ORAL PRESENTATION # ND3

Short- and Long-Term Disability Burden Among Employed Patients Receiving Disease-Modifying Treatment for Multiple Sclerosis

Machaon Bonafede,[1] Rina Mehta,[2] Gilwan Kim,[1] Ila Sruti,[1] Marc Tian,[2] Corey Pelletier,[2] Neil Goldfarb[3]

[1]IBM Watson Health, Cambridge, MA, USA; [2]Celgene Corporation, Summit, NJ, USA; [3]Greater Philadelphia Business Coalition on Health, Philadelphia, PA, USA

Presented at ISPOR Europe 2019; 2-6 November 2019; Copenhagen, Denmark

INTRODUCTION

- Multiple sclerosis (MS) is a chronic autoimmune disease that results in demyelination of axons and other injuries to multiple functional systems in the body[1]
  - There is a wide variation of symptoms, including sensory, motor, pain, and cognitive symptoms[2,3]
- MS affects 2.2 million people worldwide[4]
- From a social burden perspective, MS contributes to significant direct and indirect costs[2-10]
  - A major direct cost driver is prescription drugs
  - Most patients with MS are diagnosed between the ages of 20–40
  - MS impacts young working adults most often, which affects their working, social, and family life
  - Patients with MS have higher use of long- and short-term sick leave and associated costs compared with those without MS
  - Absenteeism, reduced work hours, and early retirement account for 44% of total economic burden of MS
- Currently, there is limited real-world evidence that describes absenteeism (ABS), short-term disability (STD), long-term disability (LTD) and its associated costs for patients with MS, especially since the introduction of newer oral disease-modifying treatments (DMTs)

OBJECTIVE

- To quantify the indirect cost burden (ABS, STD, and LTD) of MS from the employer perspective, among employees with MS initiating DMTs

3

METHODS

- Databases
  - IBM MarketScan Commercial Claims and Encounters Database:
    - Contains medical and drug data for individuals with employer-sponsored primary health insurance
  - IBM MarketScan Health and Productivity Management (HPM) Database:
    - Contains workplace absence, STD, and LTD data from a subset of IBM Watson Health's employer clients
    - The database is fully linkable to the corresponding medical and pharmacy claims data for these employees
- Study outcomes
  - Missed days from work potentially due to MS: ABS, STD, and LTD, and their indirect costs during the first, the most recent, and all calendar years
    - Indirect costs of ABS were calculated based on the estimated hourly wage of $26.47, which is the 2017 Bureau of Labor Statistics average hourly earnings of all employees on private nonfarm payrolls, seasonally adjusted

4

METHODS (CONT'D)

- Patient selection
  - Patients with at least 2 non-diagnostic MS claims between 2009 and 2016
  - Index date was the first qualifying DMT claim
  - At least 12 months of continuous enrollment before the index date
  - Has ABS eligibility, STD eligibility, and/or LTD eligibility in any year on or after the index date
  - All years of HPM data on or after the index date were retained to examine the first calendar year, most recent calendar year, and all calendar years
- Exclusion criteria
  - DMT use in 12 months pre-index
  - Evidence of pregnancy or malignancy during study period

5

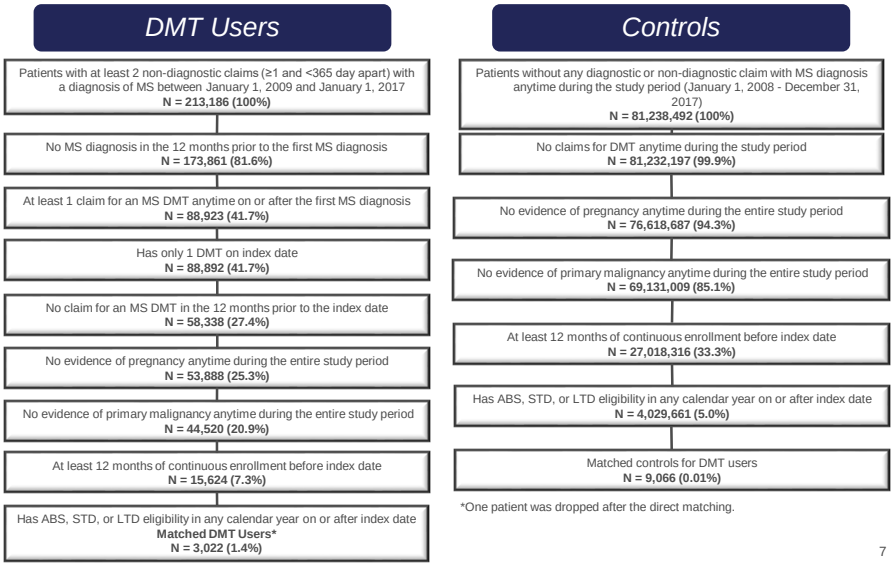
METHODS (CONT'D)

- Study cohorts
  - Patients were stratified by index DMT route of administration (ROA): injectable, oral, or infusion
  - Direct matching of DMT user to non-MS controls was completed with the following matching criteria:
    - Matching ratio of 1:3 for case (n = 3,022) to controls (n = 9,066; **Figure 1**)
    - Matching variables included age group, sex, plan type, index year, urbanicity and region
    - The 3 ROA matched groups originated from the matched overall DMT group

6

METHODS (CONT'D)

Figure 1. Patient Attrition



7

RESULTS

- A majority of DMT users initiated an injectable (2,065, 68.3%), followed by orals (772, 25.5%)
  - In this population, infusions were only initiated by 186 (6.15%) patients
- DMT users had an average age of 41.4 years on index date (**Table 1**)
  - DMT infusion users were the youngest (39.3 yrs), followed by DMT injectable users (41.3 yrs), and DMT oral users (42.2 yrs)
- Baseline clinical characteristics were consistent across all ROA except for history of stroke and opioid use
  - Stroke was significantly higher in DMT injectable users than DMT infusion users (7.5% vs 2.7%, *P*=0.0143)
  - Opioid use was significantly higher in DMT injectable users than DMT oral users (36.9% vs 32.4%, *P*=0.0254)
- After matching, most baseline clinical variables were similar between the DMT users and controls except for history of stroke, use of antidepressants, benzodiazepines, and opioids across all ROAs, and active hepatitis B (infusion only)
- DMT users had a relapse rate ranging from 33.4% – 38.5% during the pre-index period
  - DMT oral users had a significantly higher relapse rate than DMT injectable users (38.5% vs 33.4%; *P*=0.0110)
  - DMT infusion users had a significantly higher relapse rate than DMT injectable users (41.9% vs 33.4%; *P*=0.0182)
- The number of days between the earliest MS claim and the earliest DMT claim ranged from 174.9 – 378.4 days
  - DMT oral users had longer days between the 2 events than DMT injectable users (348.3 days vs 174.9 days; *P*=0.000)
  - DMT infusion had longer days between the 2 events than DMT injectable users (378.4 days vs 174.9 days; *P*=0.000)

8

RESULTS (CONT'D)

Table 1. Baseline Demographic and Clinical Characteristics of DMT Users and Matched Controls by ROA

	DMT Users	Controls for DMT Users	Oral DMT Users	Controls for Oral DMT Users	Injectable DMT Users	Controls for Injectable DMT Users	Infusion DMT Users	Controls for Infusion DMT Users
	N = 3,022	N = 9,066	N = 772	N = 2,316	N = 2,064	N = 6,192	N = 186	N = 558
Age, mean (SD)	41.4 (9.2)	41.6 (9.7)	42.2 (9.4)	42.4 (9.7)	41.3 (9.2)	41.4 (9.6)	39.3 (9.1)	39.5 (9.6)
Age groups, n (%)								
18-24	51 (1.7)	153 (1.7)	13 (1.7)	39 (1.7)	36 (1.7)	108 (1.7)	2 (1.1)	6 (1.1)
25-34	708 (23.4)	2,124 (23.4)	155 (20.1)	465 (20.1)	488 (23.6)	1,464 (23.6)	65 (34.9)	195 (34.9)
35-44	1,134 (37.5)	3,402 (37.5)	288 (37.3)	864 (37.3)	784 (38.0)	2,352 (38.0)	62 (33.3)	186 (33.3)
45-54	849 (28.1)	2,547 (28.1)	227 (29.4)	681 (29.4)	576 (27.9)	1,728 (27.9)	46 (24.7)	138 (24.7)
55-64	280 (9.3)	840 (9.3)	89 (11.5)	267 (11.5)	180 (8.7)	540 (8.7)	11 (5.9)	33 (5.9)
Female, n (%)	1,878 (62.1)	5,634 (62.1)	495 (64.1)	1,485 (64.1)	1,289 (62.5)	3,867 (62.5)	94 (50.5)	282 (50.5)
CCI, mean (SD)	0.4 (0.9)	0.2 (0.5)	0.4 (0.9)	0.2 (0.6)	0.4 (0.9)	0.2 (0.5)	0.3 (0.8)	0.1 (0.4)
Baseline medications, n (%)								
Antidepressant	857* (28.4)	1,359 (15.0)	214* (27.7)	374 (16.1)	584* (28.3)	913 (14.7)	59* (31.7)	72 (12.9)
Benzodiazepine	622* (20.6)	757 (8.3)	147* (19.0)	212 (9.2)	441* (21.4)	502 (8.1)	34* (18.3)	43 (7.7)
Opioid	1,082* (35.8)	1,988 (21.9)	250* (32.4)	468 (20.2)	762* (36.9)	1,404 (22.7)	70* (37.6)	116 (20.8)
Patients with a relapse,[1] n (%)	1,063 (35.2)		297 (38.5)		688 (33.3)		78 (41.9)	
Patients with 0 relapses	1,959 (64.8)		475 (61.5)		1,376 (66.7)		108 (58.1)	
Patients with 1 relapse	958 (31.7)		258 (33.4)		635 (30.8)		65 (34.9)	
Patients with 2 relapses	80 (2.6)		29 (3.8)		44 (2.1)		7 (3.8)	
Patients with ≥3 relapses	25 (0.8)		10 (1.3)		9 (0.4)		6 (3.2)	
Number of days between the earliest MS and the earliest DMT, mean (SD)	231.8 (374.8)		348.3 (500.0)		175.0 (287.5)		378.4 (464.0)	

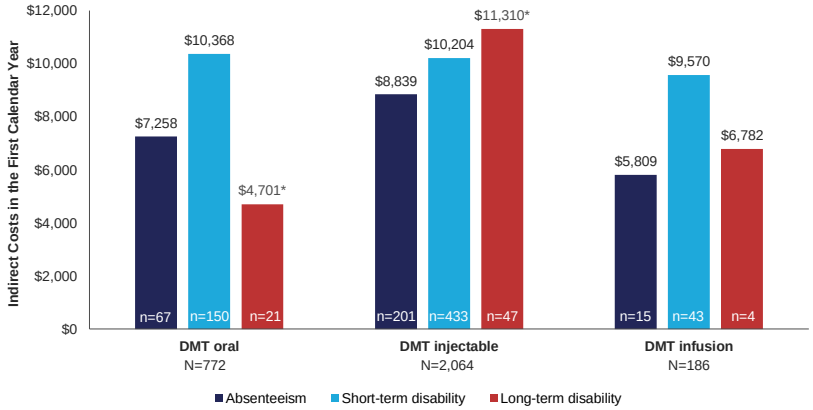
CCI, Charlson Comorbidity Index.
*Indicates that the standardized differences between the cases and controls were above 10.
[1]Unique relapses were defined as a gap greater than 30 days between (1) inpatient admissions with a diagnosis of MS in the primary position or (2) outpatient claims with a diagnosis of MS in any position and use of steroids (dexamethasone, methylprednisolone, prednisolone or prednisone) or corticotropin within 7 days.

9

RESULTS (CONT'D)

- ABS and STD costs were not significantly different across ROAs (**Figure 2**)
- LTD costs were significantly lower in DMT oral users than DMT injectable users in first calendar year ($4,701 vs $11,310, *P*=0.0307; **Figure 2**)

Figure 2. Productivity Loss of DMT Users in the First Year



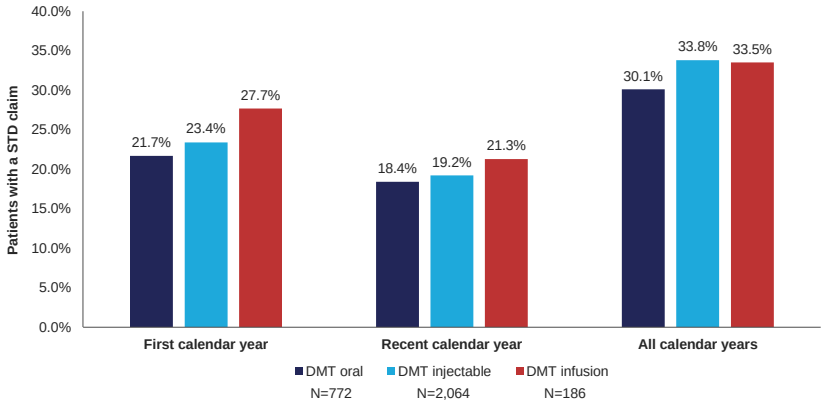
*The differences are statistically significant (*P*<0.05) between the 2 groups.
Indirect costs were reported in the subset of samples with an ABS, STD, and LTD claim, respectively.

10

RESULTS (CONT'D)

- DMT oral users had the lowest percentage of STD claims in the first calendar year, recent calendar year, and all calendar years, and lowest LTD days per patient in the first calendar year (**Figure 3**)

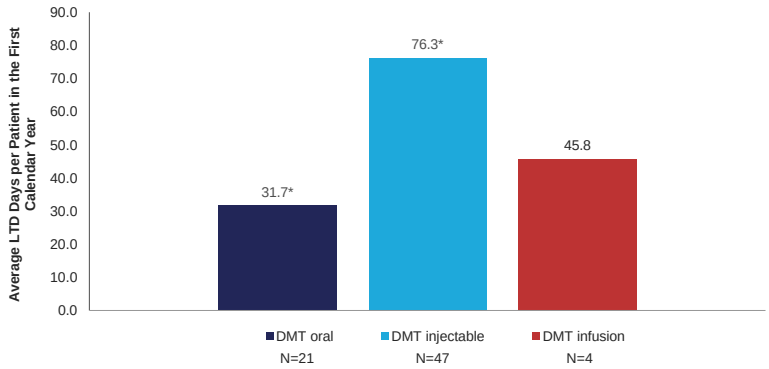
Figure 3. Proportion of Patients With STD Claims



RESULTS (CONT'D)

- Patients who initiated a DMT injectable had the most LTD days per patient in the first calendar year (**Figure 4**)

Figure 4. Average LTD Days per Patients in the First Calendar Year



*The differences are statistically significant ($P<0.05$) between the 2 groups.
Average LTD days per patients were reported among those with an LTD claim

RESULTS (CONT'D)

Table 2. Productivity Loss of DMT Users and Matched Controls in the First Calendar Year

Productivity Loss	Matched DMT Users	Matched Controls for DMT Users	DMT Users vs Controls
	N =3,022	N =9,066	*P* value
Absenteeism (ABS) eligibility, n (%)	363 (12.0)	899 (9.9)	0.0011
Patients with an ABS claim, n (%)*	283 (78.0)	684 (76.1)	0.4758
Overall number of ABS hours per patient, mean (SD) †	313.7 (249.8)	221.8 (124.5)	0.0000
Non-recreational number of ABS hours per patient, mean (SD) †	153.8 (241.6)	65.3 (103.1)	0.0000
Indirect costs per patient, mean (SD) †	$8,304 ($6,613)	$5,872 ($3,296)	0.0000
Short-term disability (STD) eligibility, n (%)	2,696 (89.2)	7,850 (86.6)	0.0002
Patients with a STD claim, n (%)*	626 (23.2)	417 (5.3)	0.0000
Average number of STD days per claim, mean (SD)†	61.8 (50.1)	37.5 (35.8)	0.0000
Average number of STD days per patient, mean (SD)†	68.8 (53.9)	41.7 (40.2)	0.0000
Indirect costs per patient, mean (SD)†	$10,200 ($7,993)	$6,177 ($5,961)	0.0000
Long-term disability (LTD) eligibility, n (%)	2,346 (77.6)	7,035 (77.6)	0.9699
Patients with a LTD claim (N, %)*	72 (3.1)	20 (0.3)	0.0000
Average number of LTD days per claim, mean (SD)†	61.4 (79.2)	76.5 (75.2)	0.4500
Average number of LTD days per patient, mean (SD) †	61.6 (79.1)	85.4 (84.7)	0.2451
Indirect costs per patient, mean (SD)†	$9,131 ($11,725)	$12,652 ($12,559)	0.2451

*Among patients with ABS, STD, or LTD eligibility, respectively.
†Among patients with an ABS, STD, or LTD claim, respectively.

- Compared to their matched controls, the DMT users had a significantly higher percentage of STD (23.2% vs 5.3%, *P*<0.001) and LTD claims (3.1% vs 0.3%, *P*<0.001)
- ABS costs ($8,304 vs $5,872, *P*<0.001) and STD costs ($10,200 vs $6,177, *P*<0.001) were significantly higher in the DMT users than their matched controls
- The length of follow-up ranged from 182.5 and 215.3 days across all DMT and matched controls
- DMT oral users had lower incremental ABS costs in the first calendar year and recent calendar year compared with injectable users
- In the first calendar year, DMT oral users had lower incremental STD costs compared with injectable users

STRENGTHS AND LIMITATIONS

- Strengths
  - Analysis was conducted using a large, real-world database that included over 3,000 MS patients with combined administrative claims and workplace absence data
  - Results were robust to multivariate adjustment accounting for baseline demographic and clinical characteristics
- Limitations
  - Study population is limited to only those individuals employed and with commercial insurance coverage
  - Administrative claims are generated for billing purposes, not research, and therefore coding errors may be present
  - There were no indicators for MS severity available in the data
  - Pharmacologic treatments are based on filled prescriptions. It was assumed that patients took their medication as directed
  - Identified sample sizes were small
  - ABS, STD, and LTD data had separate samples; the sum of these findings cannot be calculated to a total economic burden

CONCLUSIONS

- MS is associated with significant workplace absence among employed patients
- Productivity loss burden was high in the first year in patients with MS
- Oral DMT initiators had the lowest percentage of STD claims and days per LTD claim, suggesting there may be productivity benefits with oral DMT use compared to injectable use
- Oral DMT use is associated with fewer disability claims
- Additional research is needed to better quantify this potential benefit

15

REFERENCES

1. Cross AH, Naismith RT. Established and novel disease-modifying treatments in multiple sclerosis. *J Intern Med*. 2014;275(4):350-363.

2. Gold R, Toumi M, Meesen B, Fogarty E. The payer's perspective: what is the burden of MS and how should the patient's perspective be integrated in health technology assessment conducted for taking decisions on access to care and treatment? *Mult Scler.* 2016;22(suppl 2):60-70.

3. Zwibel HL, Smrtka J. Improving quality of life in multiple sclerosis: an unmet need. *Am J Manag Care*. 2011;17(suppl 5):S139-S145.

4. GBD 2016 Multiple Sclerosis Collaborators. Global, regional, and national burden of multiple sclerosis 1990–2016: a systematic analysis for the global burden of disease study 2016. *Lancet Neurol.* 2019;18(3): 269-285.

5. Adelman G, Rane SG, Villa KF. The cost burden of multiple sclerosis in the United States: a systematic review of the literature. *J Med Econ.* 2013;16(5):639-647.

6. Hunter SF. Overview and diagnosis of multiple sclerosis. *Am J Manag Care.* 2016;22(suppl 6):S141-S150.

7. Kobelt G, Berg J, Atherly D, Hadjimichael O. Costs and quality of life in multiple sclerosis: a cross-sectional study in the United States. *Neurology.* 2006;66(11):1696-1702.

8. Brandes DW RP. The manifold economic impact of multiple sclerosis–indirect and direct costs of managing patients. *Eur Neurol*. 2012(7 suppl 2):17-23.

9. Khan F, Pallant J, Brand C. Caregiver strain and factors associated with caregiver self-efficacy and quality of life in a community cohort with multiple sclerosis. *Disabil Rehabil.* 2007;29(16):1241-1250.

10. Petrikis P, Baldouma A, Katsanos AH, Konitsiotis S, Giannopoulos S. Quality of life and emotional strain in caregivers of patients with multiple sclerosis. *J Clin Neurol.* 2019;15(1):77-83.

16

ACKNOWLEDGMENTS

The authors acknowledge financial support for this study from Celgene Corporation. The authors received editorial support in the preparation of this presentation from Samantha Rivera, MS, of Peloton Advantage, LLC, an OPEN Health company, Parsippany, NJ, USA, sponsored by Celgene Corporation, Summit, NJ, USA. The authors, however, directed and are fully responsible for all content and editorial decisions for this presentation.

CORRESPONDENCE

Machaon Bonafede– [mbonafed@us.ibm.com]

DISCLOSURES

MB, GK, & IS: IBM Watson Health – employment. **RM, MT, & CP:** Celgene Corporation – employment. **NG:** Greater Philadelphia Business Coalition on Health– employment.

Copies of this poster obtained through the QR Code are for personal use only and may not be reproduced without permission from the authors of this poster.

Presented at: ISPOR EUROPE 2019; 2–6 November 2019; Copenhagen, Denmark.