

# DIRECT MEDICAL COSTS AND THE LIKELIHOOD OF HEALTH SERVICE UTILIZATION BEFORE AND AFTER INITIATION OF INTERFERON $\beta$ 1A-IM TREATMENT AMONG PERSONS WITH MULTIPLE SCLEROSIS (MS)

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## BACKGROUND:

- Multiple sclerosis (MS) is an acquired, inflammatory and immune mediated disorder of the central nervous system characterized by inflammation, demyelination and degeneration of axonal neurons that affects more than 2 million people worldwide, and estimates range from 350,000 to 440,000 in the United States.<sup>1,2</sup>
- MS usually affects young adults between the ages of 20 to 40 years, with a female to male risk ratio between 1.5 and 3.6.<sup>3,4</sup>
- Several studies have reported that persons with MS have difficulty maintaining employment due to the condition.<sup>5</sup>
- Avonex, interferon- $\beta$ 1a IM (IFN- $\beta$ 1a IM) is a Disease Modifying Treatment (DMT) administered intramuscularly (IM) for MS.
- IFN- $\beta$ 1a IM aims to reduce the frequency and severity of relapses, delay disability, and postpone the onset of the progressive phase of the disease.
- While efficacy data of the IFN- $\beta$ 1a IM exists, limited objective data are available on the impact on medical costs and health service utilization among employed individuals with MS in the periods before and after the initiation of therapy.

## INTRODUCTION:

- To assess changes, if any, in medical costs and health service utilization among employees when treated with IFN- $\beta$ 1a IM (Avonex) for multiple sclerosis in a real-world setting.

## METHODS:

- A retrospective analysis was performed using patient claims data (1/1/2001 to 6/30/2008) from the Human Capital Management Services (HCMS) Research Reference Database consisting of approximately 670,000 employees representative of the US Employed Civilian Labor Force (2004).
- Employer insurance claims records were analyzed for medical costs and health service utilization.
- Anonymity of person-level data was maintained according to the Health Insurance Portability and Accountability Act guidelines.
- Healthcare was provided through managed care plans contracted by respective employers.
- International Classification of Diseases-9 (ICD-9) codes were used to identify subjects with MS (ICD-9 code of 340.XX).
- Patients with available prescription claims for IFN- $\beta$ 1a IM (Avonex) were examined in the six-months before and after their initial prescription (index date).
- A histogram of 5-year age groupings was developed for all eligible subjects.
- Costs were inflation adjusted to 2008 dollars.
- Employee outcomes for both groups were compared over the 6 months before and after the index date and included:

- Overall (total) medical costs, and
- where available, the likelihood of care and the mean and median cost of health service utilization for the following locations:
  - doctor's office; inpatient hospital; outpatient hospital or clinic; emergency department; laboratory; pharmacy; and "other."

## Statistical Analysis

- Differences in means were compared using *t*-tests and median differences were compared using non-parametric tests to test the difference in the number of observations in each group that are above or below the combined-groups median value.

- Differences were considered significant at  $P < 0.05$ .
- The pre/post design adjusted for confounding factors by having each employee serve as his/her own control.

## RESULTS:

- Records of 68 patients with MS (ICD-9 code of 340.XX) treated with IFN- $\beta$ 1a IM (Avonex) were extracted with six-months of data before and after the employee's index date. Of these 68 patients with medical claims data and full health plan enrollment, 42 had detailed health service utilization information identifying the type or location of the medical service. Demographics from both cohorts are presented in **Table 1**.
  - The age distributions of Avonex users from the two samples are shown in **Figure 1**.
- The mean and median cost in the pre-and post-treatment periods for the 68 Avonex treated patients with direct medical claims data are shown in **Table 2**.
- Within the 42 Avonex treated patients who had location of health service utilization information:
  - The likelihood of care by location of health service utilization in the pre-and post-treatment periods are shown in **Table 3**
    - Likelihoods of all types/locations of health service utilization decreased in the post-treatment period (**Figure 2**), with the reductions in likelihood of Emergency Department, Other and Outpatient Hospital changes being significant.
  - The mean cost of care by location of health service utilization in the pre-and post-treatment periods are shown in **Table 4**, and the changes in the mean costs are shown in **Figure 3** with Office and total cost changes significant.
  - Non-zero median costs of care by location of health service utilization in the pre-and post-treatment periods are shown in **Table 5**, and the changes are shown in **Figure 4**. The differences for Emergency Department, Inpatient Hospital, Office, Outpatient Hospital, and total costs are all significant.

## LIMITATIONS:

- While this study adds to the body of evidence about health benefit costs among employees treated for Multiple Sclerosis with Avonex (IFN- $\beta$ 1a IM), the study has the same limitations characteristic of database studies using administrative claims, i.e., lack of severity classification, MS stage or type, and may not be representative of MS patients who are not diagnosed, who are not treated, who are treated with other therapies, or not able to maintain employment. Furthermore, the small sample size suggests that results may be interpreted with caution. Despite such limitations, the study attempted to control for confounding factors by using a pre/post study design where each employee was his/her own control, and thus represents an important addition to the literature.

## CONCLUSIONS:

- Overall the study results suggest that after initiating treatment with Avonex for Multiple Sclerosis, employees had:
  - Significant decreases in mean and median total direct medical costs in the post-treatment period.
  - Either a decrease or no change in health service utilization and costs by location

(Additional charts on back page.)

**Table 1:** Demographics of Employees Receiving Avonex Treatment and Meeting Enrollment Criteria

Variable	Mean (S.E.) or Percent	Mean (S.E.) or Percent
	With Medical Claims Data (N=68)	With Health Service Utilization Data by Location (N=42)
Age (at index date <sup>1</sup> )	42.06 (0.94)	41.99 (1.19)
Tenure (at index date <sup>1</sup> )	10.49 (1.03)	8.64 (1.11)
Annual Salary	\$62,186 (\$4,086)	\$67,361 (\$5,399)
Female	64.7%	59.5%
Married	54.4%	61.9%
Not Married	38.2%	31.0%
Missing Marital Status	7.4%	7.1%
White	57.4%	71.4%
Black	16.2%	16.7%
Hispanic	2.9%	4.8%
Other	1.5%	2.4%
Race Missing	22.1%	4.8%
Exempt	44.1%	50.0%
Full Time	94.1%	97.6%
Zipcode 1st Digit = 0	13.2%	2.4%
Zipcode 1st Digit = 1	8.8%	4.8%
Zipcode 1st Digit = 2	11.8%	7.1%
Zipcode 1st Digit = 3	14.7%	19.0%
Zipcode 1st Digit = 4	7.4%	7.1%
Zipcode 1st Digit = 5	0.0%	0.0%
Zipcode 1st Digit = 6	2.9%	0.0%
Zipcode 1st Digit = 7	27.9%	45.2%
Zipcode 1st Digit = 8	7.4%	7.1%
Zipcode 1st Digit = 9	5.9%	7.1%
Charlson index during the six months before the index date	0.265 (0.080)	0.333 (0.116)

S.E. = Standard Error

<sup>1</sup> The index date is the date of the first Avonex prescription in the study period such that the employee was enrolled in a health plan and had no other multiple sclerosis medication other than the index medication during the six months before and after the index date.

## References

- Joy JE, Johnston RB, eds. Multiple Sclerosis: Current Status and Strategies for the Future. Committee on Multiple Sclerosis. Washington, DC: National Academy Press; 2004. Available in part at: [http://books.nap.edu/exccsummm\\_pdf/10031.pdf](http://books.nap.edu/exccsummm_pdf/10031.pdf). Accessed March 3, 2008.
- Just the Facts. Frequently asked questions about MS and the National MS Society. Available at <http://www.nationalmssociety.org/about-multiple-sclerosis/FAQs-about-MS/index.aspx#top>. Accessed March 10, 2008.
- Noonan CW, Kathman SJ, White MC. Prevalence estimates for MS in the United States and evidence of an increasing trend for women. *Neurology*. 2002 Jan 8;58(1):136-8.

**Table 2:** Mean and Median Direct Medical Costs for Employees With Avonex Treatment (N=68)

Direct Medical Costs	6 Months Pre-Index	6 Months Post-Index	Pre vs. Post (Within Cohort) P-Values
Mean	\$5,339	\$2,467	0.0016
Median	\$4,596	\$905	<0.0001

**Table 3:** Mean Likelihood of Health Service Utilization by Place of Service for Employees With Avonex Treatment (N=42)

Place of Service	6 Months Pre-Index	6 Months Post-Index	Pre vs. Post (Within Cohort) P-Values
Emergency Department	11.91%	0.00%	0.0235
Inpatient Hospital	16.67%	4.76%	0.0959
Lab	7.14%	7.14%	1.0000
Office	92.86%	92.86%	1.0000
Other	30.95%	14.29%	0.0177
Outpatient Hospital	64.29%	40.48%	0.0106

**Table 4:** Mean Costs by location of Health Service Utilization, Employees With Avonex Treatment (N=42)

Place of Service	6 Months Pre-Index	6 Months Post-Index	Pre vs. Post (Within Cohort) P-Values
Emergency Department	\$54	\$0	0.1088
Inpatient Hospital	\$1,165	\$41	0.1562
Lab	\$10	\$5	0.3690
Office	\$1,880	\$1,079	0.0067
Other	\$265	\$72	0.0750
Outpatient Hospital	\$2,369	\$1,153	0.0868
Total Costs	\$5,743	\$2,350	0.0034

**Table 5:** Median Costs by location of Health Service Utilization, Employees With Avonex Treatment (N=42)

Place of Service	6 Months Pre-Index	6 Months Post-Index	Pre vs. Post (Within Cohort) P-Values
Office	\$1,413	\$507	0.0301
Outpatient Hospital	\$844	\$0	0.0092
Total Costs	\$4,796	\$929	0.0001

All other median costs were zero and were excluded from the table.

<sup>4</sup> Kantarci O, Wingerchuk D. Epidemiology and natural history of multiple sclerosis: new insights. *Curr Opin Neurol*. 2006 Jun;19(3):248-54.

<sup>5</sup> Roessler RT, Rumrill PD Jr, Hennessey ML, Vierstra C, Pugsley E, Pittman A. Perceived strengths and weaknesses in employment policies and services among people with multiple sclerosis: results of a national survey. *Work*. 2003;21(1):25-36.

Figure 1: Age Distribution of Avonex Users

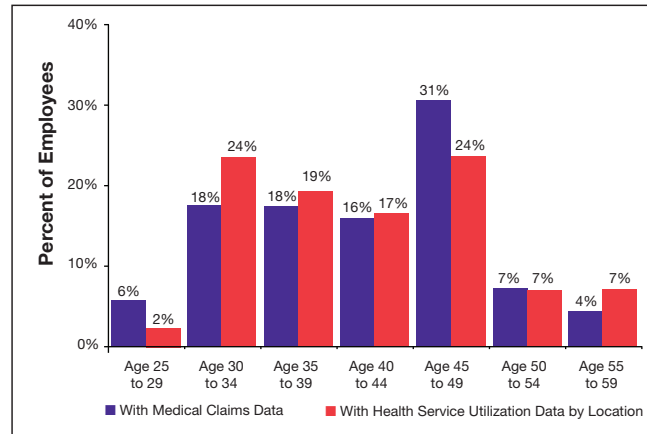


Figure 3: Change in Mean Costs by Point of Service

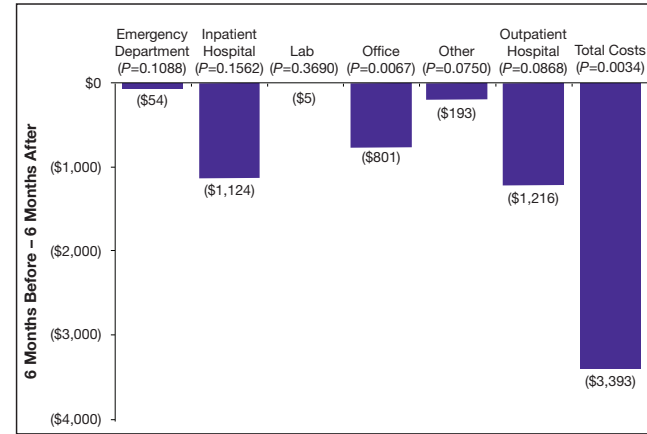


Figure 2: Change in Health Service Utilization by Point of Service

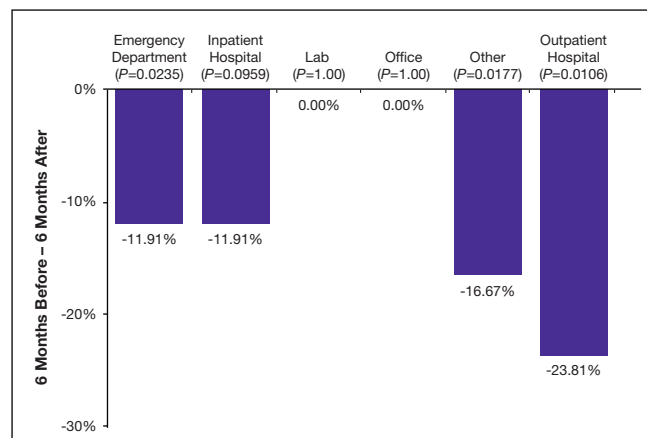
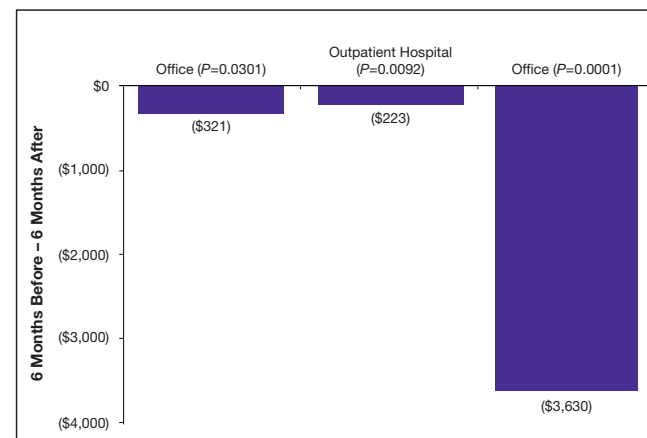


Figure 4: Change in Median Costs by Point of Service



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### ABSTRACT

**OBJECTIVES:** Because limited data are available on changes in direct costs (medical and prescription) and likelihood of health service utilization among employees treated with IFN β1a-IM for MS, we aimed to assess the changes in direct costs and likelihood of health service utilization for persons with multiple sclerosis (MS) treated with Interferon (IFN) β1a-IM.

**METHODS:** A healthcare claims database of US employees from 2001-2008 was used to identify patients with MS (2 IFN β1a-IM prescriptions [Rxs] or an IFN β1a-IM Rx + MS diagnosis [ICD-9=340.X]). Employees with eligibility 6 months before and after their initial IFN β1a-IM Rx and no other disease-modifying therapies were included in the analysis. Non-parametric tests and *t*-tests were used to compare the mean and median direct medical costs and the likelihood of health service utilization before and after initiation of IFN β1a-IM.

**RESULTS:** Data from 68 employees with MS that took IFN β1a-IM (42 employees with health service utilization data) were eligible for analysis. All direct medical cost changes were significant ( $P < 0.01$ ). Mean medical costs decreased by \$2872 (54%) from \$5339 to \$2467 and median costs decreased by \$3691 (80%) from \$4596 to \$905. Significant ( $P < 0.05$ ) decreases in the likelihood of health service utilization were noted for the following: 11.9% for emergency department from 11.9% to 0%, 23.8% for outpatient hospital from 64.3% to 40.5%, and 16.7% for “other” (including home-care, ambulance, mobile unit, and unknown) from 31.0% to 14.3%. Inpatient hospital care decreased non-significantly ( $P = 0.096$ ) by 11.9% from 16.7% to 4.8%, while lab and office claims stayed the same (7.1% and 92.9%, respectively).

**CONCLUSIONS:** Direct medical costs decreased for IFN β1a-IM patients after therapy initiation, with reduced use of emergency department, inpatient and outpatient hospital care, and other services. These differences suggest the costs of Interferon β1a-IM are partially offset by medical care saving.