

# Measuring Fatigue Severity in Adult Women with Multiple Sclerosis in the United States

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## Introduction

- Systems-level improvement collaboratives can improve outcomes, quality, and value of care.<sup>1,2</sup> *Coproduction Learning Health System (CLHS)* models<sup>3</sup> can empower *Quality Improvement (QI)* and research and demonstrate the value of MS care to payers and regulators.
- MS-CQI is the 1st multi-center MS improvement research collaborative. Four MS centers are currently participating (N=5,000).
- MS centers contribute de-identified *Electronic Health Record (EHR)* data including DMT, MRI, and relapses, and receive quarterly benchmarking reports on population health outcomes to inform improvement.
- Patients interested in contributing PRO data complete informed consent and answer online questionnaires for 19 PRO measures (*PROMs*) including *Neuro-QoL*, *PHQ-9*, *PROMIS Fatigue<sub>MS</sub>*, *WPAI*, and *TSQM-9*, and others.
- Three of the four centers participating in MS-CQI are currently randomized to QI intervention via a step-wedge randomized design.

Figure 1. MS-CQI Infrastructure

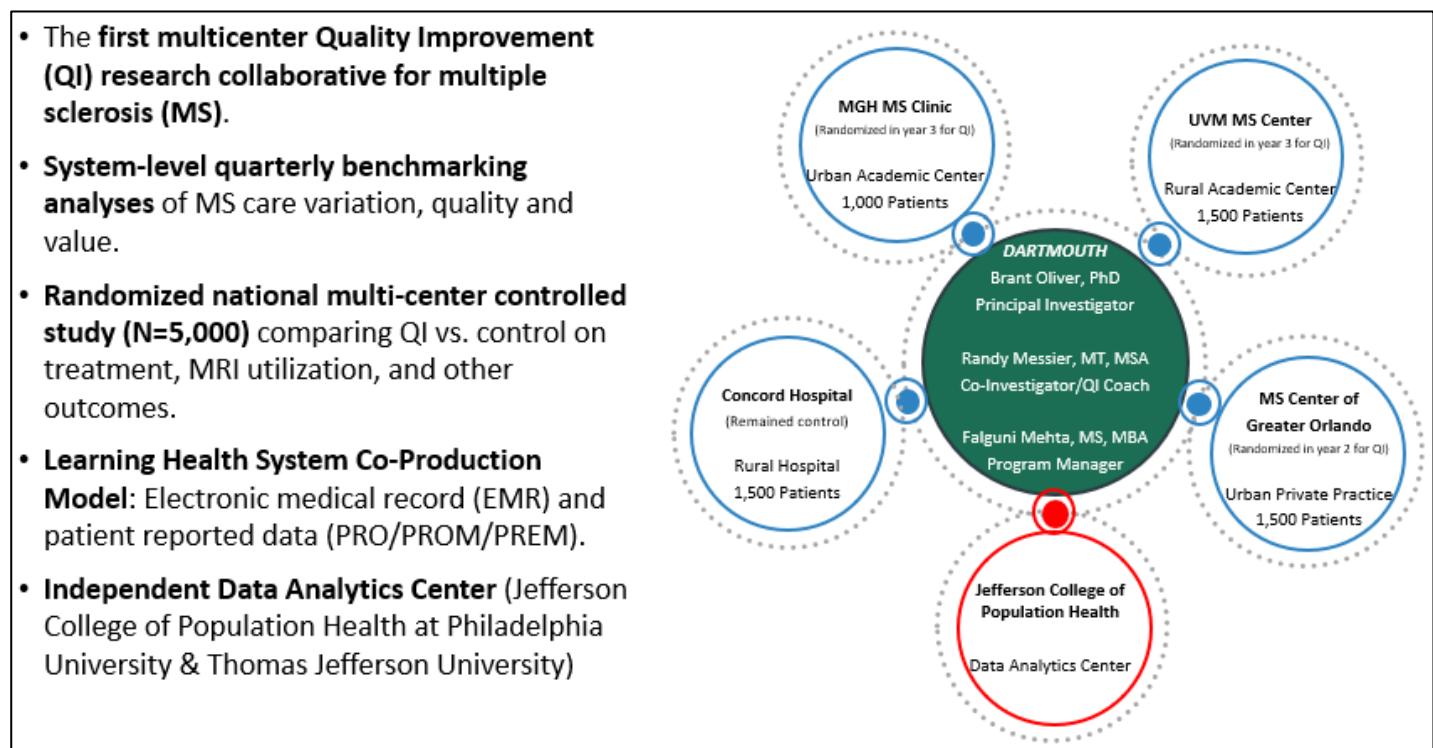


Table 1. Modified Step-Wedge/Dynamic Clinical Trial Schema (3 Year Trajectory)

MS-CQI Sites	Benchmarking	Modified IHI Breakthrough Series CQI with Improvement Coaching	
	Years 1-3	Year 2	Year 3
Center A (Remained Control)	X		
Center B	X		X (Randomized for QI Interventions)
Center C	X		X (Randomized for QI Interventions)
Center D	X	X (Randomized for QI Interventions)	X (Randomized for QI Interventions)

## Fatigue in MS and female sex

- Impairment of brain function in MS causes various neurological symptoms including fatigue, pain, muscle weakness, difficulty walking, vision changes, pain, cognitive changes, and depression.
- Fatigue is the most common and disabling symptom for patients with MS.<sup>4</sup>
- Female sex is correlated with higher reported fatigue severity.<sup>5</sup>

## Objective

MS-CQI aims to: (1) analyze fatigue severity in adult women with MS; and (2) identify significant differences between four MS clinical centers on mean fatigue severity scores.

## Methods

### Study design

- Prospective, longitudinal 1-year baseline study across four MS-CQI centers (A,B,C,D).

### Population

- Adult females (18+) with MS presenting to any of the 4 sites between July 2017 and June 2018.

### Primary outcome

- Fatigue severity measured quarterly using the *PROMIS Fatigue<sub>MS</sub>* (PROM).

### Statistical analysis

- Descriptive statistics were evaluated for each center, as well as significance testing across and between centers.
- Continuous variables were analyzed using ANOVA, and categorical variables were analyzed using Chi-square tests.
- Tukey's Honest Significant Difference tests used for exact fatigue severity variations among the centers.

## Results

- They were 378 patients in the MS-CQI baseline cohort.
- 85.2% were female, 93.5% were white, and 99.4% were English-speaking.
- Mean fatigue severity score was  $56.7 \pm 8.4$ ; compared to a reference population mean of 50.

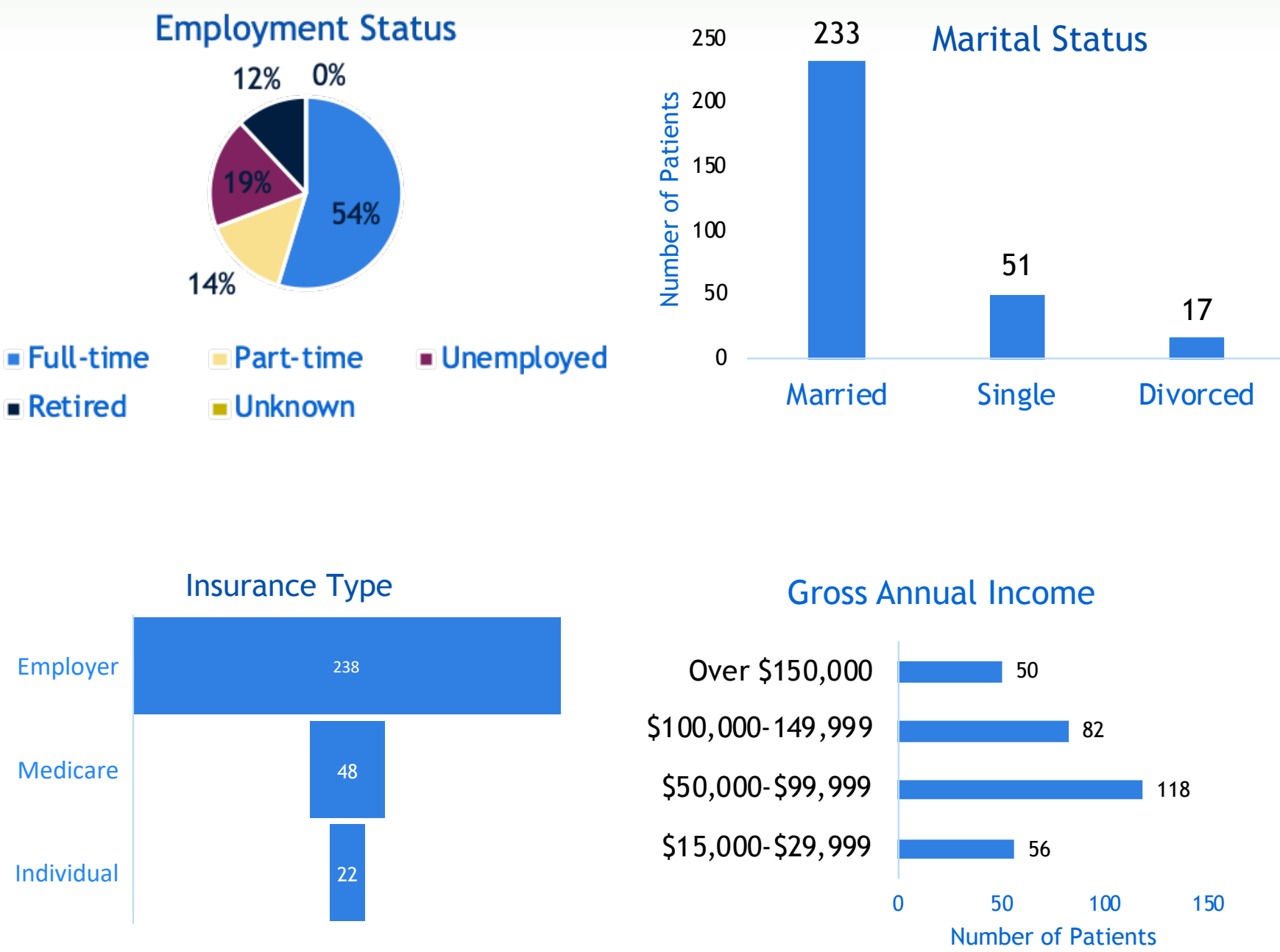


Figure 2. Center-level variations in mean fatigue severity scores

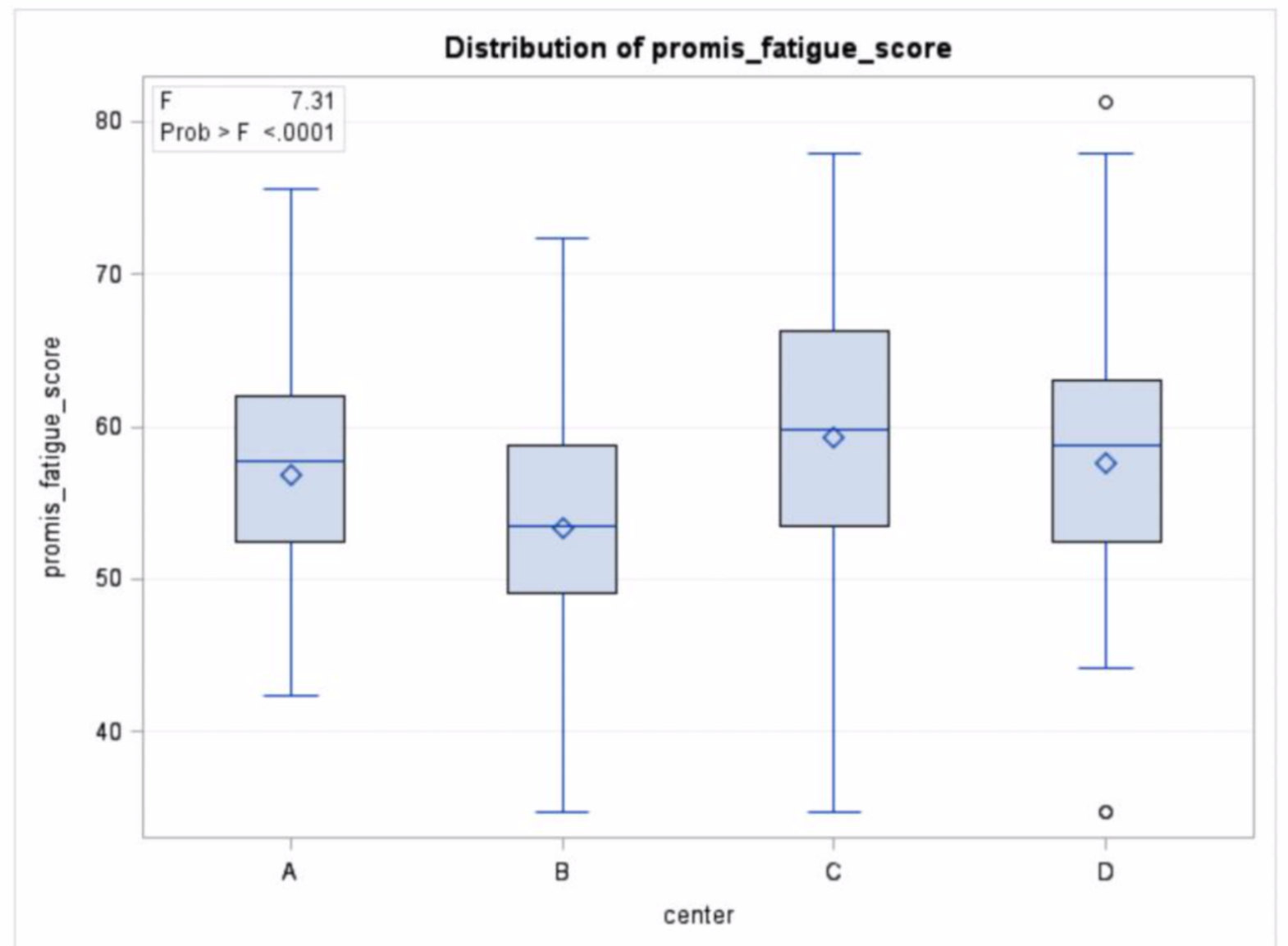


Table 2. Tukey's Honest Significant Difference tests for variations in fatigue severity scores between centers

Center comparison	Difference between means	Simultaneous 95% Confidence Limits		
		Lower	Upper	
C - D	1.779	-1.64	5.198	
C - A	2.488	-0.913	5.889	
C - B	5.98	2.542	9.418	***
D - C	-1.779	-5.198	1.64	
D - A	0.709	-2.532	3.95	
D - B	4.201	0.921	7.481	***
A - C	-2.488	-5.889	0.913	
A - D	-0.709	-3.95	2.532	
A - B	3.492	0.231	6.753	***
B - C	-5.98	-9.418	-2.542	***
B - D	-4.201	-7.481	-0.921	***
B - A	-3.492	-6.753	-0.231	***

\*\*\*Comparisons significant at the 0.05 level are indicated by

## Limitations

Sample represents the US Eastern population and only 1 year of data was analyzed. Fatigue is self-reported and perception is relative. Lastly, PRO data were not linked to EHR data therefore results are not adjusted for comorbidities or disease severity.

## Conclusion

Fatigue severity scores in women were clinically worse than the reference MS population. Prescribers should be more conscious about fatigue worsening to identify progression of MS. Our results also suggest significant center-level differences in mean fatigue scores across and between centers. There is a need to investigate the factors influencing center-level differences and fatigue worsening related to progression of MS and MS outcomes (i.e. relapse rates).