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# Medicare's New Bundled Payment For Joint Replacement May Penalize Hospitals That Treat Medically Complex Patients

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**ABSTRACT** In an effort to reduce episode payment variation for joint replacement at US hospitals, the Centers for Medicare and Medicaid Services (CMS) recently implemented the Comprehensive Care for Joint Replacement bundled payment program. Some stakeholders are concerned that the program may unintentionally penalize hospitals because it lacks a mechanism (such as risk adjustment) to sufficiently account for patients' medical complexity. Using Medicare claims for patients in Michigan who underwent lower extremity joint replacement in the period 2011–13, we applied payment methods analogous to those CMS intends to use in determining annual bonuses or penalties (reconciliation payments) to hospitals. We calculated the net difference in reconciliation payments with and without risk adjustment. We found that reconciliation payments were reduced by \$827 per episode for each standard-deviation increase in a hospital's patient complexity. Moreover, we found that risk adjustment could increase reconciliation payments to some hospitals by as much as \$114,184 annually. Our findings suggest that CMS should include risk adjustment in the Comprehensive Care for Joint Replacement program and in future bundled payment programs.

**O**n April 1, 2016, the Centers for Medicare and Medicaid Services (CMS) implemented the Comprehensive Care for Joint Replacement (CJR) program.<sup>1</sup> This program introduced mandatory episode-based bundled payment to 800 hospitals across sixty-seven Metropolitan Statistical Areas.<sup>2</sup> Since lower extremity joint replacement is one of the most common procedures performed on Medicare beneficiaries, the CJR program represents perhaps the most aggressive move yet by CMS toward alternative payment programs.

Under the CJR program, all providers (for example, hospitals, physicians, and postacute care providers) will continue to receive standard fee-for-service payments from Medicare for all claims from admission through ninety days after

discharge. However, at the end of each performance year, CMS will compare participating hospitals' ninety-day episode payments against a target episode price based on historical spending for this procedure. Hospitals will receive additional payments if their actual ninety-day episode spending (and the spending of their affiliated physicians and postacute care providers) is less than the target, but they will be required to pay CMS a penalty if their episode spending exceeds the target. In the CJR program, such bonuses and penalties are referred to as reconciliation payments.

In contrast to previous bundled payment demonstrations from CMS (such as the Bundled Payments for Care Improvement initiative), the CJR program is unique in that each hospital's target episode price is calculated by blending its own

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historical episode spending with the average spending of other hospitals in the same region. Over time, the blended price is increasingly weighted toward the regional benchmark, and by the fourth year of the program, the target price is based entirely on regional episode spending. By implementing region-based target pricing, CMS aims to reduce episode payment variation resulting from disparate practice patterns (for example, in the use of postacute care) across geographic regions.

While differences in hospital episode spending can certainly be driven by variation in use of services, it is also true that payment differences can reflect disparities in patients' medical complexity (hospital case-mix).<sup>3</sup> This may not be a problem for a program such as the Bundled Payments for Care Improvement initiative, where an individual hospital's spending is benchmarked against its own historical episode payments. But the CJR program is different because it determines reconciliation payments by benchmarking a hospital's performance against other hospitals in a given region without accounting for patient-specific factors (for example, age, medical comorbidities, and functional status) that are known to affect episode spending. During the rule-making period, many commenters<sup>1</sup> identified this as an important limitation of the CJR program and expressed concerns that by not adjusting for hospital case-mix, CMS may unfairly penalize hospitals that treat more medically complex patients.

Despite these concerns, CMS did not include a mechanism to account for important patient characteristics such as age and number of comorbidities in the calculation of target prices, and it offered several reasons for this decision. First, CMS stated that there is no need for additional risk adjustment because there is sufficient stratification of patients through the use of different target prices for episodes associated with complicated inpatient stays (Medicare severity diagnosis-related group [MS-DRG] code 469) or hip fractures. Second, CMS argued that there is no gold standard risk-adjustment model for patients undergoing joint replacement. Third, the agency noted that commercially available risk-adjustment tools were built using different patient populations than those in the CJR program and therefore might not be applicable to Medicare beneficiaries. Finally, although CMS uses its Hierarchical Condition Category (CMS-HCC) risk scores to predict future expenditures for patients in Medicare Advantage plans,<sup>4</sup> the agency stated that these scores have not been sufficiently validated for joint replacement episodes.

Nonetheless, CMS is using a CMS-HCC framework for other programs, including Medicare

Spending per Beneficiary.<sup>5</sup> Given the multiple stakeholder concerns about differences in patient complexity across hospitals, it seems reasonable for CMS to further evaluate the merits of risk adjustment for the CJR program and future bundled payment programs.

In this context, we examined the association between patient complexity and hospital reconciliation payments for lower extremity joint replacement episodes. We also estimated the financial impact on hospitals of excluding more granular patient characteristics in the calculation of target prices.

## Study Data And Methods

**DATA AND STUDY POPULATION** We identified all Medicare claims for beneficiaries in Michigan who underwent lower extremity joint replacement (MS-DRG codes 469 and 470) in the period 2011–13. We included only patients who underwent one of these procedures in a hospital that was located in a Metropolitan Statistical Area (a requirement for inclusion in the CJR program) and that performed more than twenty of the procedures during the study period.

We excluded patients who did not have complete ninety-day claims or were not continuously enrolled in Medicare Parts A and B, who died during the episode of care, who had coverage through a health maintenance organization (HMO), or who were eligible for Medicare because of end-stage renal disease or disability. In addition, to reduce some of the heterogeneity associated with infrequent and expensive procedures, we excluded patients who had a primary diagnosis of fracture (12.3 percent of episodes). On average, fracture cases accounted for 1.5 percent (range: 0.03–5.42 percent) of an individual hospital's joint replacement procedures.

This study was deemed exempt from review by the Institutional Research Board at the University of Michigan.

**DEFINING EPISODES OF CARE AND CALCULATING PAYMENTS** We defined ninety-day episodes of care according to specifications from the CJR program.<sup>1</sup> Specifically, we first identified all hospitalization, professional, and postacute care claims from the index admission through ninety days after discharge and then excluded claims based on DRGs and *International Classification of Diseases, Ninth Revision (ICD-9)*, primary diagnosis codes that matched those on the exclusion list published by CMS.<sup>1</sup>

Next, we calculated the total ninety-day payment for each joint replacement episode of care by aggregating the payments received for each claim attributed to that episode. Then, following the methods used by CMS in the CJR program

# Risk adjustment is important for bundled payment programs that use regional spending benchmarks.

final rule,<sup>1</sup> we removed payments for disproportionate-share hospitals, indirect medical education, and new technologies.

Finally, we truncated episodes with extremely high or low costs, to limit the influence of outliers. Specifically, we excluded 362 episodes (1.53 percent) with ninety-day payments lower than \$4,000. In addition, we assigned the value of the ninety-fifth percentile to episodes with costs above that percentile. CMS uses a similar approach to reduce the impact of outliers in many of its hospital performance programs, including the CJR program.

To account for changes in Medicare payments during the study period, we adjusted all payments to 2013 dollars.

**DEFINING HOSPITAL CASE-MIX AND CALCULATING RECONCILIATION PAYMENTS** We used Medicare claims to calculate the CMS-HCC risk score for each beneficiary in our study. Specifically, we used HCC software (version 1212.70.F1) and collected information on beneficiaries' age, sex, types of comorbidities, dual eligibility (for Medicare and Medicaid) status, and original reason for Medicare entitlement from Medicare claims, to calculate each patient's risk score.

Using established methods, we retrieved this information by reviewing each patient's inpatient, outpatient, and selected professional claims for the previous twelve months.<sup>4</sup> For example, if a patient had joint replacement surgery on October 14, 2011, we searched claims from October 14, 2010 through October 14, 2011, to identify the patient's comorbidities.

We then aggregated these patient risk scores to calculate an average for each hospital. We used the average hospital risk score as a proxy for hospital case-mix.

We calculated each hospital's reconciliation payment using methods similar to those outlined in the CJR final rule.<sup>1</sup> Specifically, we first calculated target prices for each hospital using 2011–12 spending for MS-DRG codes 469 and 470 separately. Next, we aggregated 2013 spending for MS-DRG codes 469 and 470 and sub-

tracted the target amount (that is, the target price multiplied by the number of cases for each code). Finally, we calculated per capita reconciliation payments by dividing the total reconciliation payment by case volume for each MS-DRG code.

**HOSPITAL CASE-MIX AND RECONCILIATION PAYMENTS: TWO SCENARIOS** We examined the association between average CMS-HCC risk scores and the estimated reconciliation payments that hospitals would receive under two different scenarios. In the first scenario, we calculated reconciliation payments using the hospital's own 2011–12 spending to define target episode spending. This scenario is closely aligned with the Bundled Payments for Care Improvement initiative. In the second scenario, we used the 2011–12 average regional spending (in this case, the average state spending) to set the target episode price. The use of a regional target is consistent with the CJR program.

For both scenarios, we fitted linear regression models with heteroskedastic robust standard errors to test the association between CMS-HCC risk scores and reconciliation payments per joint replacement episode. For these models, reconciliation payment per episode was our dependent variable, and CMS-HCC risk score was our primary exposure variable.

We also performed a multivariable analysis to examine the independent association of CMS-HCC risk score and reconciliation payments. We expected that teaching hospitals, hospitals with a larger number of beds, and those with a higher proportion of Medicaid patients would have higher expenditures, which in turn might affect reconciliation payments. Therefore, these variables were included in our multivariable analysis.

**RISK ADJUSTMENT FOR RECONCILIATION PAYMENTS** We estimated the impact of CMS's decision to exclude risk adjustment by calculating the net difference in reconciliation payments that hospitals would receive with and without risk adjustment. Our risk-adjustment model used log-transformed ninety-day episode payment as our dependent variable and average CMS-HCC risk score as our independent variable.

We used the model to estimate an expected ninety-day episode payment for each patient and then used a standard observed-to-expected framework to arrive at the risk-adjusted payment.<sup>6</sup> Next, we aggregated the risk-adjusted payments to the hospital level and calculated reconciliation payments as described above. Finally, we calculated the difference between the risk-adjusted and unadjusted reconciliation payments for each hospital.

All analyses were performed using Stata, version 13/SE. We assumed that  $p$  values of  $<0.05$  were significant.

**SENSITIVITY ANALYSES** We performed several sensitivity analyses to confirm our findings. First, we examined the variation in average hospital CMS-HCC scores by MS-DRG categories (codes 469 and 470) and fracture status. The purpose of this analysis was to understand how hospitals' risk scores differed for these specific subpopulations.

Second, we examined the association between average CMS-HCC risk score and reconciliation payments after including patients with fractures. Third, we examined the association between average CMS-HCC risk score and reconciliation payments with our truncated cases included. The purpose of these two sensitivity analyses was to ensure that our exclusion of fractures and cases with extremely low costs would not substantially alter the estimates from our primary analyses.

Finally, because we used average state spending to set the regional target price in our analysis, while the actual CJR program used average census division spending, we performed a sensitivity analysis using the target prices published by CMS for the East North Central census division (\$50,954 for MS-DRG code 469 and \$25,480 for MS-DRG code 470).

**LIMITATIONS** Our study had several limitations. First, because we analyzed only Michigan hospitals, the results of this study might not be generalizable to all hospitals in national joint replacement bundled payment programs such as the CJR program. However, this concern is tempered by the fact that Michigan hospitals do not differ from the hospitals selected for inclusion in the CJR program in important ways such as utilization rates for knee replacement and hip replacement, teaching status, proportion of Medicaid patients served, and bed size.

Second, in this analysis we did not include several provisions that are included in the CJR program (for example, the stop-loss mechanism and the quality floor). While such specifications may affect the absolute dollars that are transferred between CMS and the hospitals in the CJR program, we do not believe that the inclusion of these provisions would substantially change our primary findings related to risk adjustment.

Finally, our risk-adjustment model did not include other important variables for joint replacement (such as patient body mass index and functional status or procedure type). However, we deliberately used a risk-adjustment model that had a low administrative burden and that CMS is already using for several existing programs.

## Study Results

We identified 23,251 Medicare beneficiaries who underwent lower extremity joint replacement procedures (MS-DRG codes 469 and 470) in sixty Michigan hospitals from 2011 through 2013. The average CMS-HCC risk scores for the hospitals varied from 0.7 to 1.8 (mean: 1.12; standard deviation: 0.19) (Exhibit 1). This variation was greater for patients with MS-DRG code 469 than for those with code 470 (see online Appendix Exhibit 1).<sup>7</sup>

In the first scenario, we found no significant association between reconciliation payments and CMS-HCC risk scores when target episode prices were set using a hospital's historical spending ( $r = -0.15$ ;  $p = 0.24$ ). This finding reflects the relative consistency over time of patient complexity within hospitals.

In contrast, in the second scenario, we found a significant inverse association between reconciliation payments and CMS-HCC risk scores when target prices were set to a regional benchmark ( $r = -0.37$ ;  $p = 0.003$ ) (Exhibit 2). Specifically, for each standard deviation increase in CMS-HCC risk score, reconciliation payments per episode were reduced by \$827 (95% confidence interval:  $-1,368$ ,  $-285$ ). This estimate remained stable and significant after we adjusted for hospital teaching status, number of beds, and proportion of Medicaid patients served.

We found that risk adjustment consistently reduced reconciliation payments to hospitals with the lowest CMS-HCC risk scores and consistently increased payments to hospitals with the highest scores (Exhibit 1). Including CMS-HCC risk scores in the calculation of reconciliation payments would lead to reductions in annual payments by as much as \$146,360 for hospitals with the least medically complex patients and increases as large as \$114,184 for hospitals with the most medically complex patients. The results of our sensitivity analyses were not substantively different from those of our primary analyses.

## Discussion

Using methods analogous to those used by the CJR program, we found that using region-based target pricing led to reduced reconciliation payments to hospitals that treat medically complex patients. In addition, we found that after risk adjustment with CMS-HCC risk scores, estimated reconciliation payments were substantially increased for hospitals that treat patients with high complexity and reduced for hospitals that treat patients with low complexity. The magnitude of these payments was similar to that of the incentive payments received by hospitals in CMS's Hospital Value-Based Purchasing pro-

gram.<sup>8</sup> Collectively, these findings suggest that risk adjustment is important for bundled payment programs that use regional spending benchmarks, including the CJR program.

Our primary finding that patients' medical complexity is associated with the magnitude and direction (that is, bonus versus penalty) of hospital reconciliation payments is consistent with the results of numerous studies showing that underlying clinical factors influence episode payments for multiple conditions.<sup>9-12</sup> In fact, many published risk-adjustment models for joint replacement include risk-adjustment variables beyond the ones we used—age, sex, number of comorbidities, dual eligibility (for Medicare and Medicaid) status, and original reason for Medicare entitlement to assess risk—such as anesthesia class and functional status.<sup>13,14</sup> Our results imply that even a modest risk-adjustment model would have important implications for reconciliation payments received by hospitals when target prices are based on regional benchmarks.

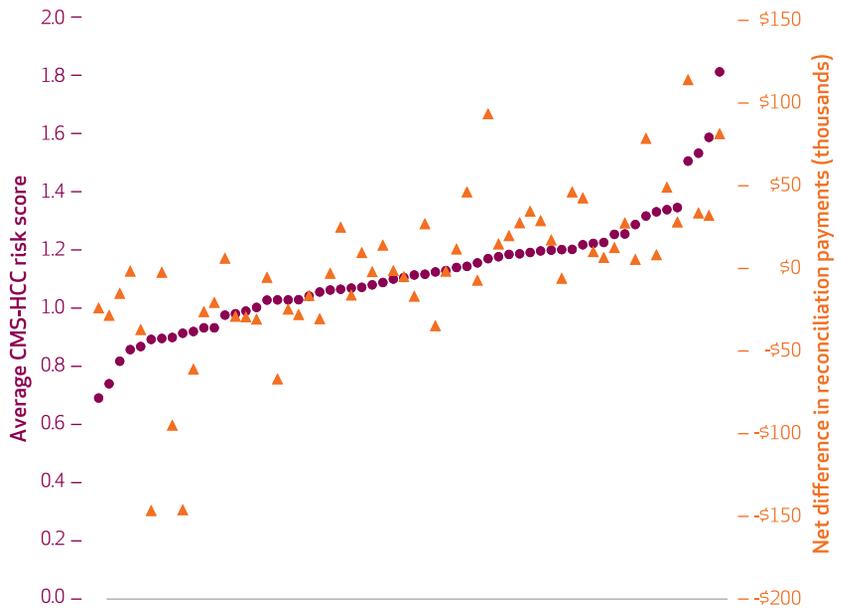
Our results have several immediate implications for policy makers. Our finding that risk-adjusting the target price would have a significant impact on reconciliation payments suggests that CMS should strongly consider amending the current CJR target pricing strategy to account for participating hospitals' patient populations during the second performance year of the CJR program—the year when hospitals begin to face penalties.

At present, CMS sets a different target price for each of the following MS-DRG codes: 469 with hip fracture, 469 without hip fracture, 470 with hip fracture, and 470 without hip fracture. Our results suggest that CMS should further refine cohort-specific target prices at each hospital by accounting for key patient characteristics that affect the determinants of episode payments, including complications, readmissions, and use of postacute care services. Such additional risk adjustment would raise the target price for hospitals that serve older, sicker, and more medically complex patients and lower the target price for hospitals that treat populations that are younger, healthier, or both. This methodological refinement is essential because target prices—and the corresponding reconciliation payments—are increasingly anchored to regional payment data during the latter years of the program.

In this study we used CMS-HCC risk scores to refine target prices. We selected this particular measure for three reasons. First, HCCs are used by CMS for risk adjustment in a number of other performance programs, including programs that are focused on joint replacement and epi-

## EXHIBIT 1

**Variation in patients' medical complexity and changes in expected reconciliation payments across hospitals in Michigan after risk adjustment is added to the CJR program**



**SOURCE** Authors' analysis of data for 2011-13 from the Medicare Research Identifiable Files. **NOTES** The average Centers for Medicare and Medicaid Services Hierarchical Condition Category (CMS-HCC) risk scores reflect the medical complexity of a hospital's patient population. The score for each patient uses information on his or her age, sex, number of comorbidities, dual eligibility status, and original reason for Medicare entitlement. Net difference is the difference between risk-adjusted reconciliation payments (the sum of any annual bonuses from CMS to hospitals and any penalties from hospitals to CMS) and unadjusted reconciliation payments. A negative net difference means that the hospital would expect a reduction in reconciliation payments if CMS used risk adjustment; a positive net difference means that the hospital would expect an increase. Regional target prices were used to calculate reconciliation payments. All payments were adjusted to 2013 dollars. CJR is Comprehensive Care for Joint Replacement.

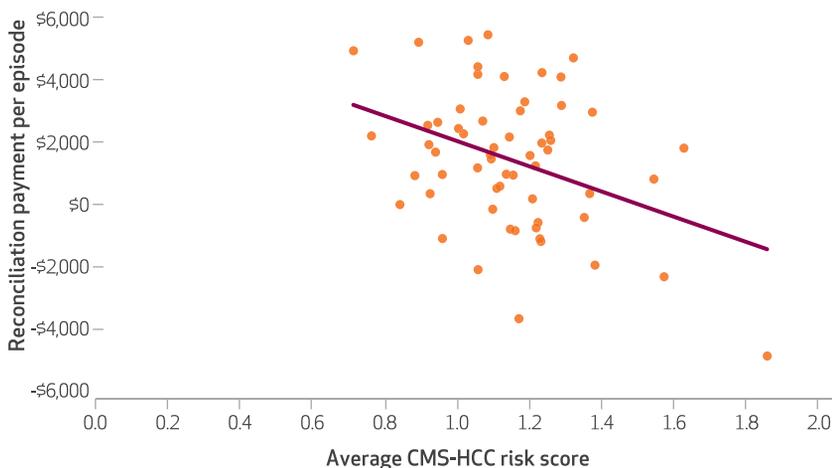
sode payment (for example, Medicare Spending per Beneficiary, Hospital Compare measures, and the Hospital Readmission Reduction Program). Second, CMS-HCC risk scores can be obtained from administrative claims with minimal burden. Third, some of the factors that make up the CMS-HCC risk score (age, number of comorbidities, and dual eligibility status) have been independently shown to affect expenditures.

In addition to CMS-HCC risk scores, CMS should consider other important risk-adjustment variables such as socioeconomic status, marital status, body mass index, and functional status. While CMS may need to devote resources to identifying and validating specific variables that adequately account for patient characteristics, our findings suggest that without sufficient risk adjustment, hospitals will be financially penalized for treating medically complex patient populations.

There are several reasons why our findings support this position. First, the difference be-

## EXHIBIT 2

## Association between reconciliation payment per average episode of lower extremity joint replacement and average CMS-HCC risk scores with the use of a regional benchmark



**SOURCE** Authors' analysis of data for 2011–13 from the Medicare Research Identifiable Files. **NOTES** The solid line indicates the trend line of the association. Average Centers for Medicare and Medicaid Services' Hierarchical Condition Category (CMS-HCC) risk scores and reconciliation payments are explained in the notes to Exhibit 1. A negative reconciliation payment means that the hospital must pay CMS a penalty; a positive payment means that CMS must pay the hospital a bonus. All payments were adjusted to 2013 dollars.

tween risk-adjusted and unadjusted payments can be significant for some hospitals. In fact, the magnitude of the payment is similar to the amount currently received by hospitals through the Hospital Value-Based Purchasing program.

Second, if CMS continues to use regional targets as it expands bundled payment programs to include other conditions,<sup>15</sup> the effect of not adjusting for number of medical comorbidities will likely be compounded for some hospitals. Because a hospital's patient population is often determined by its fixed geographic and structural characteristics, hospitals that are disadvantaged by the CJR program will likely be disadvantaged by future bundled payment programs that do not incorporate risk adjustment.

Third, CMS is already using HCC-based risk adjustment for several of its episode-based payment metrics (for example, Medicare Spending per Beneficiary). It is not clear why this should not also be the case for the CJR program, especially given our findings.

Fourth, as evidenced by comments from key stakeholders during the rule-making process for the CJR program, patient-level risk adjustment is strongly supported by clinicians, hospital administrators, and many organizations (including the Medicare Payment Advisory Commission).

Finally, the absence of risk adjustment in the

CJR program may lead to unintended consequences, such as reduced access to necessary surgical or postacute care for Medicare beneficiaries with chronic diseases. For example, providers that have established gain-sharing agreements or contracts with hospitals participating in the CJR program might refuse to care for patients whose predicted expenditures exceed the hospital's unadjusted target price. By closely aligning reimbursement and predicted expenditures, CMS may partially mitigate concerns about patient selection in the CJR program.

This analysis suggests that risk adjustment based on CMS-HCC risk scores affects reconciliation payments when target prices are regionalized. Moving forward, research in this area should focus on defining risk-adjustment variables beyond the CMS-HCC model that are predictive of episode cost, reflect the underlying severity of illness of the patient, and can be relatively easily obtained from administrative claims data.

Clinical registry data may be an option, if the data can be linked to Medicare claims.<sup>16–18</sup> Such data often have robust risk-adjustment variables that are not available in administrative claims data. The trade-off is that clinical registry data may be labor-intensive to obtain. For example, in 2011 Blue Cross Blue Shield of Michigan funded and established the Michigan Arthroplasty Registry Collaborative Quality Initiative. The initiative is a statewide quality collaborative that aims to improve the care of patients undergoing joint replacement.<sup>16</sup> The initiative's data registry contains information on clinical indications for surgery, procedure details, surgical approach, and specific complications that might not be identifiable from billing data. Individual abstractors at each participating site are required to collect, store, and submit this information to the registry. It is not clear whether CMS would be able to replicate such a model in a scalable manner.

## Conclusion

In the end, the goal of any alternative payment program should be to provide hospitals with realistic incentives to provide high-quality care and reduce costs. While we believe that the Comprehensive Care for Joint Replacement program could serve as an important step in that direction, the inclusion of risk adjustment based on CMS-HCC risk scores would make the program more equitable for and acceptable to all participants and would limit the potential unintended consequences for Medicare beneficiaries with multiple comorbid conditions. ■

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