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Improving bundled payments in the Medicare program

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EDITOR'S NOTE

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Introduction

The Center for Medicare and Medicaid Innovation (CMMI) is tasked with testing new payment and delivery models and has undertaken a number of initiatives that bundle payment for episodes of care related to an acute hospitalization. For example, one model within the Bundled Payments for Care Improvement (BPCI) initiative has combined reimbursement for inpatient and professional services delivered during an initial hospital stay as well as services that are received post-discharge including post-acute care (PAC). This kind of approach has the potential to lower health care expenditures while preserving or even improving the quality of care received by beneficiaries by creating incentives around the delivery of the full episode of care.[1-4]

The purpose of this white paper is to provide practical perspective to decision makers about how to improve the effectiveness of bundled payment systems. We make three primary recommendations.

Our first recommendation is that episodes based on an acute hospitalization should continue to play an important role in bundled payment. Hospitalization-based bundling offers a significant opportunity for improved performance within the health care system, especially for episodes for which a substantial share of the care associated with an episode is typically delivered after the hospitalization, particularly at PAC facilities. In this situation there is ample scope for more effectively coordinating—and even redesigning—the delivery of care episodes across providers, and the transition from hospitals to PAC and other providers is critical to system performance and likely to be managed most effectively by hospitals and physicians providing inpatient care. It is also now well established that post-acute care accounts for a large share of geographic variation in Medicare spending overall, which suggests that settings involving substantial PAC spending may be a fruitful place to look for opportunities to improve the efficiency of care [5-8].

Using Medicare claims from 2012, we document that post-discharge and PAC spending account for substantial fractions of average episode spending for episodes types in use in major CMMI bundled payment initiatives. For example, post-discharge and PAC spending in BPCI models account for nearly half and one quarter, respectively, of total episode spending on average. We also document marked variation in the PAC share across anchor hospitals; for example, for double joint replacement of the lower extremity, PAC spending varied from 16.2% at the anchor hospital at the 10th percentile of the episode spending distribution to 26.8% at the 90th percentile. This pattern mirrors the variation in PAC spending at the population level and points to a meaningful opportunity for improved performance.

Second, decision makers should revisit mandatory participation by health care providers. The Trump Administration cancelled CMMI's mandatory Episode Payment Models, and scaled back the number

of metro areas in which participation is required in the Comprehensive Care for Joint Replacement (CJR) Model. We believe that a mandatory approach has some notable strengths. Such an approach is more effective in sustaining and maximizing the potential of payment and delivery reforms over time, by building the evidence about what works and helping to achieve scale for effective models. In addition, with mandatory participation, it is possible to specify more appropriate and equitable benchmarks for the performance of individual providers.

A mandatory approach does compel participation by providers who see a relatively unfavorable balance between reward and risk under bundled payment, and the relatively limited number of voluntary participants under BPCI indicates that most providers see the risks as outweighing the benefits. We nevertheless believe that the systemic benefits of mandatory participation justify pressing ahead, although it may be worth considering making greater use of policy levers that can mitigate adverse impacts (e.g., a stop loss for downside risk).

Third, payments for hospitalization-based bundles should be risk adjusted to a greater extent than has been the case in BPCI and CJR. Again using Medicare claims, we analyzed the degree to which the average characteristics of patients admitted to anchor hospitals could explain differences in average total episode payments. We found that age, gender and race/ethnicity accounted for 12 percent of the variation in average payments across hospitals, averaged across BPCI episodes. With Hierarchical Condition Category scores, which are used to risk-adjust payments to Medicare Advantage Plans, added to the model, the share of cross-hospital payment variation that is explained rose to 22 percent on average for BPCI episodes. The share was larger for some mandatory CMMI episodes. These shares are comparable to the typical performance of risk-adjustment approaches, and our findings suggest that risk adjustment could help to ensure that adequate resources are available for treating patients in relatively poor health. This is particularly important in the context of mandatory models with regional payment benchmarks.

Bundled payment in Medicare

CMMI has developed a number of initiatives that bundle payment for episodes of care triggered by an acute hospitalization. BPCI specified four distinct models that could apply to initial hospitalizations for any of 48 episode types, with implementation begun in 2013. The volume of episodes in each model reflects the numbers of acceptable applications by provider groups. The vast majority (more than 85%) have been initiated under Model 2, which includes Part A and B services during the initial hospitalization as well as PAC and other care within 90 days of the initial discharge.[9]¹

¹ To be precise, Model 2 participants could choose 30, 60 or 90 day post-discharge windows, but 90 days was the nearly unanimous choice.[9]

The Comprehensive Care for Joint Replacement Model (CJR) model kicked off in 2016, and is similar to BPCI Model 2 in its scope, but focused on one BPCI episode type (MS-DRGs 469 and 470 for major joint replacement of the lower extremity.) The Episode Payment Models (EPM) demonstration – which had been planned but was cancelled by former HHS Secretary Price – would have been similar in scope to CJR, but focused on coronary and surgical hip / femur fracture treatment episodes in BPCI.

In January, 2018, CMMI announced its BPCI Advanced (BPCI-A) model. This model includes 28 of the 48 episode types from BPCI and adds a hospitalization-based episode for certain liver disorders. In addition, BPCI Advanced introduces three outpatient episodes for certain cardiac and back / neck procedures.

Likewise, other bundled payment models within the Medicare program are not based on an acute hospitalization. The Oncology Care Model (OCM) initiates an episode of care with chemotherapy, which may be administered in a physician's office, or in some cases taken orally.² The Medicare Access and CHIP Reauthorization Act of 2015 created a Physician-Focused Payment Model Technical Advisory Committee (PTAC).[11] Starting in 2017, PTAC has reviewed several proposed models, and recommended that some undergo limited testing, including, for example, a proposal from the American College of Surgeons and Brandeis University researchers that bundles payments for 54 procedural episodes using a framework that, depending on the clinical context, can initiate an episode without an admission.

Role of hospitalization-based models

Hospitalization-based models should continue to play an important role in bundled payment within Medicare. While we recognize that a physician-oriented approach can have merit, there are important benefits to episodes that focus on hospitals. One is the magnitude of revenue flows into most hospitals, which can make sharing of financial risk of bundled payment with the Medicare program more feasible. In addition, episodes that incorporate outpatient care prior to any admission may need to be more customized, for example, with respect to the services that trigger an episode; such complexity would tend to increase the cost of developing a payment model. Some surgeries can be performed on an outpatient basis, and in these circumstances an episode might be triggered by ambulatory surgery. Accounting for differences in patient severity across ambulatory and inpatient settings could be highly challenging.

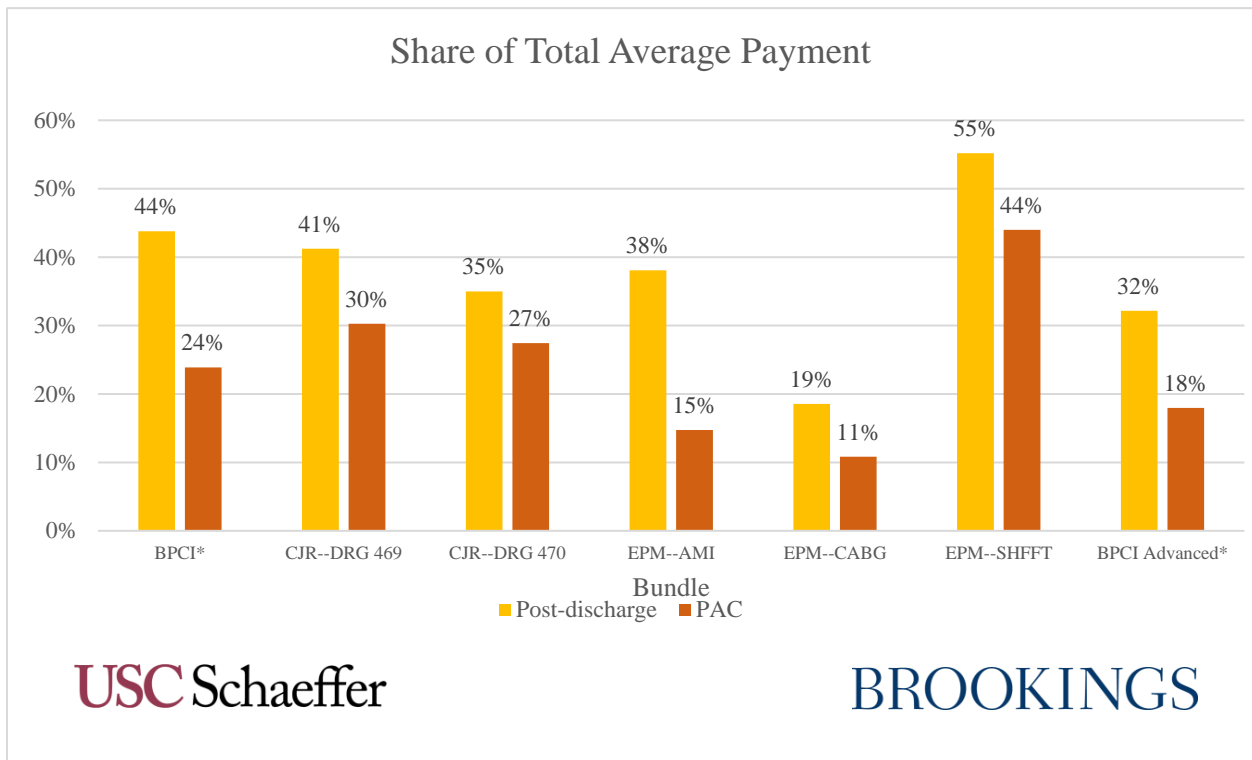
Hospitals and physicians providing inpatient care may be better situated to collaborate with PAC providers, or otherwise exert some control over PAC. On this point, the third and most recent BPCI evaluation noted a decreased use of institutional PAC (in particular, skilled nursing facilities and

²The OCM is a multi-payer model that involves commercial insurers as well as fee-for-service Medicare.[10]

inpatient rehabilitation facilities) and an increased use of home health for many episode types. Hence, episodes that typically involve more services post-discharge, and PAC in particular, may provide greater opportunities for improved performance. These episode types are likely to have relatively broad scope for coordinating and even redesigning the delivery of care across providers, with an emphasis on the utilization of a cost-efficient mix of services.

We provide some empirical perspective on the appropriateness of particular hospitalization-based episodes for bundled payment. We quantify the share of total Part A and B Medicare payments which were attributable to post-discharge care and PAC providers specifically, across episodes specified by the BPCI, CJR and EPM models. Our analysis uses claims from Medicare fee-for-service beneficiaries in 2012, before any of these models took effect. To make a comprehensive analysis of all of the episodes practical, we have not excluded specific services which are not included in bundled payment accounting.³ Additional details can be found in the appendix.

Figure I



*Note: Averages are weighted by number of episodes in 2012.

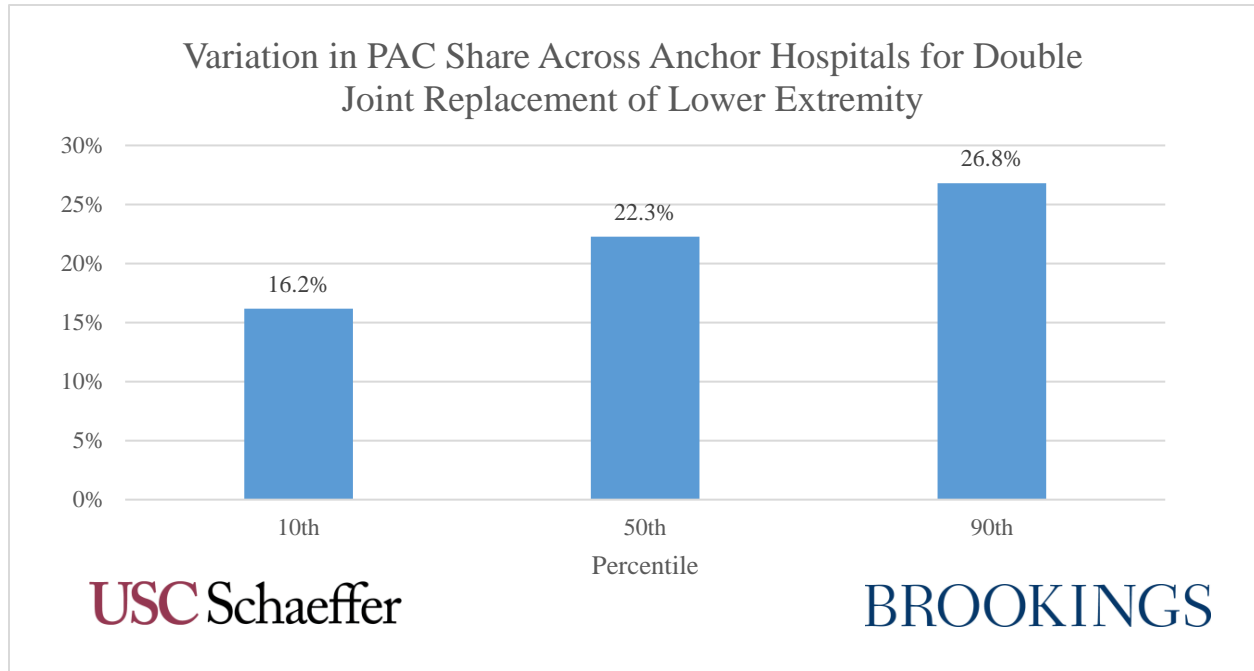
Source: Authors' calculations from CMS data.

³Under BPCI, participants may propose specific post-discharge services (based on International Classification of Disease codes) or readmissions (Based on MS-DRGs) for exclusion.[12] Under CJR, excluded services vary across episodes.[13]

Among BPCI episode types, the share of post-discharge payments within average total payments ranged from a minimum of 16% (cardiac defibrillator) to a maximum of 68% (fractures femur and hip/pelvis), while the PAC share ranged from 5% to 51% (same episodes). As Figure 1 shows, the post-discharge and PAC shares were 44% and 24%, respectively, on average across BPCI episodes. The PAC share was higher than this average for CJR (30% for MS-DRG 469) but lower for the EPM AMI episode (15%.) For the 27 BPCI episodes included in BPCI-A, the average share was lower, specifically, 18% (we return to this observation below.)

Within an episode type, there is substantial variation in the PAC share across anchor hospitals. Figure 2 shows the case of double joint replacement of the lower extremity. Pardee Hospital of Hendersonville, North Carolina is at the 90th percentile, with a PAC share of 26.8%, compared to Redlands Community Hospital in Redlands, California the 10th percentile, with a share of 16.2%.

Figure 2



Source: Authors' calculations from CMS data.

In our view, the substantial share of PAC payments in many episodes, together with marked variation in the PAC share across anchor hospitals, point to a meaningful opportunity for improved performance through hospitalization-based bundled payment. This conclusion is strengthened by evidence that PAC drives geographic variation in total per capita Medicare FFS spending.[5-8]

Mandatory participation

The initial CJR and now-cancelled EPMs mandated that hospitals in select metropolitan areas participate in the models. The number of geographic areas in which CJR participation is mandatory was scaled back in 2017, and CMMI announced the voluntary BPCI Advanced model this January. In our view, CMMI and CMS should reconsider these recent movements away from mandatory participation.[14]

Certainly, a voluntary approach does have strengths. Providers who are well-positioned to improve their performance will elect to participate, while those who do not see an opportunity to improve will not. Similarly, providers who would be disadvantaged by an unusually hard-to-treat mix of patients could opt out. Thus, a voluntary approach can target a model to providers who are likely to achieve better-than-average improvements, while limiting adverse impacts on other providers.

Yet voluntary participation can impair our ability to sustain and maximize the benefits of payment and delivery reforms over time. We need to know what works and under what circumstances; inability to understand fully the differences between participants and nonparticipants may preclude reliable inferences from the experience of the volunteers. CJR is now mandatory in only 34 areas, and certain bundles in BPCI Advanced with substantial post-acute utilization saw little participation in BPCI (for example, cardiac defibrillator). Moreover, some and possibly many providers who would prove successful may elect not to participate, due to risk aversion and the frontloading of participation costs.

By building the evidence base, a mandatory approach can help target models toward all of the providers that are able to achieve positive performance improvements. Reluctant or underperforming providers have an incentive to improve, while strong performers are rewarded. Over time, it is likely that fewer beneficiaries will receive care from providers who manage their cost of care ineffectively; current policy constrains the Medicare program from pursuing this objective through financial incentives for beneficiaries. With more providers participating, there may be greater scope for learning across the community from successes and failures.

Another strength of mandatory participation is its compatibility with setting target prices based on regional benchmarks. CJR transitions each provider from its own benchmark to a regional benchmark. If a provider's target were tied only to its own historical performance, not only will already-efficient providers find this highly challenging, but if policymakers rebase the benchmarks periodically to more recent historical performance, it undermines the business case for investing in improvement. Yet regional benchmarks cannot be used under a voluntary program since only the already efficient would join and could reap large rewards for continuing what they are doing.

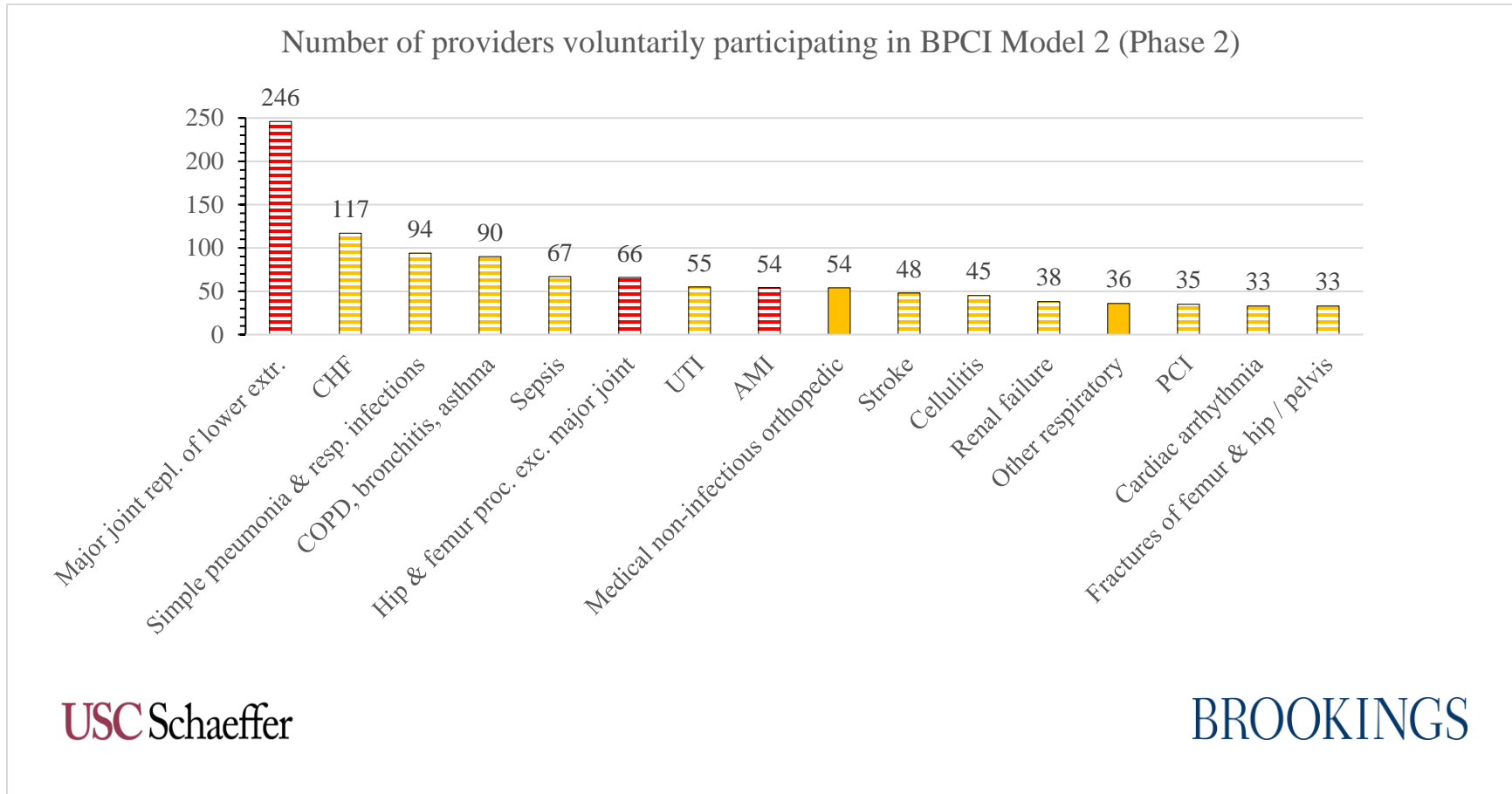
Actual participation in BPCI has implications for mandatory bundled payment. As of October 1, 2017, 304 hospitals and 177 physician group practices were active in Model 2.[9] These numbers are not trivial, but neither are they large. The modest numbers make inferences less reliable and limit the

potential impact on beneficiaries and Medicare spending. Clearly, the impact of mandatory participation on providers is an important concern. Policy levers for mitigating adverse effects include a smaller “discount” of the target price below the benchmark (at least initially), a stop loss on downside risk (a general feature of CMMI’s hospital-based bundled payment models), and an initial rollout to select geographic areas (CJR and the now-cancelled EPMS adopted this feature). Indeed, the use of such mitigation strategies within voluntary models can be seen as kind of compromise with the benefit of more rapidly scaling of bundled payment within the health system, but at the expense of delaying worthwhile refinements that could be made with what is learned from the evaluation of mandatory models.

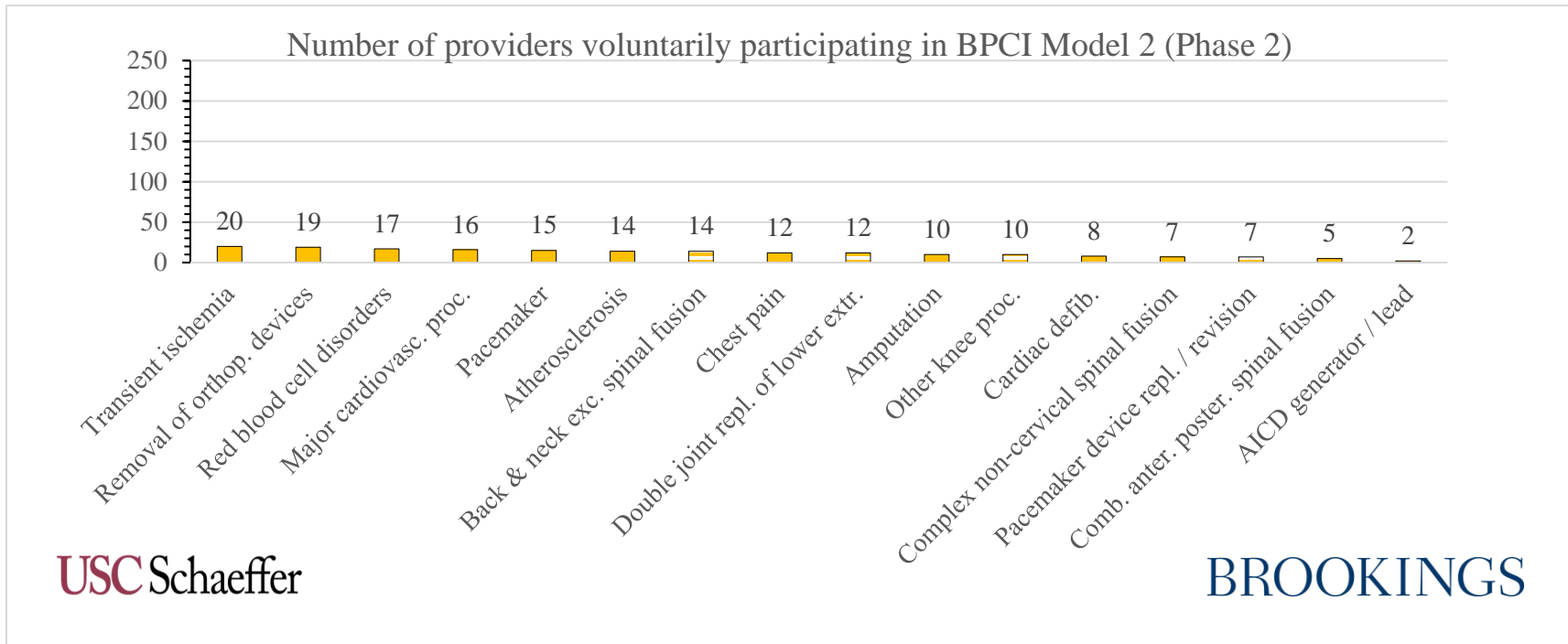
Voluntary participation across BPCI episode types nevertheless offers lessons for bundled payment going forward. Willingness to participate in a particular episode type is a signal of providers’ assessments about the balance between risk and reward, compared to other bundles. Figure 3 shows the 16 episode types with the greatest and least participation. Hospitals and physician group practices have been more likely to participate in BPCI episodes related to mandatory CJR and EPM models, as indicated by red instead of yellow bars. Other episodes with relatively strong participation may be good candidates for a mandatory approach.

Figure 3 further shows (with dashed instead of solid bars) that the BPCI Advanced model tends to include BPCI episode types with stronger participation. Indeed, the eight episodes with the greatest participation in BPCI are all included in BPCI-A. We previously noted that BPCI-A episode types had a lower average share of PAC in total payment than did BPCI episode types in 2012. However, the eight BPCI-A episode types with the greatest BPCI participation tended to have substantial PAC shares, as Figure 4 shows. On average the share was 25%, slightly higher than for BPCI episodes.

Figure 2



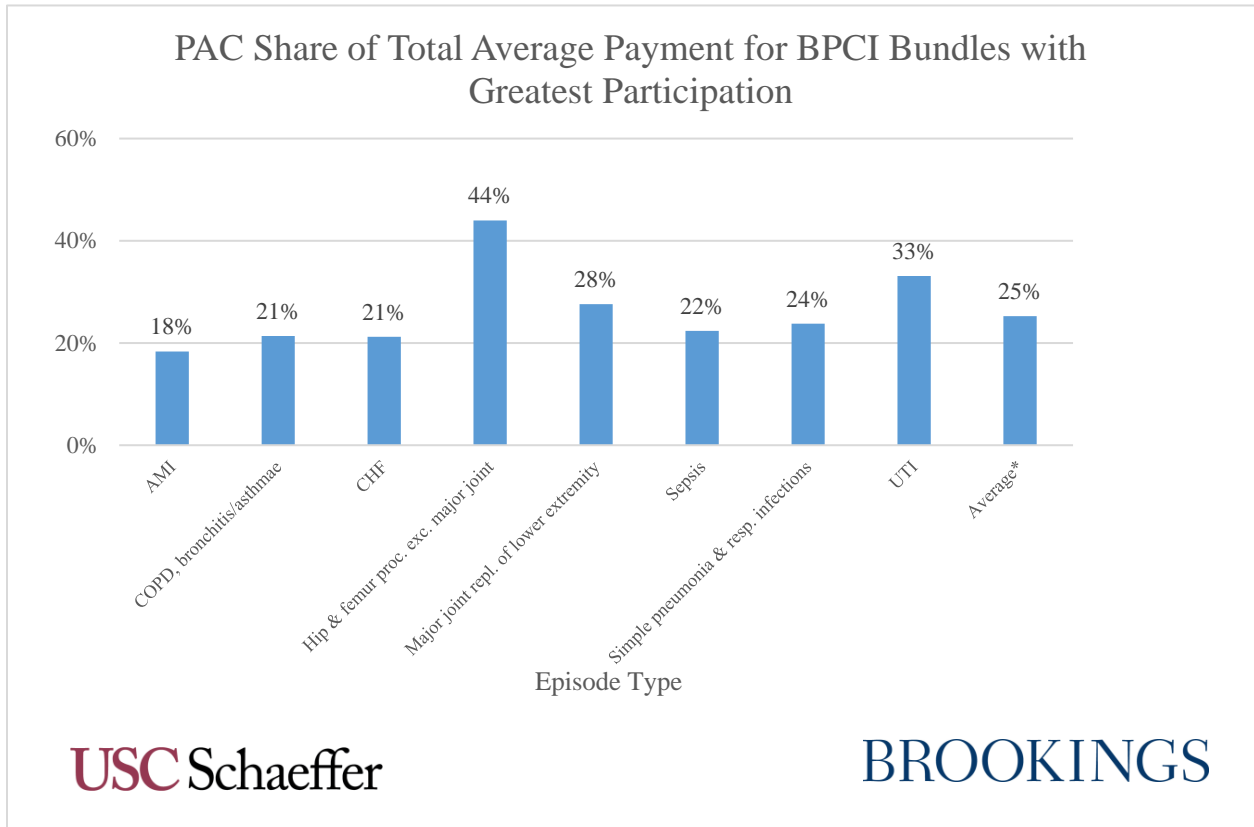
16 Episode Types with Greatest Participation



16 Episode Types with Least Participation

Notes: Red color indicates BPCI episode is related to a mandatory CMMI model; dashed bar indicates BPCI episode is included in BPCI Advanced.

Figure 3



Source: Authors' calculations from CMS data.

In designing BPCI-A, CMMI sought to simplify the scope of episode types, and to include types for which good participation would be expected.[15] The substantial PAC share for high-participation episode types is consistent with our view that hospitalization-based bundles offer meaningful opportunities for improved performance. We encourage CMS and CMMI to make the most of these opportunities by developing and implementing mandatory models that address the needs of both patients and providers.

Risk adjustment

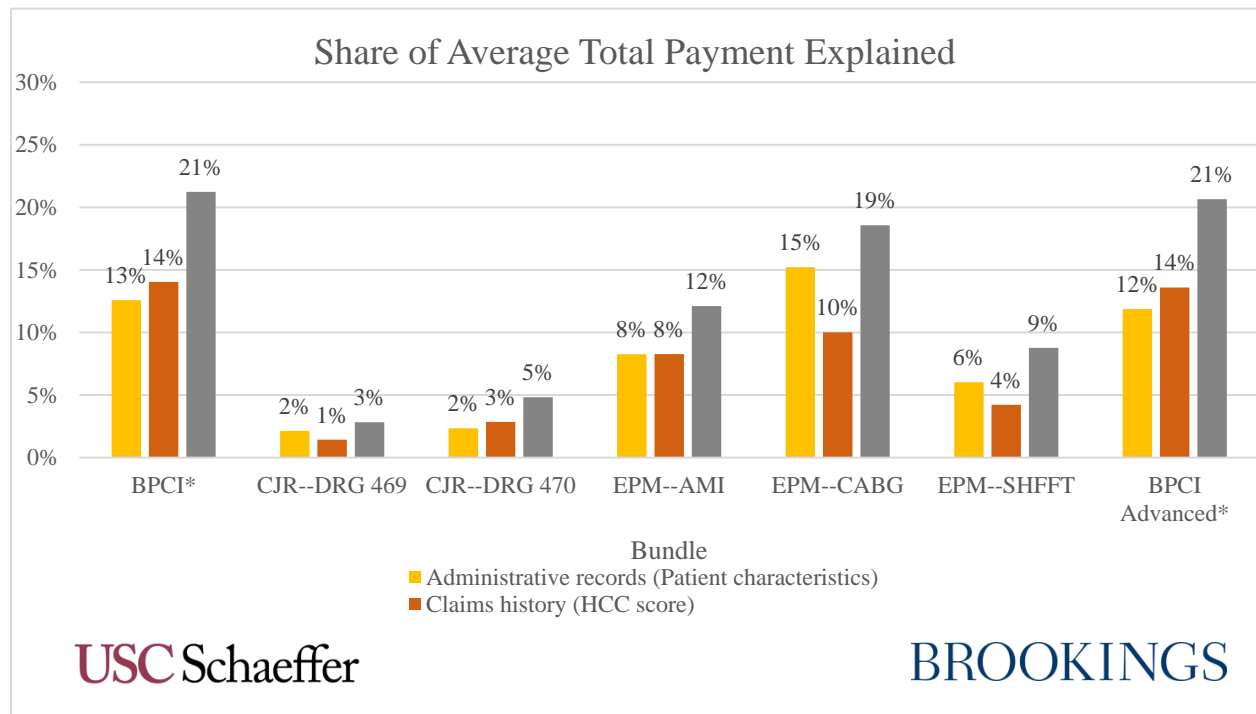
Risk-adjusted payment should be used to a greater extent than has been the case in the BPCI and CJR models implemented by CMMI. In BPCI, there has been no risk adjustment of payment within episode type. In CJR, the payment target differs by MS-DRG (469 versus 470), and according to a beneficiary's hip fracture status. CJR payments do depend on well-established quality metrics that are themselves

risk-adjusted, but a provider with sicker patients still would not receive the additional resources needed to treat its population.

To better understand the role of risk adjustment in bundled payment, we assessed the utility of a practical and consistent approach to risk adjustment across a range of episodes. Again using Medicare claims, we quantified the degree to which patient characteristics and health status could explain the variation across anchor hospitals in average total payments for episodes, as detailed in the appendix.

First, we used patient characteristics from administrative records, including age, gender, race / ethnicity and current source of Medicare entitlement. For BPCI, these patient characteristics were able to explain 12 percent of the variation in total payment across hospitals, averaged across episode types. As Figure 5 shows, the share explained for the CJR subtypes (MS-DRGs 469 and 470) and the coronary EPM episodes ranged from 2% to 15%. Across all episode types, the maximum share explained was 84.0% for automatic implantable cardioverter-defibrillator generator or lead. For some episodes, a single characteristic accounts for a substantial share of the variation in payment across hospitals. For example, age 75 or older explains 10.3% of cross-hospital differences in payment for cervical spinal fusion, or 38.4% of all of the variation explained by patient demographics (i.e., 10.3% / 26.8%.)

Figure 4



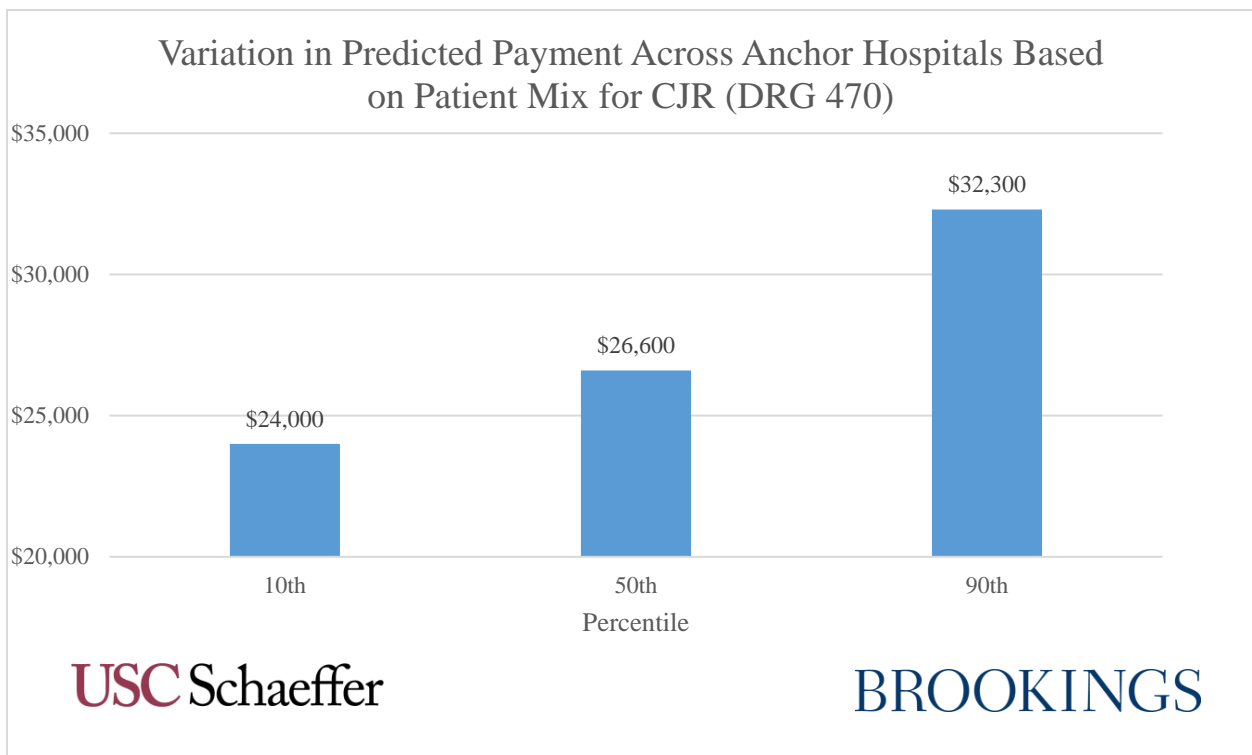
***Note:** Average is weighted by number of episodes in 2012.

Source: Authors' calculations from CMS data.

We then incorporated Hierarchical Condition Category (HCC) scores. HCC scores are used to prospectively set payment rates to Medicare Advantage plans. While these scores are not specific to the episodes considered or even to the fee-for-service population within Medicare, they can be easily calculated from a prior year of claims history, and CMMI has employed HCCs

for risk adjustment in its Comprehensive Primary Care Initiative and proposed their use for BPCI-A.[15,16] When we added HCC scores to patient characteristics, we were able to explain 22% of the variation in total payments across hospitals per episode for BPCI on average. This explanatory power is comparable to other risk adjustment schemes in practical use [17,18] (the explanatory power of these schemes also stems from variability among individuals treated by the same providers.)

Figure 6



Source: Authors' calculations from CMS data.

To further interpret our findings, consider the case of joint replacement of the lower extremity (DRG 470.) Figure 6 shows how predicted total payments vary with an anchor hospital's patient mix. Suppose that hospitals had received bundled payments in 2012, set to the level predicted for the hospital with the median patients in terms of severity (\$26,600.) Then the hospital at the 10th percentile of the severity distribution (South Texas Surgical Hospital in Corpus Christi, Texas) would have received \$2,600 more per patient than was needed, or an excess payment of 11.0% in relative terms, due to its relatively healthy patient mix. By contrast, Aurora Lakeland Medical Center in Elkhorn, Wisconsin would have received \$5,700 less than was needed to treat its patients at the 90th

percentile of the severity distribution, for a payment deficit of 17.7%. If these bundles were risk adjusted for fracture status, payment would still have been \$2,400 less than needed.

Misalignments between provider payment and patient severity raise concerns as to whether providers have the resources needed to treat patients appropriately. Indeed, such misalignments can create incentives for providers to avoid beneficiaries who are sicker or costlier, or to skimp on their care [19,20] (patient characteristics are able to explain substantial variation in episode spending within as well as across anchor hospitals.) Moreover, equity toward providers is important for the political sustainability of a payment system. Risk adjustment can help to ensure that the desired incentives can be created while minimizing the risk borne by providers.

Risk adjustment is less of a concern when participation is voluntary and payment is tied to a provider's historical performance, so long as patient mix is stable. Conversely, risk adjustment becomes more critical when participation is mandatory and payment is set to a regional benchmark. The latter scenario applies to mandatory models that CMMI may pursue in the future,⁴ while the former is relevant to [21] BPCI and BPCI Advanced. CMMI does plan to risk adjustment payments under BPCI-A, based on HCCs and other factors. Figure 5 shows that our risk adjustment approach explained 23% of the variation in payments for the BPCI episodes included in BPCI-A. The smaller number of episode types in BPCI-A makes it more practical to customize the risk adjustment approach to the episode type. For example, our research has found that the efficiency with which heart-attack care is delivered differs according to the diagnosis codes that indicate the location of the event within the heart.[22]

One concern with risk adjustment mechanisms in general is that providers may be able to game the system. This concern is less acute for administrative schemes (e.g., age-based) than for claims-based adjustment, because providers may exercise meaningful discretion over coding. The potential for upcoding is limited for the claims-based approach considered here. The HCC scores we used were for all of the Medicare services received by a beneficiary in the prior year. Thus the providers involved in delivering care for an episode have very little influence over the HCC scores of their patients. It is the case that diagnostic practices vary across the U.S.[23,24], and CMMI could set regional benchmarks for risk scores so as to provide appropriate and equitable payment targets. With mandatory participation, any upcoding by providers would tend to “cancel out” in regional benchmarks, so upcoding would at least not affect aggregate Medicare payments.

Conclusions

This white paper has sought to provide practical perspective about how to maintain and improve the effectiveness of bundled payment systems. These systems aim to spur providers to better coordinate

⁴To be precise, CJR will transition over time to regional benchmarks.

and even redesign the delivery of care episodes, with an emphasis on the utilization of services that result in good quality of care at reduced cost, and evaluations of the BPCI initiative have shown promise. Even as CMS develops new approaches to payment and delivery, we believe that hospitalization-based bundles, with appropriate adjustments to payment for patient severity, will continue to offer meaningful opportunities for improved performance within the health system, and we encourage decision makers to make the most of these opportunities by adopting mandatory models that address the needs of both patients and providers.

References

1. Navathe, A.S., et al., Characteristics of hospitals earning savings in the first year of mandatory bundled payment for hip and knee surgery. *JAMA*, 2018. **319**(9): p. 930-932.
2. Dummit, L.A., et al., Association between hospital participation in a medicare bundled payment initiative and payments and quality outcomes for lower extremity joint replacement episodes. *JAMA*, 2016. **316**(12): p. 1267-1278.
3. Sood, N., et al., Medicare's Bundled Payment Pilot for Acute and Postacute Care: Analysis and Recommendations on Where to Begin. *Health affairs (Project Hope)*, 2011. **30**(9): p. 1708-1717.
4. Iorio, R., et al., Early Results of Medicare's Bundled Payment Initiative for a 90-Day Total Joint Arthroplasty Episode of Care. *The Journal of Arthroplasty*, 2016. **31**(2): p. 343-350.
5. Institute of Medicine, *Variation in Health Care Spending: Target Decision Making, Not Geography*, ed. J.P. Newhouse, et al. 2013, Washington, DC: The National Academies Press. 206.
6. Newhouse, J.P. and A.M. Garber, Geographic variation in health care spending in the United States: insights from an Institute of Medicine report. *JAMA*, 2013. **310**(12): p. 1227-8.
7. Newhouse, J.P. and A.M. Garber, *Geographic variation in Medicare services*. *N Engl J Med*, 2013. **368**(16): p. 1465-8.
8. Mechanic , R., *Post-Acute Care – The Next Frontier for Controlling Medicare Spending*. *New England Journal of Medicine*, 2014. **370**(8): p. 692-694.
9. Centers for Medicare and Medicaid Services, *CMS Bundled Payments for Care Improvement Initiative Models 2-4: Year 3 Evaluation & Monitoring Annual Report*, 2017.
10. CMS Innovation Center. *Oncology Care Model*. Available from: <https://innovation.cms.gov/initiatives/oncology-care/>.
11. U.S. Department of Health and Human Services. *PTAC*. Available from: <https://aspe.hhs.gov/ptac-physician-focused-payment-model-technical-advisory-committee>.
12. CMS Innovation Center. *Bundled Payments for Care Improvement (BPCI) Initiative: General Information*. Available from: <https://innovation.cms.gov/initiatives/bundled-payments/>.
13. CMS Innovation Center. *Comprehensive Care for Joint Replacement Model*. Available from: <https://innovation.cms.gov/initiatives/cjr>.

14. T, G., et al., How Should The Trump Administration Handle Medicare's New Bundled Payment Programs?, in Health Affairs 2017.
15. CMS Innovation Center. *BPCI Advanced*. Available from:
<https://innovation.cms.gov/initiatives/bpci-advanced>
16. CMS Innovation Center. *Comprehensive Primary Care Initiative*. Available from:
<https://innovation.cms.gov/initiatives/comprehensive-primary-care-initiative/>.
17. Newhouse, J.P., M.B. Buntin, and J.D. Chapman, *Risk Adjustment And Medicare: Taking A Closer Look*. Health Affairs, 1997. **16**(5): p. 26-43.
18. Pope, G.C., et al., *Risk adjustment of Medicare capitation payments using the CMS-HCC model*. Health Care Financ Rev, 2004. **25**(4): p. 119-41.
19. Dranove, D., et al., Is More Information Better? The Effects of Report Cards on Health Care Providers. Journal of Political Economy, 2003. **111**(3): p. 555-588.
20. Brown, J., et al., How Does Risk Selection Respond to Risk Adjustment? New Evidence from the Medicare Advantage Program. American Economic Review, 2014. **104**(10): p. 3335-64.
21. Buntin, M.B., et al., Medicare Spending and Outcomes After Postacute Care for Stroke and Hip Fracture. Medical Care, 2010. **48**(9): p. 776-784.
22. Romley, J.A., D.P. Goldman, and N. Sood, *US hospitals experienced substantial productivity growth during 2002-11*. Health Aff (Millwood), 2015. **34**(3): p. 511-8.
23. Welch, H., et al., Geographic variation in diagnosis frequency and risk of death among medicare beneficiaries. JAMA, 2011. **305**(11): p. 1113-1118.
24. Song, Y., et al., *Regional Variations in Diagnostic Practices*. New England Journal of Medicine, 2010. **363**(1): p. 45-53.

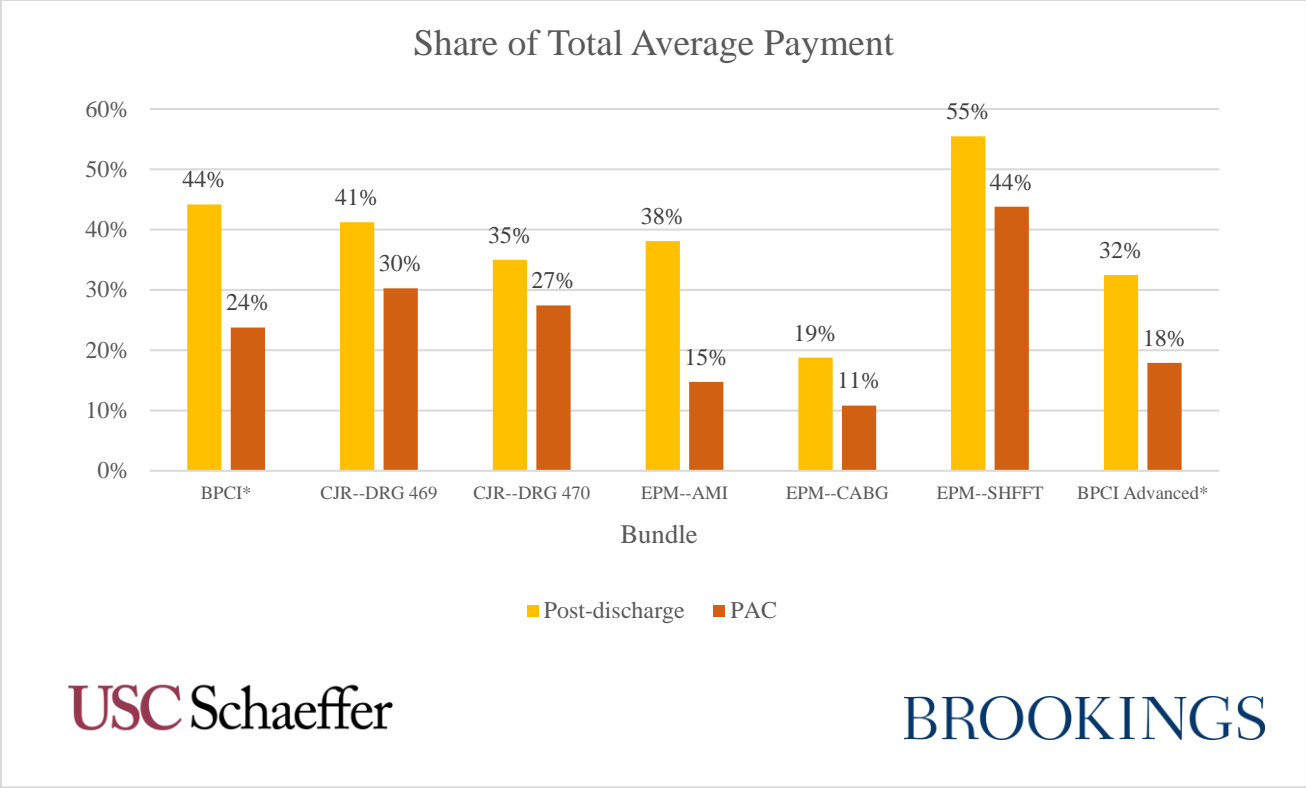
Appendix

Our analyses used a random sample of 20% of Medicare beneficiaries in 2012. We used the Inpatient File to identify anchor hospitalizations at IPPS hospitals in the 50 states and D.C., using the MS-DRG codes associated with each bundle type and hospitals' Medicare provider numbers.[12] We restricted the analysis to beneficiaries who were continuously enrolled in fee-for-service from 90 days prior to the anchor admission to 90 days after the discharge, using the Part A/B segment of the Master Beneficiary Summary File; episodes during which a beneficiary died were retained. We excluded a potential episode if the beneficiary was discharged from another hospital for the same episode type within 90 days prior.

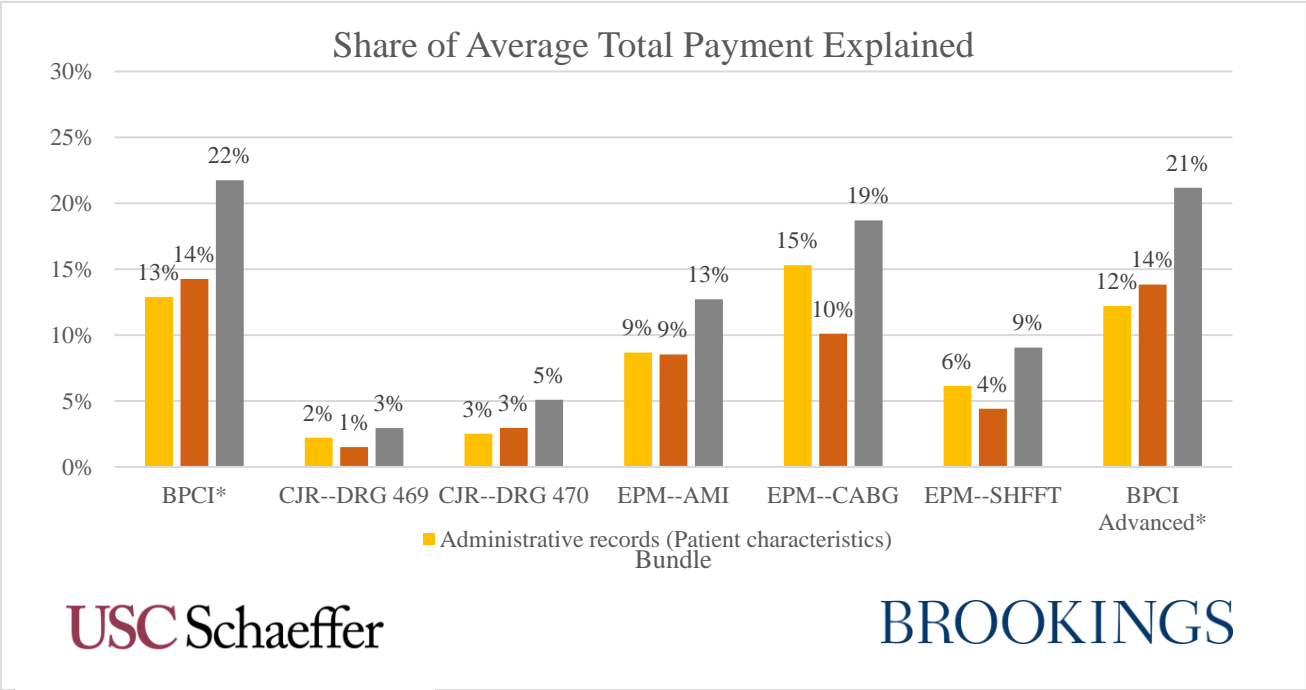
We measured total Medicare spending / payment per episode in the Inpatient, Carrier, Outpatient, Skilled Nursing Facility, Home Health, Durable Medical Equipment, Hospice Files, and Part D Drug Event Files. Claims that began before the anchor admission were excluded. A claim that extended beyond the 90-day post-discharge window was attributed to the episode according to its overlap with the episode.

To analyze the data, we used the Stata **mixed** command to estimate anchor-hospital-level random effects models of total payments in episodes with positive payment. Beneficiary characteristics were obtained from the Master Beneficiary Summary File. Linear and quadratic terms for age at time of admission were included. The RTI methodology was used to characterize race / ethnicity, according to non-Hispanic white, African American, Hispanic, and other. HCC scores were calculated using the 2010 model applied to 2011 claims. For CJR models, an indicator for fracture was included in the benchmark specification, identified using diagnosis codes.[13] We also used random effects models to address sampling variability in PAC spending share (e.g., in Figure 2); these models did not adjust for patient characteristics.

The analyses presented in the white paper exclude Part D payments. Supplemental analyses included Part D payments, and included an indicator variable for enrollment in a Part D plan. We present versions of Figures 1 and 5, with Part D included, below. The results are almost indistinguishable.



Source: Authors' calculations from CMS data.



Source: Authors' calculations from CMS data.

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