Movement Disorders: Parkinson's and Related Conditions, Multiple Sclerosis (MS), and Amyotrophic Lateral Sclerosis (ALS)

Measure Testing Form

February 2024

Contents

1.0 Introduction

This Measure Testing Form (MTF) provides a summary of the preliminary measure testing results as part of field testing two episode-based cost measures. Readers may review these results, alongside other documentation, to provide feedback on the draft measure using the field testing survey. The testing results reflect the performance of the measure as specified at the time of field testing, which is part of the measure development process. Please see the Draft Cost Measure Methodology for a description of the measure specifications and the Draft Measure Codes List for the list of codes used to specify the measure.[1]

1.1 Project Title and Overview

The Centers for Medicare & Medicaid Services (CMS) has contracted with Acumen, LLC to develop care episode and patient condition groups for use in cost measures to meet the requirements of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA). The contract name is "Physician Cost Measures and Patient Relationship Codes (PCMP)." The contract number is 75FCMC18D0015, Task Order 75FCMC19F0004.

1.2 Measure Name

Movement Disorders: Parkinson's and Related Conditions, Multiple Sclerosis (MS), and Amyotrophic Lateral Sclerosis (ALS) Episode-Based Cost Measure

1.3 Type of Measure

Cost/Resource Use

1.4 Data

The study period is from January 1, 2022, through December 31, 2022. All episodes ending during the study period that meet inclusion and exclusion criteria are included in testing. The measure is calculated with Medicare Parts A, B, and D administrative claims data, the Long-Term Minimum Data Set, and the Medicare Enrollment Database. For testing purposes, other data sources are used, including the American Community Survey and Common Medicare Environment.

Testing results are presented at a testing volume threshold of 20 episodes for clinician groups and individual clinicians. Clinician groups are identified by a Tax Identification Number (TIN). Individual clinicians are identified using a combination of a Tax Identification Number and National Provider Identifier (TIN-NPI).

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[1] These documents will be available on the CMS Cost Measures Information page once field testing begins: https://www.cms.gov/medicare/quality/value-based-programs/cost-measures/current.

2.0 Preliminary Testing Results

This section presents preliminary testing results based on the measure as specified for field testing. Section 2.1 provides an overview of the measure's coverage of beneficiaries and cost. Section 2.2 lists the most frequently attributed specialties. Sections 2.3 through 2.5 provide evidence of the scientific acceptability of the measure. Section 2.6 presents empirical results of the risk adjustment and stratification methods used by this measure. Section 2.7 examines the impact of adding social risk factors to the measure's risk adjustment model. Lastly, Section 2.8 examines the impact of exclusion criteria used by the measure through their frequency and resource use patterns.

2.1 Measure Coverage

Table 1 shows the patient population for the Movement Disorders measure testing. It consists of Medicare beneficiaries enrolled in Medicare Parts A and B who meet all inclusion and exclusion criteria as specified by the measure.

Table 1: Beneficiary Demographics

Metric	Value
Number of Beneficiaries	286,830
Mean Age	73.46
Female %	51.11%
Part D Enrollment %	78.16%

Table 2 shows the characteristics of TINs and TIN-NPIs who are attributed at least 20 episodes.

Table 2: Clinician Characteristics

Metric	TIN		TIN-NPI	
	Count	%	Count	%
Count	2,927	100%	3,020	100%
Number of Episodes Attributed	-	-	-	-
20-39 Episodes	1,234	42.2%	1,831	60.6%
40-59 Episodes	500	17.1%	592	19.6%
60-79 Episodes	286	9.8%	274	9.1%
80-99 Episodes	157	5.4%	128	4.2%
100-199 Episodes	409	14.0%	175	5.8%
200-299 Episodes	135	4.6%	18	0.6%
300+ Episodes	206	7.0%	2	0.1%
Census Region	-	-	-	-
Northeast	592	20.2%	607	20.1%
Midwest	607	20.7%	622	20.6%
South	1,153	39.4%	1,150	38.1%
West	573	19.6%	639	21.2%
Unknown	2	0.1%	2	0.1%

2.2 Frequently Attributed Specialties

Table 3 shows the top 10 attributed specialties for this measure, using a 20-episode testing volume threshold. The most frequently attributed specialties reflect the intent of the measure to capture costs of the management of Movement Disorders, including neurology, nurse practitioner, and physician assistant (Table 3). These clinicians are also consistent with input provided by stakeholders, including patient and family partners (PFPs), during the measure development process. PFPs identified neurologists, physical/occupational therapists, and psychiatrists, amongst others, as being part of their care team.

Table 3: Count of the Top 10 Attributed Specialties

Specialty	Number of TIN-NPIs Attributed
Neurology	2,590
Nurse Practitioner	210
Physician Assistant	99
Internal Medicine	42
Physical Medicine and Rehabilitation	16
Family Practice	14
Psychiatry	12
Neurosurgery	8
Neuropsychiatry	7
Certified Clinical Nurse Specialist	4

2.3 Reliability

Reliability evaluates a measure's ability to consistently differentiate the performance of one clinician from another. The signal-to-noise ratio is used to estimate reliability, which indicates how much of the variation in the measure score is explained by differences among clinicians' performance (i.e., signal) instead of differences within each clinician's performance (i.e., noise). Specifically, noise is the variation from one episode to another during the performance period for a particular clinician.

Table 4 shows reliability metrics at various testing volume thresholds. While higher thresholds yield higher reliability results, it is at the cost of further reducing the number of clinicians and clinician groups eligible for the measure, which would reduce the potential impact of the measure. For the purposes of field testing, we used a 20-episode testing volume threshold (bolded in the table below). If the measure is implemented in the Merit-based Incentive Payment System (MIPS) in the future, CMS will establish a case minimum through notice-and-comment rulemaking.

Table 4: Sample Size, Mean Reliability, and Proportion of Clinicians above Moderate Reliability at Various Testing Volume Thresholds

Testing Volume Threshold	TIN			TIN-NPI		
	Number of TINs	Mean Reliability	Percent Above 0.4	Number TIN-NPIs	Mean Reliability	Percent Above 0.4
10	5,290	0.40	46.05%	6,273	0.46	57.39%
20	**2,927**	**0.51**	**66.59%**	**3,020**	**0.54**	**74.40%**
30	2,149	0.57	78.50%	1,853	0.60	86.13%

At the testing volume of 20 episodes, the mean reliability for the Movement Disorder measure is moderate, specifically 0.51 at the TIN level and 0.54 at the TIN-NPI level (Table 4). CMS generally considers 0.4 as the threshold indicating 'moderate' reliability and 0.7 indicating 'high' reliability, which is supported by previous work into reliability, and the threshold was finalized in the 2022 Physician Fee Schedule final rule.[2,3] The majority of TINs and TIN-NPIs meet or exceed the moderate reliability threshold of 0.4 at the 20-episode testing volume threshold.
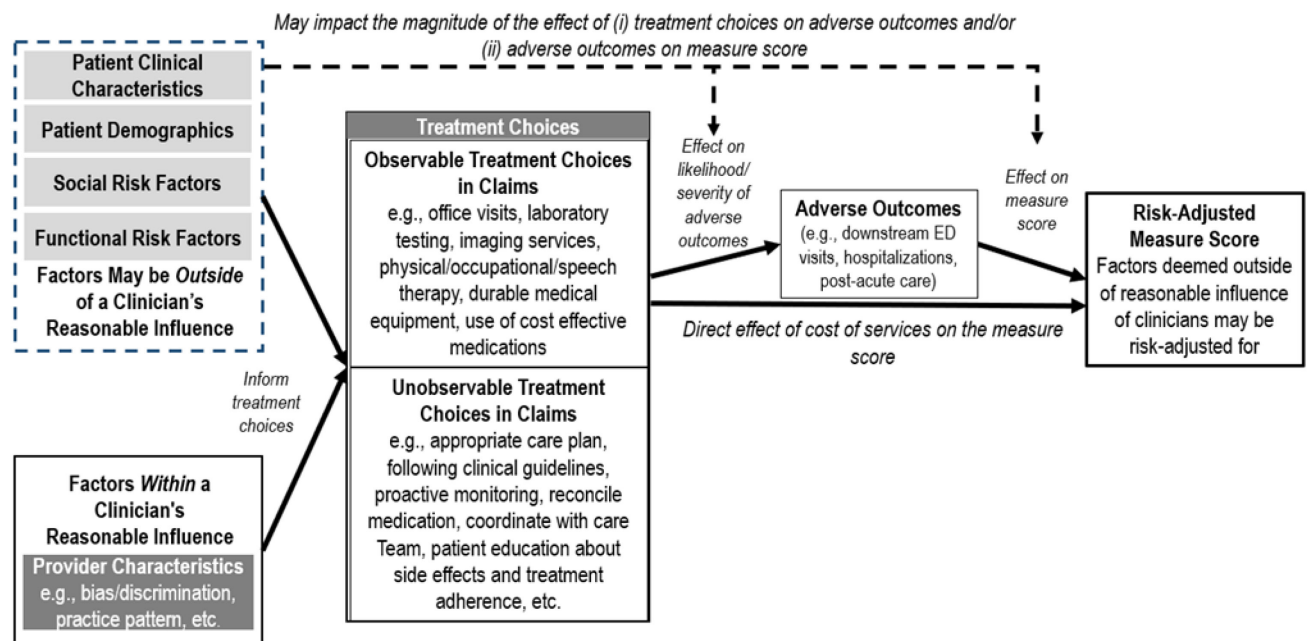
2.4   Validity

Validity is a criterion that evaluates whether the cost measure is able to quantify the construct that it aims to measure, which is the cost directly related to treatment choices and cost of adverse outcomes as a result of care. Validity is evaluated empirically by estimating the effect of relevant treatment choices on the measure score using multiple regression, based on the conceptual model outlined in Figure 1.

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[2] Mathematica, Inc., "Memorandum: Reporting Period and Reliability of AHRQ, CMS 30-Day and HAC Quality Measures – Revised," http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/hospital-value-based-purchasing/Downloads/HVBP_Measure_Reliability-.pdf.

[3] CMS, "Medicare Program; CY 2022 Payment Policies Under the Physician Fee Schedule and Other Changes to Part B Payment Policies; Medicare Shared Savings Program Requirements; Provider Enrollment Regulation Updates; and Provider and Supplier Prepayment and Post-Payment Medical Review Requirements," 86 FR 64996-66031.

Figure 1: Conceptual Model of the Relationship between Treatment Choices and the Measure Score

The cost measure is designed to reflect the cost directly related to treatment choices, as well as the cost of adverse outcomes as a result of care. Therefore, treatment choices, either observable in claims or otherwise, by an attributed clinician can directly impact the measure score or indirectly when they're mediated through the cost of adverse outcomes. The cost of adverse outcomes, in turn, contributes to the total costs that are captured by the measure score.

To demonstrate that the measure score is reflective of both the direct and indirect effects of treatment choices, this analysis first estimates the association between treatment choices and the measure score while controlling for the cost of adverse outcomes. Then, the association between treatment choices and the cost of adverse outcomes is estimated to demonstrate the indirect effect.

Generally, adverse outcomes are inpatient hospitalizations, emergency room visits, and post-acute care that occur after the episode starts. The remaining service categories are generally considered treatment. For each of these categories, the regression models use the mean cost across episodes that were attributed to an individual clinician. The measure score is represented by a clinician's mean observed cost over expected cost ratio across their attributed episodes.

Overall, the results demonstrate that the cost measure is reflective of both the cost directly related to treatment choices, as well as cost of adverse outcomes as a result of care (Table 5). Therefore, there's evidence that the measure is capturing what it purports to measure.

Model 1 shows that the cost of adverse events is associated with a worse measure score. Physical/occupational/speech pathology therapy, major procedures, imaging services, laboratory tests, and Parts B and D medications are all associated with worse measure scores (Model 1) but also with lower costs of adverse events (Model 2), suggesting that these services are beneficial to patient outcomes and are likely not good candidates for cost reduction. Costs

of outpatient evaluation and management (E/M) services and durable medical equipment are associated with better measure scores at the TIN level (Model 1) and associated with higher costs of adverse outcomes at both reporting levels (Model 2), which suggests that they are beneficial to the overall episode spending.

Table 5: Estimated Effect of Treatment Choices

Categories of Service	Coefficient in Thousands [95% Confidence Interval] (p-value)			
	TIN		TIN-NPI	
	Model 1: Mean O/E = Mean Cost of Treatment Choices + Mean Cost of Adverse Events	Model 2: Mean Cost of Adverse Events = Mean Cost of Treatment Choices	Model 1: Mean O/E = Mean Cost of Treatment Choices + Mean Cost of Adverse Events	Model 2: Mean Cost of Adverse Events = Mean Cost of Treatment Choices
Adverse Events	0.05 [0.05,0.06] (p < 0.01)	-	0.07 [0.06,0.07] (p < 0.01)	-
Outpatient Evaluation & Management Services	-0.06 [-0.08,-0.03] (p < 0.01)	4.20 [3.99,4.41] (p < 0.01)	0.04 [0.00,0.07] (p = 0.07)	3.00 [2.76,3.25] (p < 0.01)
Major Procedures	0.08 [0.00,0.17] (p = 0.06)	-2.19 [-3.05,-1.33] (p < 0.01)	0.18 [0.10,0.26] (p < 0.01)	-0.77 [-1.30,-0.23] (p < 0.01)
Ambulatory/Minor Procedures	0.06 [0.02,0.11] (p < 0.01)	0.09 [-0.38,0.56] (p = 0.71)	0.09 [0.04,0.14] (p < 0.01)	0.48 [0.16,0.80] (p < 0.01)
Outpatient Physical, Occupational, or Speech and Language Pathology Therapy	0.08 [0.06,0.09] (p < 0.01)	-0.32 [-0.49,-0.16] (p < 0.01)	0.09 [0.07,0.11] (p < 0.01)	-0.22 [-0.35,-0.09] (p < 0.01)
Laboratory, Pathology, and Other Tests	0.38 [0.24,0.53] (p < 0.01)	-5.29 [-6.75,-3.82] (p < 0.01)	0.32 [0.18,0.45] (p < 0.01)	-2.12 [-3.07,-1.17] (p < 0.01)
Imaging Services	0.17 [0.05,0.30] (p < 0.01)	-4.05 [-5.31,-2.79] (p < 0.01)	-0.12 [-0.23,-0.02] (p = 0.02)	-1.28 [-1.98,-0.58] (p < 0.01)
Durable Medical Equipment and Supplies	-0.02 [-0.03,-0.01] (p < 0.01)	0.64 [0.53,0.76] (p < 0.01)	-0.03 [-0.04,-0.01] (p < 0.01)	0.37 [0.29,0.45] (p < 0.01)
Anesthesia Services	-52.19 [-107.02,2.64] (p = 0.06)	-616.54 [-1172.03,-61.05] (p = 0.03)	-	-
Chemotherapy and Other Part B-Covered Drugs	0.02 [0.02,0.02] (p < 0.01)	0.00 [-0.02,0.03] (p = 0.87)	0.02 [0.02,0.03] (p < 0.01)	0.00 [-0.01,0.01] (p = 0.91)
Part-D Drugs	0.02 [0.02,0.02] (p < 0.01)	-0.02 [-0.05,0.01] (p = 0.26)	0.02 [0.02,0.02](p < 0.01)	0.00 [-0.02,0.02] (p = 0.97)

2.5 Performance Gap

Table 6 shows the distribution of the measure score for clinicians and clinician groups. These results align with expectations based on our review of the literature and demonstrate that there is a performance gap in cost measure performance between the most and least efficient entities at both the clinician and clinician group levels. The Movement Disorders cost measure score at the 90th percentile is over two times greater than the measure score at the 10th percentile at both the TIN and TIN-NPI levels. The variation in the measure score, indicated by the interquartile range and standard deviation, is in the thousands of dollars. The results suggest that there is an opportunity for improvement in performance across clinicians.

Table 6: Distribution of the Measure Score

Metric	TIN	TIN-NPI
Mean Score	$14,255	$14,205
Score Interquartile Range (IQR)	$3,930	$4,772
Standard Deviation	$4,592	$5,721
Coefficient of Variation	0.28	0.34
Score Percentile		
10th	$9,716	$8,930
25th	$11,751	$10,919
50th	$13,892	$13,586
75th	$16,343	$16,640
90th	$19,049	$20,106

2.6 Risk Adjustment and Stratification

Figure 1 shows the conceptual model that outlines how patient-level and clinician-level factors can influence the measure score, which is informed by both published external research and our own data analysis.[4,5,6,7] The conceptual model includes risk factors that are either known by the literature or informed by the Clinical Expert Workgroup to be within or outside of the influence of the attributed clinician. Risk factors, including social risk factors (SRFs), can both influence the treatment choices and impact the size of the effect of treatment choices by mitigating the risk of adverse outcomes and the cost of adverse outcomes.

A systematic approach then guides the decision of which factors to include in the risk adjustment model. First, we reviewed the literature to gather known risk factors and drivers of resource use. These factors are usually diagnoses; therefore, the first set of risk adjustors are commonly the Hierarchical Condition Categories. Then, we consulted our clinical expert panels on additional factors that are known to be associated with resource use. Together with our

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[4]Assistant Secretary of Health and Human Services for Planning and Evaluation. Report to Congress: Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs. Washington, D.C. December 2016.
[5]Chen LM, Epstein AM, Orav EJ, Filice CE, Samson LW, Joynt Maddox KE. Association of Practice-Level Social and Medical Risk With Performance in the Medicare Physician Value-Based Payment Modifier Program. JAMA. 2017;318(5):453-461
[6]Medicare Payment Advisory Commission. Beneficiaries Dually Eligible for Medicare and Medicaid. 2018; https://www.macpac.gov/publication/data-book-beneficiaries-dually-eligible-for-medicare-and-medicaid-3/.
[7] Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. Second Report to Congress on Social Risk Factors and Performance in Medicare's Value-Based Purchasing Program. 2020. https://aspe.hhs.gov/social-risk-factors-and-medicares-value-based-purchasing-programs

clinical expert panel, we reviewed the stratified results on episode cost across many different patient characteristics. We arrived at the final list of risk adjustors based on those discussions and consensus among the clinical experts. Additionally, during our testing phases, we also follow a structured and systematic approach to decide whether SRFs should be risk-adjusted for, which is further described in Section 2.7.

2.6.1   Discrimination

Discrimination is a statistical criterion that evaluates the measure's ability to distinguish high-cost episodes from low-cost episodes, or the ability to explain the variance in cost of individual episodes. The amount of variance explained is estimated by the R-squared metric with the range between 0 and 1. The R-squared value for the measure is 0.259, and 0.257 after adjusting for the model's complexity based on the number of risk adjustors used. In other words, 25.7% of the variation in the actual observed cost of episodes is explained by the risk adjustment model and sub-group stratification.

The remaining unexplained variance is due to variation in factors that are not adjusted for by the measure, such as the clinician's performance. The objective of a cost measure is to evaluate and differentiate the performance of clinicians. Therefore, achieving high explained variance is not essential because not all of the variation in cost of care should be adjusted. In collaboration with the experts from our clinical workgroup, this measure only adjusts for factors that are deemed to be outside of the influence of clinicians. Please see the Draft Cost Measure Methodology for more information on the full list of risk adjustors and sub-groups.

2.6.2   Calibration

Calibration evaluates the consistency of the measure in estimating episode cost across the full range of resource use patterns in the population. Calibration is estimated by the average predictive ratios across groups within the population, specifically groups are partitioned by deciles of expected episode cost. The predictive ratio is calculated using the formula of average expected cost / average observed cost for all episodes in each decile. A well-calibrated measure should have predictive ratios close to 1.00 across all deciles. In other words, such results show that the measure is consistent because it does not under- or over-predict cost throughout the range of resource use patterns in the population.

Table 7 shows that the model has moderate variation in predictive ratios across risk score deciles, with the exception of over-prediction for the high-risk episodes at Decile 10. The average predictive ratio for all risk deciles is 1.00. These results suggest opportunities to improve the risk classification by refining the risk adjustors and further examining drivers of cost.

Table 7: Predictive Ratio by Decile of Predicted Episode Cost

Decile	Average Predictive Ratio
All	1.00
Decile 1	0.84
Decile 2	0.90
Decile 3	0.98
Decile 4	1.00
Decile 5	0.96

Decile	Average Predictive Ratio
Decile 6	0.95
Decile 7	0.88
Decile 8	0.91
Decile 9	0.93
Decile 10	1.17

2.7   Social Risk Factor Analysis

Beyond clinical characteristics of patients, the cost of care may be influenced by non-clinical factors related to a patient's social risk factors (SRFs), such as race, income, education, and employment. At the program level, MIPS adjusts for SRFs using the MIPS Complex Patient Bonus to ensure clinicians or groups treating more complex patients are not disadvantaged.[8] At the measure-level, the testing helps to navigate the tension between ensuring fairness for clinicians treating higher shares of vulnerable patients and the possibility of masking poor performance and perpetuating disparity if clinicians are held to different standards.

Table 8 outlines variables that may indicate SRFs and their advantages and disadvantages as indicators of individual-level SRFs. Based on availability of data, this analysis tested all variables except for the ICD-10 Z codes.

Table 8: Social Risk Factors Available for Analysis

Variable	Advantages	Disadvantages	Used in Testing
Dual Medicare and Medicaid enrollment status	• Available for all beneficiaries • Most powerful predictor of poor outcomes[9]	• Variation in Medicaid eligibility across states	Yes
Race/Ethnicity	• Available for most beneficiaries, except for ambiguous categories of "Unknown" or "Other"	• Social risk driven by someone's race is often correlated with and partially captured by dual status[10] • Only 5 categories available, which may lack granularity to fully capture disparities[11,12]	Yes

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[8] https://qpp-cm-prod-content.s3.amazonaws.com/uploads/966/QPP%20COVID-19%20Response%20Fact%20Sheet.pdf

[9] Refer to footnote 4.

[10] Refer to footnote 4.

[11] Nguyen, Kevin H., Kaitlyn P. Lew, and Amal N. Trivedi. "Trends in Collection of Disaggregated Asian American, Native Hawaiian, and Pacific Islander Data: Opportunities in Federal Health Surveys." *American Journal of Public Health* (2022).

[12] Kader, Farah, Lan N. Doan, Matthew Lee, Matthew K. Chin, Simona C. Kwon, and Stella S. Yi. "Disaggregating Race/Ethnicity Data Categories: Criticisms, Dangers, And Opposing Viewpoints", *Health Affairs Forefront* (2022).

Variable	Advantages	Disadvantages	Used in Testing
ICD-10 Z codes for social determinants of health	• Reflects individual-level factors that influence health status and contact with health services	• Not routinely and consistently coded on claims, only available for 0.1% of all fee-for-service claims in 2019[13]	No
American Community Survey	• Can link beneficiary's ZIP code to socioeconomic (SES) measurement of their neighborhood • Many SES indices can be derived from the survey data (e.g., Agency for Healthcare Research and Quality SES index, deprivation index)	• Only a proxy measure, not always accurate at individual-level	Yes

First, this analysis evaluated each of the variables for their association with episode cost using step-wise regression. Testing findings demonstrate that dual Medicare and Medicaid enrollment status is the most consistent predictor, even in the presence of other variables (Tables 9 and B1). This is also consistent with other research that found dual status to be the best proxy of SRFs in predicting health outcomes.[14]

Table 9: Associations of Available Social Risk Factor Variables and Cost of Care – TIN Reporting Level

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Amyotrophic Lateral Sclerosis with Part D Enrollment	Dual Status	0.05 (0.08,0.49)	0.05 (0.08,0.51)	0.09 (0.08,0.27)
	Race - Asian	-	-0.23 (0.18,0.18)	-0.26 (0.18,0.14)
	Race - Black	-	-0.02 (0.12,0.84)	0.00 (0.12,0.98)
	Race - Hispanic	-	0.29 (0.15,0.05)	0.31 (0.15,0.03)
	Race - North American Native	-	-0.42 (0.57,0.47)	-0.45 (0.57,0.44)

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[13] Centers for Medicare & Medicaid (CMS), Office of Minority Health. "Utilization of Z Codes for Social Determinants of Health among Medicare Fee-for-Service Beneficiaries." (2019) https://www.cms.gov/files/document/z-codes-data-highlight.pdf

[14] Office of the Assistant Secretary for Planning and Evaluation. "Second report to Congress on social risk and Medicare's value-based purchasing programs." (2020) https://aspe.hhs.gov/pdf-report/second-impact-report-to-congress

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Amyotrophic Lateral Sclerosis with Part D Enrollment (cont.)	Race - Others	-	0.00 (0.11,1.00)	-0.03 (0.11,0.82)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,0.00)
Amyotrophic Lateral Sclerosis without Part D Enrollment	Dual Status	-0.17 (0.36,0.64)	-0.15 (0.36,0.67)	-0.13 (0.36,0.71)
	Race - Asian	-	0.54 (0.38,0.15)	0.45 (0.38,0.24)
	Race - Black	-	0.03 (0.21,0.89)	0.06 (0.21,0.76)
	Race - Hispanic	-	-0.15 (0.39,0.70)	-0.15 (0.39,0.69)
	Race - North American Native	-	0.94 (1.79,0.60)	0.96 (1.78,0.59)
	Race - Others	-	-0.29 (0.26,0.26)	-0.35 (0.26,0.17)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.02 (0.01,0.04)
Multiple Sclerosis with Part D Enrollment	Dual Status	0.47 (0.02,<0.001)	0.46 (0.02,<0.001)	0.48 (0.02,<0.001)
	Race - Asian	-	0.03 (0.09,0.71)	0.00 (0.09,0.98)
	Race - Black	-	0.12 (0.02,<0.001)	0.15 (0.02,<0.001)
	Race - Hispanic	-	-0.02 (0.05,0.7)	0.00 (0.05,0.99)
	Race - North American Native	-	-0.24 (0.11,0.02)	-0.23 (0.11,0.04)
	Race - Others	-	0.12 (0.04,<0.001)	0.11 (0.04,<0.001)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,<0.001)
Multiple Sclerosis without Part D Enrollment	Dual Status	0.23 (0.11,0.04)	0.22 (0.11,0.05)	0.23 (0.11,0.04)
	Race - Asian	-	0.14 (0.24,0.57)	0.14 (0.24,0.57)
	Race - Black	-	0.16 (0.04,<0.001)	0.19 (0.04,<0.001)
	Race - Hispanic	-	0.14 (0.12,0.22)	0.16 (0.12,0.16)
	Race - North American Native	-	-0.01 (0.24,0.98)	0.06 (0.24,0.81)
	Race - Others	-	0.09 (0.08,0.25)	0.07 (0.08,0.36)
	Race - White	-	ref	ref

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Multiple Sclerosis without Part D Enrollment (cont.)	AHRQ SES Index	-	-	0.01 (0.00,<0.001)
Parkinson's and Related Conditions with Part D Enrollment	Dual Status	0.10 (0.01,<0.001)	0.10 (0.01,<0.001)	0.13 (0.01,<0.001)
	Race - Asian	-	0.05 (0.02,0.01)	0.03 (0.02,0.12)
	Race - Black	-	-0.05 (0.01,<0.001)	-0.03 (0.01,0.04)
	Race - Hispanic	-	0.01 (0.02,0.51)	0.04 (0.02,0.06)
	Race - North American Native	-	0.00 (0.05,0.97)	0.03 (0.05,0.52)
	Race - Others	-	0.05 (0.01,<0.001)	0.03 (0.01,0.01)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,<0.001)
Parkinson's and Related Conditions without Part D Enrollment	Dual Status	0.22 (0.06,<0.001)	0.22 (0.06,<0.001)	0.23 (0.06,<0.001)
	Race - Asian	-	-0.04 (0.05,0.46)	-0.05 (0.05,0.35)
	Race - Black	-	0.02 (0.03,0.50)	0.03 (0.03,0.22)
	Race - Hispanic	-	-0.02 (0.07,0.77)	0.00 (0.07,0.95)
	Race - North American Native	-	0.17 (0.08,0.04)	0.21 (0.08,0.01)
	Race - Others	-	-0.05 (0.03,0.06)	-0.07 (0.03,0.02)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,<0.001)

The subsequent analyses focus on dual status as the main proxy variable for SRFs for risk adjustment. To determine whether it's appropriate to risk adjust for SRFs, the following criteria are considered:

(i)   whether there's an association between social risk and performance by examining the coefficient of patient-level dual status when added into the risk model,

(ii)   whether the observed association is most influenced by patient-level factors or clinician-level factors by examining the stability of the patient-level dual status coefficient after adding clinician's dual share variable, as well as including the clinician's fixed effects,

(iii)   whether the patient's need or complexity (rather than poor quality) is driving the observed performance differences by examining the differences in performance on

           dual patients versus non-dual patients and if there are many clinicians who are able to perform similarly or better on their dual patients than their non-dual patients, and

(iv)   the impact of risk adjusting for SRFs by examining the performance shift of clinicians compared to a risk adjustment model that doesn't risk adjust for SRFs.

There is a statistically significant association between the patient's dual status and episode cost, as observed in the largest subgroups (Table 10). This association is relatively stable even after adding variables to account for clinician-level factors, which suggests that the patient-level factors are more influential than clinician-level factors. This is also supported by the evidence that dual episodes tend to have higher mean ratios of observed to expected costs compared to all and non-dual episodes (Table 11). When comparing clinician performance on dual over non-dual episodes, a large majority of clinicians perform equally well. Still, there are many more clinicians performing significantly worse on their dual episodes than their non-dual episodes, which suggests that clinicians aren't able to fully mitigate the effect of SRFs (Table 12). Lastly, risk adjusting for dual status appears to change the performance ranking for a subset of clinicians (Table 13).

Table 10: Coefficient of Patient-level Dual Status under Different Models

Level	Subgroup Risk Model	% of All Episodes	Coefficient in Log Form under Loglinear Model (p-value)		
			Base Model + Patient-level Dual Status	Base Model + Patient-level Dual Status + Clinician's Dual Share	Base Model + Patient-level Dual Status + Clinician's Fixed Effect
TIN	Amyotrophic Lateral Sclerosis with Part D Enrollment	0.85%	0.05 (p=0.49)	0.08 (p=0.34)	0.05 (p=0.62)
	Amyotrophic Lateral Sclerosis without Part D Enrollment	0.25%	-0.17 (p=0.64)	-0.19 (p=0.60)	-0.01 (p=0.98)
	Multiple Sclerosis with Part D Enrollment	19.44%	0.47 (p<0.001)	0.48 (p<0.001)	0.49 (p<0.001)
	Multiple Sclerosis without Part D Enrollment	4.67%	0.23 (p=0.04)	0.22 (p=0.05)	0.45 (p<0.001)
	Parkinson's and Related Conditions with Part D Enrollment	58.24%	0.10 (p<0.001)	0.08 (p<0.001)	0.07 (p<0.001)
	Parkinson's and Related Conditions without Part D Enrollment	16.55%	0.22 (p<0.001)	0.17 (p=0.01)	0.29 (p<0.001)
TIN-NPI	Amyotrophic Lateral Sclerosis with Part D Enrollment	0.81%	0.11 (p=0.18)	0.14 (p=0.17)	0.19 (p=0.18)
	Amyotrophic Lateral Sclerosis without Part D Enrollment	0.24%	-0.41 (p=0.28)	-0.28 (p=0.49)	1.07 (p=0.33)
	Multiple Sclerosis with Part D Enrollment	19.18%	0.49 (p<0.001)	0.53 (p<0.001)	0.57 (p<0.001)
	Multiple Sclerosis without Part D Enrollment	4.55%	0.12 (p=0.31)	0.03 (p=0.77)	0.60 (p=0.02)
	Parkinson's and Related Conditions with Part D Enrollment	58.68%	0.11 (p<0.001)	0.13 (p<0.001)	0.11 (p<0.001)
	Parkinson's and Related Conditions without Part D Enrollment	16.54%	0.21 (p<0.001)	0.20 (p<0.001)	0.23 (p=0.03)

Table 11: Mean Ratio of Observed Cost to Expected Cost (O/E) Stratified by Clinician's Dual Share and Patient's Dual Status

Dual Share	TIN			TIN-NPI		
	All Episodes	Dual Episodes	Non-Dual Episodes	All Episodes	Dual Episodes	Non-Dual Episodes
All	1.06	1.15	1.06	1.07	1.25	1.05
0-20%	1.01	1.17	1.00	1.01	1.44	1.00
21-40%	1.05	1.13	1.04	1.04	1.24	1.03
41-60%	1.06	1.20	1.04	1.05	1.19	1.04
61-80%	1.09	1.14	1.07	1.09	1.28	1.06
81-100%	1.11	1.11	1.13	1.16	1.21	1.14

Table 12: Proportions of Clinicians Who Perform Significantly Worse, Equally Well, or Significantly Better on Their Dual Episodes than Non-Dual Episodes

Reporting Level	Significantly Better	Equally Well	Significantly Worse
TIN	1.91%	90.46%	7.63%
TIN-NPI	0.26%	91.21%	8.52%

Table 13: Clinicians' Performance Shift Measured by the Change in the Average Ratio of Observed Cost to Expected Cost (O/E)

Reporting Level	Proportions of Clinicians Affected at Various Levels of Performance Shift	
	Ranking Shift by 1% or more	Ranking Shift by 5% or more
TIN	74.42%	11.77%
TIN-NPI	66.82%	9.42%

2.8   Impact of Exclusions

Table 14 displays descriptive statistics of all episodes meeting the measure's triggering logic, excluded episodes, and final reportable episodes at both TIN and TIN-NPI levels. These exclusion criteria ensure that the reportable episode populations are more homogenous and comparable than all episodes meeting triggering logic. It is worth noting that only the observed cost is shown, which has not been risk adjusted for using our risk adjustment model. Therefore, the differences in cost may appear much smaller after risk adjustment than as-is.

Overall, the exclusion criteria decrease the distribution of observed cost of all episodes meeting trigger logic, from the mean of $15,819 to $13,376 at the TIN-level and $12,859 at the TIN-NPI level (Table 14). All of the exclusion criteria have a higher mean observed cost than all episodes meeting triggering logic, with substantial differences for several exclusion categories. In particular, the largest differences due to exclusions come from applying the testing volume threshold to ensure a sufficient sample size for the measure.

Episodes shorter than the one-year attribution window are excluded because the methodology for MIPS chronic cost measures requires at least one year of claims data to measure clinician cost performance to ensure sufficient observation of chronic care, which is often intermittent and

sparse over a long period of time. These episodes also have a substantially higher mean observed cost than all episodes meeting triggering logic, at $33,188 (Table 14). Although these episodes are excluded during the performance period being examined, they are likely to be included in the following performance period once the episode length is longer than one year.

Episodes where a beneficiary died before the episode end date are excluded because they do not provide sufficient data in the episode window period. These episodes also have a higher mean observed cost than all episodes meeting triggering logic, at $26,258 (Table 14).

Episodes classified as outlier cases are excluded because they deviate substantially from the projected cost for a given patient risk profile. Outlier episodes have a mean observed episode cost of $39,550 compared to $15,819 for all episodes meeting triggering logic (Table 14). The wide variability of observed episode costs for outlier cases also supports their exclusion. At the 10th percentile the outlier cases observed cost is $2,350 and at the 90th percentile the observed cost is $89,903.

Episodes where there is not an attributed clinician are excluded because these episodes do not have any TIN-NPIs that billed at least 30% of the clinically-related claims with a relevant diagnosis. As such, they cannot be used in the measure at the TIN-NPI level.

Finally, episodes where the attributed provider does not meet the volume threshold are excluded to ensure that providers subject to the measure have a sufficient sample of attributed episodes for fair and accurate measurement. In particular, these episodes display substantial variability in observed episode costs, with a 10th percentile cost of $728 and $704 at the TIN and TIN-NPI thresholds, respectively, compared to a 90th percentile cost of $47,603 and $47,484 (Table 14).

Table 14: Cost Statistics for Measure Exclusions

| Exclusion Criteria | Episodes | | Observed Episode Cost | | | | | |
	Count	Percent of All Episodes Meeting Trigger Logic	Mean	10th	25th	50th	75th	90th
All Episodes Meeting Triggering Logic	466,792	100.0%	$15,819	$741	$1,734	$5,855	$18,584	$47,603
Episode Length Less Than 1 Year	29,228	6.3%	$33,188	$1,581	$4,598	$14,033	$36,427	$81,254
Beneficiary Death in Episode	69,293	14.8%	$26,258	$1,491	$4,425	$13,092	$30,748	$61,876
Outlier Cases	7,892	1.7%	$39,550	$2,350	$7,251	$47,603	$55,969	$89,903
No Attributed Clinician (TIN-NPI Reporting Only)	55,713	11.9%	$17,859	$946	$2,327	$7,476	$22,121	$51,129
TIN does not Meet Testing Volume Threshold	106,526	22.8%	$16,677	$728	$1,823	$6,552	$19,847	$47,603
TIN-NPI does not Meet Testing Volume Threshold	259,942	55.7%	$16,214	$704	$1,715	$6,073	$19,125	$47,484
Reportable Episodes (if all clinicians reported as TIN at the Testing Volume Threshold)	**303,513**	**65.0%**	**$13,376**	**$689**	**$1,507**	**$4,746**	**$15,154**	**$40,869**
Reportable Episodes (if all clinicians reported as TIN-NPI at the Testing Volume Threshold)	**134,415**	**28.8%**	**$12,859**	**$712**	**$1,472**	**$4,370**	**$13,795**	**$39,865**

Appendix A. Distributions of Measure Score

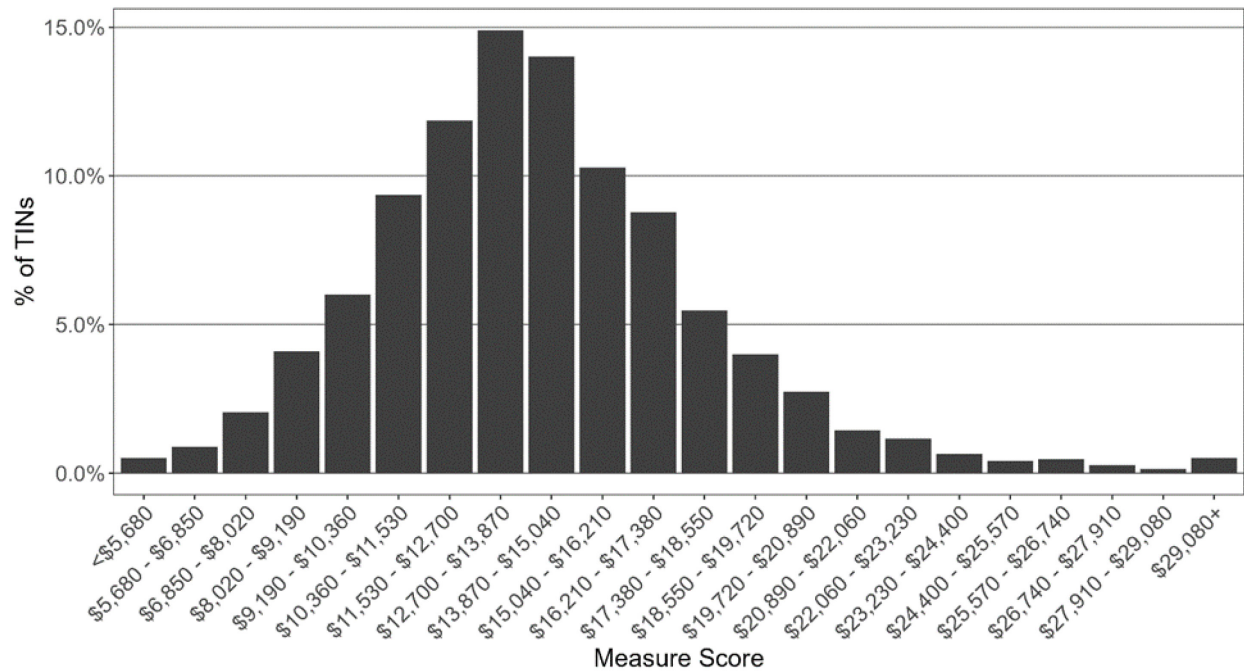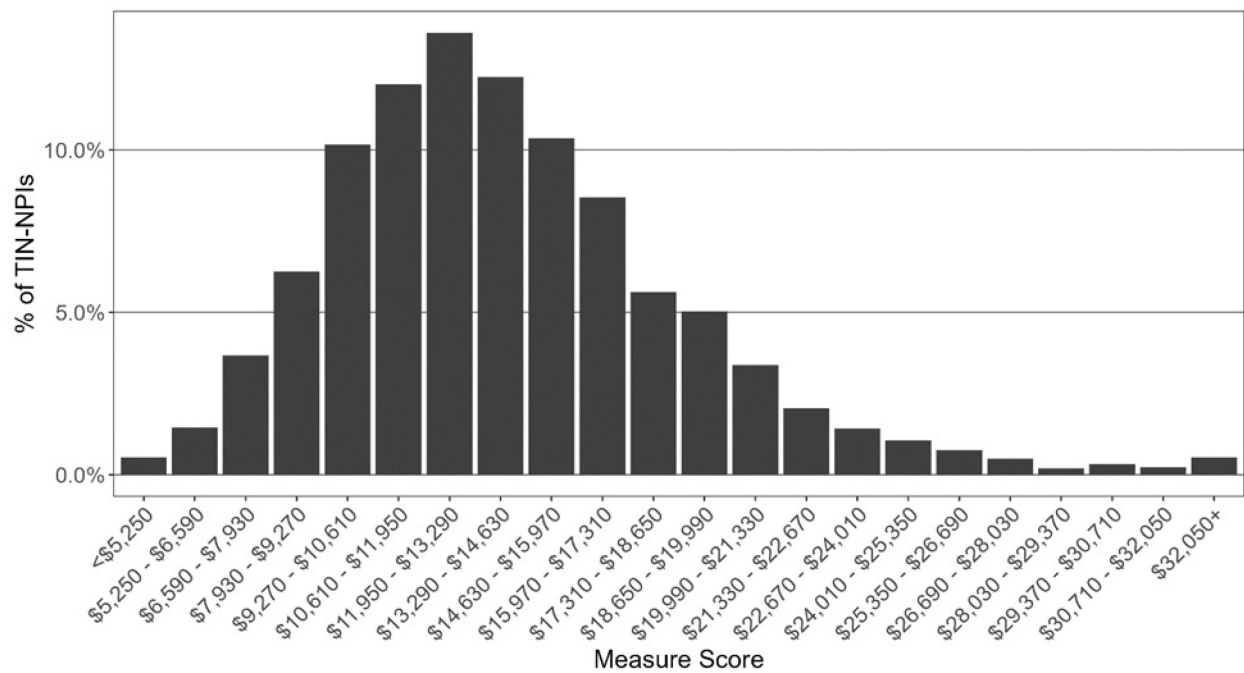**Figure 2: Distribution of Measure Score - TIN**

Figure 3: Distribution of Measure Score - TIN-NPI

Appendix B. Associations between Social Risk Factor Variables and Cost of Care for TIN-NPIs

Table B1: Associations of Available Social Risk Factor Variables and Cost of Care – TIN-NPI Reporting Level

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Amyotrophic Lateral Sclerosis with Part D Enrollment	Dual Status	0.11 (0.08,0.18)	0.11 (0.08,0.18)	0.14 (0.08,0.09)
	Race - Asian	-	-0.23 (0.18,0.22)	-0.25 (0.18,0.18)
	Race - Black	-	-0.09 (0.13,0.50)	-0.07 (0.13,0.59)
	Race - Hispanic	-	0.21 (0.16,0.20)	0.23 (0.16,0.16)
	Race - North American Native	-	0.01 (0.67,0.99)	-0.03 (0.67,0.96)
	Race - Others	-	0.03 (0.12,0.83)	0.00 (0.12,0.97)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,0.02)
Amyotrophic Lateral Sclerosis without Part D Enrollment	Dual Status	-0.41 (0.38,0.28)	-0.35 (0.38,0.36)	-0.35 (0.38,0.36)
	Race - Asian	-	0.48 (0.40,0.23)	0.40 (0.40,0.33)
	Race - Black	-	0.34 (0.22,0.13)	0.34 (0.22,0.12)
	Race - Hispanic	-	-0.15 (0.42,0.71)	-0.15 (0.42,0.71)
	Race - North American Native	-	0.80 (1.84,0.66)	0.78 (1.84,0.67)
	Race - Others	-	-0.27 (0.26,0.31)	-0.32 (0.26,0.22)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.02 (0.01,0.07)
Multiple Sclerosis with Part D Enrollment	Dual Status	0.49 (0.02,<0.001)	0.48 (0.02,<0.001)	0.50 (0.02,<0.001)
	Race - Asian	-	0.06 (0.09,0.52)	0.03 (0.09,0.77)
	Race - Black	-	0.12 (0.02,<0.001)	0.14 (0.02,<0.001)
	Race - Hispanic	-	-0.02 (0.05,0.7)	0.00 (0.05,0.99)
	Race - North American Native	-	-0.26 (0.12,0.03)	-0.24 (0.12,0.04)

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Multiple Sclerosis with Part D Enrollment (cont.)	Race - Others	-	0.11 (0.04,<0.001)	0.10 (0.04,0.01)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,<0.001)
Multiple Sclerosis without Part D Enrollment	Dual Status	0.12 (0.12,0.31)	0.12 (0.12,0.33)	0.13 (0.12,0.29)
	Race - Asian	-	0.08 (0.25,0.75)	0.09 (0.25,0.72)
	Race - Black	-	0.13 (0.04,<0.001)	0.16 (0.04,<0.001)
	Race - Hispanic	-	0.17 (0.12,0.17)	0.19 (0.12,0.12)
	Race - North American Native	-	-0.22 (0.26,0.40)	-0.16 (0.26,0.53)
	Race - Others	-	0.11 (0.08,0.19)	0.09 (0.08,0.28)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.0,<0.001)
Parkinson's and Related Conditions with Part D Enrollment	Dual Status	0.11 (0.01,<0.001)	0.11 (0.01,<0.001)	0.13 (0.01,<0.001)
	Race – Asian	-	0.05 (0.02,0.01)	0.03 (0.02,0.15)
	Race - Black	-	-0.05 (0.01,<0.001)	-0.03 (0.01,0.07)
	Race - Hispanic	-	0.02 (0.02,0.29)	0.05 (0.02,0.02)
	Race - North American Native	-	-0.01 (0.05,0.89)	0.03 (0.05,0.62)
	Race - Others	-	0.05 (0.01,<0.001)	0.03 (0.01,0.01)
	Race - White	-	ref	ref
	AHRQ SES Index	-	-	0.01 (0.00,<0.001)
Parkinson's and Related Conditions without Part D Enrollment	Dual Status	0.21 (0.07,<0.001)	0.21 (0.07,<0.001)	0.22 (0.07,<0.001)
	Race - Asian	-	-0.04 (0.05,0.48)	-0.05 (0.05,0.37)
	Race - Black	-	0.02 (0.03,0.36)	0.04 (0.03,0.15)
	Race - Hispanic	-	0.00 (0.07,0.99)	0.03 (0.07,0.71)
	Race - North American Native	-	0.15 (0.09,0.09)	0.19 (0.09,0.04)
	Race - Others	-	-0.07 (0.03,0.03)	-0.08 (0.03,0.01)
	Race - White	-	ref	ref

Subgroup Risk Model	Variable	Coefficient in Log Form under Loglinear Model (Standard Deviation, p-value)		
		Model 1: Base Model + Dual Status	Model 2: Base Model + Dual Status + Race	Model 3: Base Model + Dual Status + Race + AHRQ SES
Parkinson's and Related Conditions without Part D Enrollment (cont.)	AHRQ SES Index	-	-	0.01 (0.00,<0.001)