Association Between Patient Cognitive and Functional Status and Medicare Total Annual Cost of Care Implications for Value-Based Payment

Kenton J. Johnston, PhD; Hefei Wen, PhD; Jason M. Hockenberry, PhD; Karen E. Joynt Maddox, MD, MPH

IMPORTANCE Medicare is moving toward value-based payment. The Merit-Based Incentive Payment System (MIPS) program judges outpatient clinicians' performance on a measure of annual Medicare spending. However, this measure may disadvantage outpatient clinicians who care for vulnerable populations because the algorithm omits meaningful determinants of cost.

OBJECTIVES To determine whether factors not included in Medicare risk adjustment, including patient neuropsychological and functional status, as well as local area health resources and economic conditions, are associated with Medicare total annual cost of care (TACC), and evaluate whether accounting for these factors is associated with improved TACC performance by outpatient safety-net clinicians.

DESIGN, SETTING, AND PARTICIPANTS In this retrospective observational study, we used the Medicare Current Beneficiary Survey (MCBS) to examine patient-reported neuropsychological and functional status and the Area Health Resources File to obtain information on local area characteristics. Included were Medicare beneficiaries with annual physician or clinic visits to outpatient safety-net (federally qualified health centers and rural health clinics) and non–safety-net clinics, contributing 76,927 person-years of data to the MCBS from 2006 through 2013. We used patient-level multivariable regression models to estimate the association between each factor and annual Medicare spending, and compared outpatient safety-net performance under current risk adjustment and after adding additional adjustment for these factors.

MAIN OUTCOMES AND MEASURES Medicare TACC, measured as the total annual reimbursed amount per patient for Medicare Part A and Part B services, in all categories.

RESULTS Our study included 111,414 unique identifiable physicians, and the final weighted sample included 213,904 (76,927 patient-years) from 30,058 unique patients, of whom 17,478 (58.1%) were women. The mean (SD) patient age was 71.84 (12.48) years. The mean TACC was $9117. Those with higher than mean TACC included beneficiaries with depression ($14,436), dementia ($18,311), and difficulty with 3 or more activities of daily living (ADLs, $19,113) or instrumental ADLs ($17,443). After adjusting for comorbidities, depression and dementia were still associated with $2740 (95% CI, $2200-$2739) and $2922 (95% CI, $2399-$3445) higher TACC, respectively. Difficulty with 3 or more ADLs ($3121 higher; 95% CI, $2633-$3609) or instrumental ADLs ($895 higher; 95% CI, $452-$1337) was also associated with higher TACC. Adding these neuropsychological and functional factors, as well as local residence area factors, to risk adjustment calculations reduced outpatient safety-net clinicians' underperformance on Medicare TACC relative to non-safety–net clinicians by 52% (from 0.098 to 0.047 difference in the observed to expected ratio).

CONCLUSIONS AND RELEVANCE Neuropsychological and functional impairment are common in Medicare beneficiaries and are associated with increased annual Medicare spending. Failure to account for these factors may inappropriately penalize outpatient clinicians who care for these vulnerable groups, such as safety-net clinicians, for factors that are arguably beyond their control.

Published online September 17, 2018.
Medicare is moving toward value-based and alternative payment models, in which outpatient clinicians are held accountable for quality and costs of care.\(^1,2\) One example is the Merit-Based Incentive Payment System (MIPS), which will adjust outpatient clinicians’ payments up or down by 4% in 2019 based on cost and quality performance.\(^3\) Outpatient clinicians covered by MIPS include all physicians, physician assistants, nurse practitioners, and certified nurse specialists who provide care to Medicare beneficiaries and are not already participating in qualified advanced alternative payment models (such as Medicare Accountable Care Organizations).\(^3\) As the MIPS start date approaches, there is concern that the program will inappropriately penalize outpatient clinicians for factors beyond their control, and assign penalties and bonuses based on these factors rather than on true differences in clinician performance.\(^1,2,4,5\)

As a result, the Medicare Payment Advisory Commission recently recommended that Congress repeal MIPS and replace it with a voluntary performance program for outpatient Medicare clinicians.\(^6\)

The broadest cost measure in MIPS is the Total Per Capita Costs (TPCC) measure, which evaluates outpatient clinicians on annual costs of care for all attributed beneficiaries.\(^7\) Beneficiaries are attributed to outpatient clinicians based on the plurality of their evaluation and management (E&M) office visits in a year.\(^8\) To make comparisons among outpatient clinicians more equitable, the measure adjusts for medical risk using the Centers for Medicare and Medicaid Services (CMS) hierarchical conditions category (HCC) score, which includes medical conditions such as heart failure, diabetes, and kidney disease.\(^9\) The CMS-HCC risk adjustment also accounts for whether or not a patient is dually enrolled in Medicare and Medicaid, as a proxy for socioeconomic status. However, the TPCC measure is not adjusted for functional status and common neuropsychological comorbidities or for local area supply-side and economic condition variables. These unaccounted for patient risk factors are known to be associated with higher health care utilization and costs\(^10-19\) and are largely outside of outpatient clinicians’ control.

In the presence of inadequate risk adjustment, the TPCC measure could lead to inappropriate penalties for outpatient safety-net clinicians, such as those working in federally qualified health centers (FQHCs) and rural health clinics (RHCs), who serve a high proportion of patients with neuropsychological and functional needs and living in underserved areas.\(^20,21\) Penalties to such clinicians, often operating on already-thin margins, could be harmful.\(^22,23\) Therefore, understanding associations between these risk factors and spending, as well as their association with outpatient safety-net clinicians’ performance on treated patients’ annual Medicare spending, is crucial as value-based payment models proliferate more broadly.

Therefore, we set out to answer three questions. First, are patient neuropsychological conditions and functional status associated with higher Medicare costs above and beyond the risk factors included in the standard CMS-HCC risk model? Second, are local area supply-side and economic factors associated with higher Medicare costs above and beyond the CMS-HCC model? Third, does adjusting for these additional patient risk factors have any association with the performance of outpatient safety-net clinicians—defined as FQHCs and RHCs—regarding patients’ Medicare total annual cost of care (TACC)?

**Methods**

**Data and Study Sample**

We conducted a retrospective observational study using the Medicare Current Beneficiary Survey (MCBS) linked to respondents’ fee-for-service Medicare claims data for the 2006-2013 period. The MCBS is an annual nationally representative survey of the Medicare population with a rotating 4-year cohort design.\(^24\) We linked county-level health care supply and economic conditions from the Area Health Resources File provided by the Health Resources and Services Administration to respondents’ records.\(^25\)

Our sample includes all Medicare beneficiaries who would be eligible for inclusion in the Medicare annual costs measure and with available data in the MCBS. Because MIPS will require physician or clinic visits for patient attribution, we limited the sample to beneficiaries with at least a 12-month continuous enrollment in fee-for-service Medicare Part A and Part B, and at least 1 outpatient physician or clinic visit during the year, as identified by E&M visits (Berenson-Eggers Type of Service codes M1A, M1B, M4A, M4B, M5C, M5D, and M6 and revenue center codes 0521, 0522, and 0525) and positive covered dollar amounts. We used the MCBS cross-sectional survey weights to compute nationally representative estimates. These weights account for the selection probability of each person sampled and include adjustments for stratified sampling design, survey nonresponse, and coverage error.

**Cost-Associated Variables**

Our cost-associated variables were patient neuropsychological conditions, patient functional status, and local area supply-side and economic characteristics of patients’ residence...
(see eTable I in the Supplement). For neuropsychological conditions, we used patient self-report of having been diagnosed with depression, Alzheimer/dementia or a confirmatory diagnosis in their medical claims using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes defined by CMS.26 Alzheimer/dementia is not included in the CMS-HCC risk model.27 In addition, although the CMS-HCC model includes acute major depressive, bipolar, and paranoid disorders, it does not include less acute but more common types of depression such as persistent depressive disorders and depressive disorders not classified as major depression. For functional status, we grouped counts of self-reported activities of daily living (ADLs) and instrumental ADLs (IADLs) that could be performed only with difficulty or not at all into no limitations (0), mild/moderate limitations (1-2), and severe limitations (3-6).28 For local area supply-side and economic characteristics, we used patient home addresses and linked them to the Area Health Resources File to obtain annual county level measures of availability of primary care or mental health professional facilities, rural-urban setting (metropolitan, micropolitan, rural), poverty rate, and unemployment rate.25

Medicare TACC
Our outcome variable was Medicare TACC measured as the total annual reimbursed amount per patient for Medicare Part A and Part B services. Following the MIPS methodology we bottom-coded patient costs at the 1st percentile value ($39) and top-coded at the 99th percentile value ($93,614).9 All costs were converted to 2013 US dollars using the gross domestic product deflator.30 Our analysis of Medicare TACC should be considered exploratory because, owing to sample size limitations, and unlike the official MIPS TPCP measure,9 we did not standardize costs to account for regional differences in the price of medical services paid by Medicare, nor did we “specialty adjust” to account for differential prices paid to specialists.

Safety-Net vs Non-Safety-Net Patients
We identified outpatient safety-net clinic patients as beneficiaries who visited a FQHC or RHC at least once during the year using revenue center codes beginning with “052” in their outpatient claims data.31 Non–safety-net patients were identified as all other beneficiaries in the sample.

Statistical Analysis
First, we computed descriptive statistics for our cost- associated variables and the CMS-HCC risk score. The HCC risk score (version V1210.70.F2) includes age, sex, original reason for Medicare entitlement, dual enrollment in Medicaid, institutionalization in long-term care, and a set of ICD-9-CM diagnosis codes.27,32 We used the Wald test to compare differences in proportions (or means) across the low-cost vs high-cost quintiles. In addition we computed overall mean annual TACC for each predictor variable category. We ran the CMS-HCC risk score model to estimate overall expected costs at the patient level and by cost quintile.27,32

Next, we created 2 patient-level multivariable regression models estimating the association between each variable and TACC after applying the standard CMS-HCC risk-adjustment approach, which adjusts for HCC risk score, risk score squared, and end-stage renal disease (ESRD) status. Similar to the federal Marketplace approach and the model used by Ash et al,19 we used a “concurrent frame” model to predict TACC using variables measured during the same year. In the first model, we assessed the association of the neuropsychological and functional status variables with increased TACC. In the second model, we added local area supply and economic characteristics to the covariates that we included in the first model. Following a protocol outlined in prior research,19,27 we used simple least squares regression to estimate the average effect of our variables on TACC measured during the same year. Both models included year fixed effects to control for secular trend and adjusted for the complex survey design of the MCBS and intraperson correlation over time.

Finally, we estimated outpatient safety-net vs non-safety-net clinicians’ performance on TACC under current risk adjustment and after adding additional adjustment for neuropsychological status, functional status, and local area variables to the risk models. All analyses were performed at the patient and not clinician level. We compared expected costs under these 3 modeling scenarios with observed costs and computed observed-to-expected ratios; a ratio greater than 1 implies that the risk model underpredicted actual costs; a ratio less than 1 implies that the risk model overpredicted actual costs.

This study was approved by the St Louis University institutional review board, waiving participant written informed consent for deidentified retrospective data. We performed analyses using SAS software, version 9.4, and Stata version 14.

Results
Patient Sample and Characteristics
Of 214,627,192 weighted patient-years eligible for inclusion in the study, we excluded 722,868 (0.3% of eligible patient-years) that were missing a valid US zip code or other key covariates (eFigure in the Supplement). Our final weighted sample consisted of 213,904,324 patient-years (unweighted, 76,927 patient-years; 30,058 unique patients; III 414 unique identifiable physicians).

The mean overall TACC was $91,177 (Table I). Beneficiaries in the highest-cost quintile (mean TPCP $34,494) were older and more often female, and were more likely to be dually enrolled in Medicare and Medicaid, institutionalized ($20,088), disabled ($95,888), or have ESRD ($55,060). Individuals with depression ($14,436) or dementia ($18,311) and those with difficulty with 3 or more ADLs ($19,113) or IADLs ($17,443), living in a mental health care shortage area ($92,333), having a high proportion of residents in poverty ($95,699), or unemployed ($95,658) had higher observed TACC.

Association Between Neuropsychological Conditions, Functional Status, and Spending
After applying the CMS-HCC risk adjustment, depression and dementia were still associated with $27,400 (95% CI, $22,000-$37,399) and $29,222 (95% CI, $23,999-$34,445) higher mean

jamainternalmedicine.com

© 2018 American Medical Association. All rights reserved.
Table 1. Mean Annual Costs and Prevalence of Patient Risk Factors of Fee-for-Service Medicare Beneficiaries

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean Total Annual Cost of Care, $US Overall</th>
<th>Low-Cost Quintile</th>
<th>Highest-Cost Quintile</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patient-years, No.</td>
<td>76 927</td>
<td>76 927</td>
<td>14 857</td>
<td>16 216</td>
</tr>
<tr>
<td>Unweighted, $US</td>
<td>213 904 324</td>
<td>213 904 324</td>
<td>42 782 528</td>
<td>42 779 367</td>
</tr>
<tr>
<td>Weighted, $US</td>
<td>9117</td>
<td>9117</td>
<td>3613</td>
<td>21 147</td>
</tr>
<tr>
<td>Expected (CMS-HCC) Medicare expenditures, $US</td>
<td>9117</td>
<td>9117</td>
<td>352</td>
<td>34 494</td>
</tr>
</tbody>
</table>

CMS/Medicare HCC Risk Score Adjustment Factors, Annual Prevalence, %

<table>
<thead>
<tr>
<th>Age, y</th>
<th>&lt;65</th>
<th>65-74</th>
<th>75-84</th>
<th>≥85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>10 068</td>
<td>7333</td>
<td>10 095</td>
<td>11 749</td>
</tr>
<tr>
<td>Female</td>
<td>9 326</td>
<td>8964</td>
<td>9 117</td>
<td>8 964</td>
</tr>
</tbody>
</table>

Sex | Male | Female | <.001 |
|-----|------|-------|------|

Original reason for Medicare eligibility

| Disabled | 55 060 | 8677 | 12 589 | 20 088 |
| End-stage renal disease | 15.9 | 81.5 | 19.0 | 5.3 |
| Age ≥65 y | 17.7 | 82.3 | 15.7 | 2.0 |
| Dual enrollee in Medicaid and Medicare | 16.6 | 80.6 | 26.4 | 11.3 |
| Institutionalized in long-term care | 4.4 | .03 | <.001 |
| HCC risk score (mean) | 1.07 | .59 | 2.06 | <.001 |

Neuropsychological conditions

| Depression | 14 436 | 23.1 | 13.2 | 37.6 | <.001 |
| Alzheimer/dementia | 18 311 | 10.1 | 4.7 | 21.0 | <.001 |

Functional Status, Annual Prevalence, %

| ADLs with difficulty or cannot do | 6152 | 11 021 | 19 113 |
| 0 | 62.9 | 22.8 | 14.3 |
| 1-2 | 76.1 | 16.9 | 7.0 |
| 3-6 | 41.4 | 28.6 | 30.1 |
| IADLs with difficulty or cannot do | 5674 | 9997 | 17 443 |
| 0 | 54.1 | 26.3 | 19.6 |
| 1-2 | 67.9 | 20.5 | 11.7 |
| 3-6 | 32.4 | 30.2 | 37.3 |

Local Area Supply and Economic Characteristics, Annual Prevalence, %

<table>
<thead>
<tr>
<th>Rural-urban area</th>
<th>Metropolitan</th>
<th>Micropolitan</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>9415</td>
<td>8066</td>
<td>8726</td>
<td></td>
</tr>
<tr>
<td>73.2</td>
<td>17.2</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>70.1</td>
<td>19.2</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>74.6</td>
<td>15.6</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>Primary care shortage area (partial or whole county)</td>
<td>9205</td>
<td>8266</td>
<td>9233</td>
</tr>
<tr>
<td>86.7</td>
<td>86.4</td>
<td>83.4</td>
<td></td>
</tr>
<tr>
<td>87.8</td>
<td>85.0</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Mental health shortage area (partial or whole county)</td>
<td>9233</td>
<td>8266</td>
<td>9233</td>
</tr>
<tr>
<td>83.6</td>
<td>83.4</td>
<td>82.7</td>
<td></td>
</tr>
<tr>
<td>87.8</td>
<td>85.0</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Adults below poverty, per 100 in county</td>
<td>8842</td>
<td>8962</td>
<td>9569</td>
</tr>
<tr>
<td>Low tertile rank</td>
<td>34.2</td>
<td>34.2</td>
<td>33.5</td>
</tr>
<tr>
<td>Medium tertile rank</td>
<td>33.2</td>
<td>34.6</td>
<td>32.2</td>
</tr>
<tr>
<td>High tertile rank</td>
<td>32.6</td>
<td>33.1</td>
<td>34.3</td>
</tr>
<tr>
<td>Unemployed adults, per 100 in county</td>
<td>8639</td>
<td>9022</td>
<td>9658</td>
</tr>
<tr>
<td>Low tertile rank</td>
<td>31.4</td>
<td>34.8</td>
<td>33.9</td>
</tr>
<tr>
<td>Medium tertile rank</td>
<td>33.1</td>
<td>34.3</td>
<td>32.6</td>
</tr>
<tr>
<td>High tertile rank</td>
<td>30.1</td>
<td>34.1</td>
<td>35.8</td>
</tr>
<tr>
<td>&lt;.001</td>
<td>.01</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: ADLs, activities of daily living; CMS, Centers for Medicare and Medicaid Services; HCC, hierarchical condition categories; MCBS, Medicare Current Beneficiary Survey; IADLs, instrumental activities of daily living.

* P value for difference in proportions (or means for costs) by lowest cost vs highest cost quintile patient categories (Wald tests). Survey estimation commands were used to adjust P values for the complex survey design of the MCBS and robust clustered on individuals to account for within-person correlation due to the same persons appearing in the data more than once over multiple years.

† Weighted estimates from the 2006-2013 MCBS for all Medicare beneficiaries with at least 1 year of enrollment in Medicare Part A and Part B and having completed the fall survey round of the MCBS (after applying exclusion criteria), as well as having at least 1 evaluation and management visit with positive expenditures. We used the MCBS cross-sectional weights to account for the overall annual selection probability of each person sampled, including adjustments for the stratified sampling design, survey nonresponse, and coverage error.

‡ We predict annual Medicare Part A and B CMS-HCC expected costs at the patient level by estimating a multivariable ordinary least squares regression model using the CMS-HCC risk score (version V1210.70.F2), risk score squared, and end-stage renal disease status as the predictor variables. We further include year fixed effects to control for secular trend and cost inflation. We also adjust for the complex survey design of the MCBS and intra-person correlation over time. All costs stated in 2013 US dollars using the gross domestic product deflator.
TACCs, respectively (Table 2). Difficulty with 3 or more ADLs was associated with a $3121 (95% CI, $2633-$3609) higher TACC, and difficulty with 3 or more IADLs was associated with an $895 (95% CI, $452-$1337) higher TACC.

**Association Between Local Area Factors and Spending**

After adjusting for the CMS-HCC risk score, we found that treated patients living in a mental health shortage area or an area with a high unemployment rate were associated with mean $517 (95% CI, $61-$972) and $455 (95% CI, $54-$857) higher TACCs, respectively (Table 3). In contrast, treated patients living in a micropolitan area or an area with a high proportion of residents in poverty were associated with $702 (95% CI, $399-$1005) and $407 (95% CI, $22-$792) lower TACCs, respectively.

**Adding Neuropsychological, Functional, and Local Area Factors to the Standard CMS-HCC Risk Adjustment Model**

Patients who utilized outpatient safety-net clinicians had a mean observed TACC ($9160) similar to patients who utilized non–safety-net clinicians ($9112) (Table 4). However, under the CMS-HCC risk adjustment model, the actual TACC of safety-net clinicians was 9% higher than the expected costs ($9160 vs $8413), whereas the actual TACC of non–safety-net clinicians was 1% less than the expected ($9112 vs $9199).

Adding patient neuropsychological and functional status variables to the CMS-HCC risk adjustment model increased the expected costs of outpatient safety-net clinicians from $8413 to $8722, whereas it decreased the expected costs of non–safety-net clinicians. Further adding residence in a mental health shortage area and county unemployment ranking to the model increased the expected cost of outpatient safety-net clinicians to $8791. As a result, adding these variables to the standard model led to a reduction in outpatient safety-net clinicians’ underperformance on TACC by 5 percentage points (a 52% relative improvement) and left non–safety-net clinicians performing at par.
Association Between Patient Cognitive and Functional Status and Medicare Cost of Care

Table 4. Previously Unobserved Medicare Patient Characteristics Added to Standard the CMS-HCC Cost Model

<table>
<thead>
<tr>
<th>Clinician Type</th>
<th>Observed Costs, Unadjusted</th>
<th>CMS-HCC Model</th>
<th>CMS-HCC + Neuropsychological and Functional</th>
<th>CMS-HCC + Neuropsychological and Functional + Local Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Expected Costs</td>
<td>Observed to Expected Ratio</td>
<td>Expected Costs</td>
<td>Observed to Expected Ratio</td>
</tr>
<tr>
<td>Safety net (n = 22 157 272 patient-years)</td>
<td>9160 (8536-9785)</td>
<td>1.09 (1.07-1.11)</td>
<td>8722 (8278-9167)</td>
<td>1.05 (1.03-1.07)</td>
</tr>
<tr>
<td>Non-safety net (n = 191 747 052 patient-years)</td>
<td>9112 (8858-9367)</td>
<td>0.99 (0.99-1.00)</td>
<td>9163 (8954-9372)</td>
<td>0.99 (0.99-1.00)</td>
</tr>
</tbody>
</table>

Abbreviations: ADLs, activities of daily living; CMS, Centers for Medicare and Medicaid Services; HCC, hierarchical condition categories; IADLs, instrumental activities of daily living; OLS, ordinary least squares.

* All data are reported as either cost (95% CI) or ratio (95% CI); all costs are reported in 2013 US dollars using the gross domestic product deflator; all P values are adjusted for the complex survey design of the MCBS and intraperson correlation over time.

+ We estimate a multivariable OLS model with the CMS-HCC risk adjustment covariates plus the neuropsychological (depression, Alzheimer/dementia) and functional status (1-2 ADLs, 3-6 ADLs, 1-2 IADLs, or 3-6 IADLs with difficulty or cannot do) covariates. We further include year fixed effects to control for secular trend and cost inflation.

|## Sensitivity Analyses

We performed 4 sensitivity analyses. First, we reestimated our models for community-dwelling patients only, excluding those with ESRD or who were institutionalized (eTables 2 and 3 in the Supplement); results were similar to those of our main analysis. Second, we tested the effect of including indicator variables for US Census Region in our safety-net to non-safety-net comparisons. Although those with 2 or more E&M visits to safety-net clinicians had higher observed and expected costs, there was no change in our findings showing an improved observed-to-expected cost ratio after adding cognitive, neuropsychological, and local area factors to the HCC risk model (eTable 5 in the Supplement). Third, we tightened our criteria for attributing patients as safety-net utilizers to 2 or more E&M visits to FQHCs or RHCs and then reestimated our safety-net to non-safety-net comparisons. Although those with 2 or more E&M visits to safety-net clinicians had higher observed and expected costs, there was no change in our findings showing an improved observed-to-expected cost ratio after adding cognitive, neuropsychological, and local area factors to the HCC risk model (eTable 6 in the Supplement).

|## Discussion

In this nationally representative study of Medicare beneficiaries, we found that neuropsychological and functional risk factors were common, and they were associated with substantially higher annual costs and poorer outpatient clinician performance on TACC. Adding these factors, along with local area variables, to the CMS-HCC risk adjustment model reduced outpatient safety-net clinicians’ underperformance on TACC relative to non-safety-net clinicians by 5 percentage points or 52%. This implies that failing to account for these factors could penalize outpatient safety-net clinicians under the MIPS program who care for patients who have greater neuropsychological and functional health needs and are located in underresourced areas.

There is a growing body of literature showing that neuropsychological and functional risk factors have a significant effect on health services utilization and health care costs. Multiple studies find that depression and dementia are associated with hospitalization or rehospitalization. Importantly, even mild depression and anxiety, in addition to serious mental illness, may be drivers of readmissions and costly post-acute-care utilization. Many prior studies have found that functional status, as measured by deficits in ADLs and IADLs, is associated with higher admissions, readmissions, and post-acute-care costs— even after adjusting for medical comorbidities and CMS-HCC risk factors. These findings also align with a recent Report to Congress on Medicare’s value-based purchasing programs, which finds that Medicare beneficiaries who are disabled have higher odds of hospital admission, even after risk adjustment. Despite a robust literature on neuropsychological and functional status, most quality and cost measures do not include these factors in risk adjustment. The reasons are manifold but include both practical and philosophical limitations. Practically speaking, measuring functional status is difficult using claims alone; we relied on patient-reported function, which would be difficult to scale nationally. However, there are a number of validated claims-based indices of disability and frailty that may hold real promise for incorporating functional status information into claims-based quality metrics in the near term. The lack of inclusion of neuropsychological factors— particularly dementia—in risk adjustment models is more of a philosophical issue, as these diagnoses are easily identified in claims. The CMS has previously argued that including de-
mentia in risk models would increase its inappropriate coding in physician claims because dementia is a “discretionary” diagnosis.\textsuperscript{43,44} Many groups, including the Alzheimer Association, have disputed this stance out of concern that failing to account for this important condition could lead to inadequate risk adjustment.\textsuperscript{45} Our findings suggest that their concerns are valid, and that failing to adjust for dementia could inappropriately penalize clinicians who care for a high proportion of patients with this devastating and costly disease, particularly as value-based payment programs spread into the outpatient and post-acute settings.\textsuperscript{46,47}

There is also prior work suggesting that local area health care supply and economic conditions have a significant effect on health care utilization above and beyond patient-level comorbidities. For example, seriously mentally ill patients who visit the emergency department are more likely to be admitted to the hospital if they live in a mental health professional shortage area.\textsuperscript{48} Higher area-level unemployment rates are associated with not only higher hospital admissions\textsuperscript{16} but also greater costs per hospitalization.\textsuperscript{17} and neighborhood disadvantage is associated with rehospitalization and higher health care costs.\textsuperscript{18,19} In the present study, we found that even county-level data on clinician supply and unemployment, which are very easily linkable, provided some additional information for risk adjustment and may be worth exploring further.

We also found living in micropolitan or high poverty areas were significant negative predictors of costs—perhaps owing to less opportunity to access medical care in these communities. We did not include these factors in our augmented risk adjustment model out of a concern for fairness because including them would have the effect of lowering these patients’ expected costs and effectively taking money away from clinicians who serve patients living in micropolitan or high-poverty areas. This raises the philosophical issue of what to do when traditional markers of greater risk (eg, poverty) are associated with lower expected costs. Following Ash et al.,\textsuperscript{19} we believe that considerations of fairness or equity in terms of real-world effect on clinicians who serve vulnerable patients should also guide risk adjustment decisions.

Limitations
This study has several limitations. First, we were unable to identify outpatient safety-net clinicians who were not FQHCs or RHCs. As a result, these unidentified outpatient clinicians’ patients were counted as non–safety-net utilizers; this would likely bias our results toward the null. Second, it is possible that safety-net clinicians have systematically lower diagnostic coding intensity and that this is what is driving their lower expected costs under the HCC model. We are unable to confirm this in our data. Third, we were only able to identify patients who participated in the MCBS; while survey and nonresponse weighting can significantly reduce bias related to this issue, our results may not generalize more broadly. Relatedly, it is possible that patients with the most serious forms of Alzheimer/dementia are less likely to participate in the MCBS. However, we found a prevalence rate of 10.1% in our study sample that is very similar to the prevalence rate of 11% reported for the entire Medicare fee-for-service population in the Chronic Condition Warehouse over the 2006-2015 period.\textsuperscript{49} Fourth, we measured TACC at a period prior to implementation of the MIPS or value-based payment modifier programs using a similar measure, and it is possible that patients or practices have changed since then. Repeating these analyses as MIPS is implemented will be important.

Conclusions
Neuropsychological and functional risk factors are common in Medicare beneficiaries, especially those cared for by outpatient safety-net clinicians. These risk factors exert an independent effect on annual Medicare spending that is largely beyond the control of outpatient clinicians and not accounted for by current Medicare risk adjustment methods. Consequently, Medicare’s MIPS scoring formula may inappropriately penalize outpatient safety-net clinicians. In the future, CMS could consider accounting for patient cognitive and functional status as well as local area health care supply and economic conditions in risk adjustment.

ARTICLE INFORMATION
Accepted for Publication: July 2, 2018.
Published Online: September 17, 2018.

Author Contributions: Dr Johnston had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: All authors. Acquisition, analysis, or interpretation of data: Johnston, Wen, Joynt Maddox. Drafting of the manuscript: Johnston, Joynt Maddox. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Johnston, Wen, Hockenberry. Obtained funding: Johnston. Administrative, technical, or material support: Johnston.

Conflict of Interest Disclosures: Dr Joynt Maddox does intermittent work under contract with the United States Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation. No other disclosures are reported.

Funding/Support: St Louis University purchased and provided access to the data used in this study. Dr Joynt Maddox is supported by grant K23- HL109177-03 from the National Heart, Lung, and Blood Institute (NHLBI).

Role of the Funder/Sponsor: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Additional Contributions: We thank Julia Clarke of St Louis University for providing assistance on the literature review. Ms Clarke’s contributions were completed as part of her research assistantship at Saint Louis University, for which she received compensation.

REFERENCES


**IMAGES FROM OUR READERS**

**Guggenheim Museum, New York City**

**Courtesy of:** Manfred Hauben, MD, MPH, Pfizer, Worldwide Safety Strategy, 235 E 42nd St, New York, NY 10017

Guggenheim Museum in New York City