵ Future studies should include efforts to examine the role of MSCs in preventing respiratory and genitourinary infections.

While utilization of the ED was lower outside of major urban centers, differences in rural health care access and delivery preclude direct comparisons. Potentially, physical access to care may be decreased due to differences in health care delivery, long distances to health care sites, and lack of public transport. It is also possible that some patients traveled outside of their health care zone to visit the ED and would not have been accurately captured by our analysis.

This is a population-based administrative data study with nearly complete ascertainment of pwMS living in the Canadian province of Alberta. Other strengths of this study include use of a 2-year study period to capture health care visits among pwMS. Unfortunately, this study has several limitations secondary to the aggregated nature of the data. Estimates of variability and tests of significance could not be performed, restricting the ability to form robust conclusions from the reported findings. However, given the sizable study population (over 10,000 pwMS), it can be reasonably inferred that the clinically significant differences reported here would also reach statistical significance. Multivariate analysis could not be performed to assess for effect modifiers and confounding variables such as MS severity and socioeconomic status. Furthermore, the benefit of MSC care can only be assumed to be the reason for differences between Calgary and

Edmonton; it is possible other factors may have differed between these regions that affected ED use. Analysis of individual data is required to examine these exploratory findings in greater detail. Additionally, although the case definition used in this study is similar to that previously used in the province of Alberta,¹⁴ it remains possible that some cases with a single billing code from an MS clinic may have been misclassified. Additionally, our case definition may have been subject to regional variations in billing practices between Calgary and Edmonton. Future studies should confirm our findings and determine which components of MS clinics (e.g. MS subspecialists, allied health professionals, psychiatry, urology) are related to decreased ED utilization.

The results of this population-based study of health care utilization in pwMS suggest that MSC care may be associated with decreased ED visits among pwMS. If confirmed, this argues for making MSC care universally available.

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DISCLOSURES

JIR reports no disclosures. CH has been on an advisory board for Novartis. LMM reports no disclosures.

STATEMENT OF AUTHORSHIP

JIR assisted with design/conceptualization of the study, analysis and interpretation of the data, drafting and revising the manuscript for intellectual content. CH assisted with design/conceptualization of the study and revising the manuscript for intellectual content. LMM assisted with design/conceptualization of the study, analysis and interpretation of the data, and revising the manuscript for intellectual content.

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