Characteristics of a population-based multiple sclerosis cohort treated with disease-modifying drugs in a universal healthcare setting

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Background

- The efficacy of a disease-modifying drug (DMD) is typically established via short, 2-3 year clinical trials in highly select and motivated groups of people with multiple sclerosis (MS).
- In clinical practice, DMDs are used for many years in a more diverse population of persons with MS.

Objective

To describe the **characteristics of a population with MS** exposed to their **first DMD** in the **real-world setting.**

Methods

- Linked, population-based health administrative data in **four Canadian provinces:** British Columbia, Saskatchewan, Manitoba and Nova Scotia (see **Data sources**).
- ***Population***:

All individuals with MS → **Aged ≥ 18 years** → Filled a **prescription for MS DMD** (1996-2018)

- ***Study follow-up***:
  - **Study entry**: most recent of their first MS or demyelinating event or 01/January/1996
  - **Study end**: to the earliest of death, emigration, or 31/March/2018
- **Characteristics** captured:

- **Sex, age and DMD class:** at **date of 1st prescription filled**
- **Socioeconomic status** (based on neighbourhood income)
- **Comorbidity burden** (in the year pre-study entry, using the Charlson Comorbidity Index)
- **Calendar period** 1996-2012 and 2013-2017 (differentiating the time periods when <5 and ≥5 individual DMD classes were available)

Data sources:

Prescription | **Hospital** | **Physician** | **Vital Statistics** | **Provincial Insurance**

Photo source: https://www2.gov.bc.ca/gov/content/health/health-drug-coverage

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Results

Table 1. Characteristics of the MS cohort

Characteristics	Total N=10,418 n (%)
Sex	
Women	7,693 (73.8)
Men	2,725 (26.2)
Age group at first DMD	
< 30 years	1,860 (17.9)
30 to 39 years	3,359 (32.2)
40 to 49 years	3,454 (33.2)
50 to 59 years	1,475 (14.2)
≥ 60 years	270 (2.6)
Calendar period at first DMD	
1996-2012	7,736 (74.3)
2013-2017	2,682 (25.7)

Characteristics	Total N=10,418 n (%)
Socioeconomic status[a]	
1 (lowest income quintile)	1,800 (17.3)
2	1,962 (18.8)
3	2,175 (20.9)
4	2,179 (20.9)
5 (highest income quintile)	2,129 (20.4)
Unavailable	173 (1.7)
Comorbidity score[b]	
0	8,673 (83.3)
1	1,369 (13.1)
2	285 (2.7)
≥ 3	91 (0.9)

[a]**Socioeconomic status** is represented by neighborhood income quintiles, based on the closest available measurement to the study entry date.
[b]**Comorbidity** is measured using the Charlson Comorbidity Index (modified to exclude hemiplegia/paraplegia to avoid misclassifying MS complications as comorbidity) during the one-year period prior to the study entry date.

Table 2. Sex and age of the MS population *by individual DMD class*

Characteristics	Sex [female] n/Total N[a] (%)	Age at first DMD Mean (SD)
Overall cohort	7,693/10,418 (73.8)	39.6 (10.1)
By individual DMD class		
Beta-interferon	4,531/6,171 (73.4)	39.7 (10.0)
Glatiramer acetate	2,289/2,967 (77.1)	39.3 (10.0)
Natalizumab	77/116 (66.4)[b]	39.6 (12.0)
Fingolimod	42/56 (75.0)[b]	41.0 (10.9)
Dimethyl fumarate	477/711 (67.1)	39.1 (10.4)
Teriflunomide	238/338 (70.4)	43.6 (10.9)
Alemtuzumab	24/37 (64.9)[b]	35.9 (10.0)

[a]**Total N** is the total number of people with that type (class) of first DMD. Key: SD, standard deviation.
[b]As per data privacy and access agreements, small cell size (<6 individuals within any group) in one or more provinces are suppressed and were not included in the total count (either the numerator or denominator).

Table 3. Disease-modifying drug use in the MS population *by calendar period*

First DMD (drug class)	First DMD filled 1996-2012 n (%) of adults with MS	First DMD filled 2013-2017 n (%) of adults with MS
Beta-interferon	5,569 (72.0)	602 (22.4)
Glatiramer acetate	2,084 (26.9)	883 (32.9)
Natalizumab	~49 (0.7)[a]	~67 (2.5)[a]
Fingolimod	21 (0.3)	~35 (1.4)[a]
Teriflunomide	6 (0.1)	332 (12.4)
Dimethyl fumarate	*NA*	711 (26.5)
Alemtuzumab	*NA*	~37 (1.4)[a]
Total	***7,736 (100)***	***2,682 (100)***

Key: NA, not applicable (as those individual DMDs were marketed in Canada after 2012).
[a]As per data privacy and access agreements, small cell size (<6 individuals within any group) in one or more provinces are suppressed and were not included in the total count (the denominator remains the same).

Summary points

Overall, 10,418 with MS filled a DMD prescription during the 22-year study period.

- **Most were women**:
  - Variations in sex distribution observed.
  - Ranged from 65% for alemtuzumab to 77% for glatiramer acetate.
- **Mean (SD) age at first DMD:**
  - Variations in the average age at first prescription fill across the different DMDs observed.
  - Ranged from 35.9 (SD 10.0) years for alemtuzumab to 43.6 (SD 10.9) years for teriflunomide.
- **Socioeconomic status:**
  - The cohort was distributed evenly across the income-based quintiles (neighborhood-level).
- **Patterns of treatment:**
  - Changed considerably between 1996-2012 vs. 2013-2017
  - Increased uptake of the oral DMDs.
  - Likely reflects increased availability (choice) of DMDs to treat MS.
- **Overall study population and implications:**

people with MS had at least **some comorbidity**.

≥50 years old at the **time of their first DMD**.

Implications

Older individuals or individuals with comorbidity are **typically excluded from clinical trials**.

Findings illustrate the need to **understand the harms and benefits** of DMD use in **these understudied groups**.

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