# Evaluation of the Maryland Episode Quality Improvement Program (EQIP)

## *Performance Year 1 Results*

Submitted to:
The Maryland Chesapeake Regional Information System (CRISP) and
the Maryland Health Services Cost Review Commission (HSCRC)

Submitted by:

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## Purpose and Study Objectives

The Maryland Chesapeake Regional Information System (CRISP) and the Maryland Health Services Cost Review Commission (HSCRC) commissioned Dobson DaVanzo & Associates, LLC (Dobson | DaVanzo) to review and present the results for the first performance year of the Episode Quality Improvement Program (EQIP).

The purpose of this report is to present the results from Performance Year 1 of the program, comment on the patterns of success and failures, provide a critical analysis of the methodology used to calculate the results, and recommend areas where the program can be expanded or improved.

## Executive Summary

This report examines the EQIP (Episode Quality Improvement Program) and compares its first-year performance to other successful bundled payment programs, such as Medicare's Bundled Payment Initiative (BPCI) and Comprehensive Care for Joint Replacement (CJR). We also analyze the results calculation methodology and offer recommendations for potential improvements in the program's structure.

### Key Findings:

**Comparative Performance:**

- The EQIP program's unadjusted savings rate of 5.1 percent across all episodes is consistent with the savings observed in other bundled payment initiatives, such as BPCI and CJR, which have shown savings between 1 and 5 percent.
- As with other programs, procedural episodes in EQIP (Orthopedics episodes) generated higher savings compared to medical episodes.

**Impact of Methodology on Results**

- The savings calculations for EQIP are based on target prices derived from the 2019 baseline spending adjusted for inflation using CMS market basket and a Maryland-specific inflation factor, which may introduce bias, particularly due to differences in Medicare spending growth within Maryland as compared to the national trend represented in the CMS market basket.
- The use of historical episode spending without risk adjustment may not significantly impact savings estimates but could obscure the influence of factors like sociodemographic risk. This unknown bias may be reflected in the study results.
- There is no evidence of selective participation bias in EQIP, as participating providers do not significantly differ from non-participating providers.

**Policy Recommendations**

- Update benchmarks to account for post-COVID-19 changes in care patterns and spending, considering the evolving nature of the healthcare environment.
- Conduct a formal evaluation using quasi-experimental methods to assess the "true" impact of EQIP on cost savings and care quality. Without careful propensity score analyses, program results could be impacted by unknown biases in unknown ways.

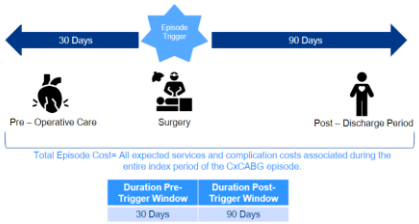
This analysis highlights the strengths of EQIP in aligning with successful bundled payment models, while also identifying key areas for refinement to enhance program effectiveness and ensure sustainable cost savings.

## Overview of EQIP Program Design

The Episode Quality Improvement Program (EQIP) is operated by Maryland's Health Services Cost Review Commission (HSCRC) as a track under the Total Cost of Care (TCOC) Model, Care Redesign Program (CRP). EQIP is a voluntary, episode-based program that engages Maryland non-hospital Medicare physicians and other practitioners in care transformation and value-based payment. The program participants are provided incentive payments that are based on both the financial performance and performance on quality metrics. Under the program, general or specialist physicians and other approved practitioners licensed and enrolled in the Medicare Provider Enrollment, Chain, and Ownership System (PECOS) are eligible to participate either individually or as a group of Care Partners. The individual physicians or other CMS-approved practitioners trigger the EQIP episodes.[1]

In Performance Year 1 (PY1), participants had the flexibility to engage in three specialty categories (Orthopedics, Cardiology, and Gastroenterology) spanning 15 different medical and surgical episodes. The episodes were constructed using the Prometheus grouper which contains a proprietary relationship methodology that combines clinical episodes in different clinical categories, but associated with each other, into the most clinically relevant category. Episodes are initiated by a "trigger event" such as an inpatient admission for a given diagnosis code or specific CPT codes from a professional claim accompanied by an ICD-10 code for a relevant diagnosis. Episode windows include a pre- and post-trigger window (around an index event) with varying durations depending on the clinical episode category. Episodes are attributed to the rendering provider on the professional claim. The grouper assigns relevant costs to each clinical episode based on episode definitions which include payments for claims with one or more relevant diagnoses or procedure codes.[2] An example episode definition for CABG is illustrated below.

Episode Length – CxCABG




Episode Triggers – CxCABG

| Trigger Group Name | Code Type | Codes |
|---|---|---|
| Coronary Artery Bypass Graft (CABG) | CPT | 33510-33536 |
| Heart Valve Repair, Outflow Reconstruction | CPT | 33400-33496<br>33860-33870 |
| Heart Valve Replacement | CPT | 33405-33413, 33430, 33465, 33475 |
| REDO CABG | CPT | 33530 |

EQIP participation involves upside-only risk for EQIP Entities. HSCRC calculates a bundled payment amount (the target price) for each selected episode by applying a national trend factor to the EQIP participant's 2019 episode spend.[3] Participants are not penalized if the expenditures are greater than the bundled payment amount; however, they are held accountable for dissavings by requiring that future savings offset any prior year dissavings. Furthermore, participants are removed from the program if

[1] A list of PY 1 EQIP participants is included in the Appendix.
[2] Information on relevant diagnoses and procedures, trigger ICD and CPT codes, episode windows and relevant costs are available in the EQIP Episode Playbook.
[3] Non-regulated payments are inflated based on CMS' Prospective Payment System (PPS)–specific market basket update factors while regulated setting payments (hospital inpatient PPS and hospital outpatient PPS for Maryland regulated hospitals) are inflated based on Health Services Cost Review Commission update factors.

they have two consecutive years of dissavings. Participants must achieve a savings threshold of 3 percent before receiving incentive payouts.

**Exhibit 1** provides a summary of the key features of the EQIP program as described throughout this section.

**Exhibit 1: Key Features of EQIP**

| | |
|---|---|
| Participation | • Voluntary participation for general and specialist physicians<br>• Entities must meet minimum episode volumes to be eligible* |
| Spending Targets | • Based on same entities 2019 data trended forward using CMS PPS market basket and HSCRC update factors |
| Risk Adjustment | • No risk adjustment |
| Episodes | • Performance Year 1 included 15 Prometheus clinical episode categories across three clinical specialty categories: Orthopedics, Cardiology, and Gastroenterology |
| Risk Sharing | • Upside only risk<br>• Entities held accountable for dissavings by requirement to offset dissavings with future savings and program removal following two consecutive years of dissavings<br>• Participants must attain a minimum savings threshold of 3 percent before receiving shared savings |
| Shared Savings | • Portion of savings earned by entity is tiered based on historical performance on specific clinical episodes across the entire state<br>• Additional incentive payments based on performance on 3 quality measures |

* To be eligible to participate in EQIP, the entity must be attributed 11 or more clinical episodes within each clinical episode category OR 50 or more episodes across all clinical episode categories in which they elect and are eligible to participate.

## Analytic Methodology

### Data and study period

We obtained data on EQIP participating entities from HSCRC. The Performance Year 1 period spanned January 1, 2022 to December 31, 2022 and comprised a baseline period from January 1, 2019 to December 31, 2019.

### Analytic Methodology

HSCRC calculated program savings by comparing the participating entity's performance year spending to target prices set by the program based on the same entity's 2019 historical spend. To calculate savings, the EQIP Entity's total episode costs during the PY (across all clinical episodes and categories) was compared to the EQIP Entity's aggregated target price (ATP), calculated as follows:

**Step 1: Calculate the Episode Target Price.** The target price for each EQIP Entity is calculated at the clinical episode category level and determined by dividing the total relevant episode costs for each clinical episode attributed to the EQIP Entity during the baseline period by the number of episodes.

$$\textit{Episode Target Price}_{\textit{Category}} = \frac{\textit{Total Episode Costs at Baseline}}{\textit{Number of Episodes at Baseline}}$$

**Step 2: Calculate the Aggregate Target Price (ATP)**. Each entity's ATP is obtained by multiplying the EQIP Entity's final episode target price by the number of clinical episodes attributed to the entity during the PY.

*Aggregate Target Price = Sum (Episode Target Price* $_{\textit{Category}}$ **x** *Volume of Episodes in PY* $_{\textit{Category}}$*)*

**Step 3: Determine Performance Year Costs**. The performance year costs are measured by taking the sum of the performance year costs for all clinical episodes calculated across all clinical episode categories in which the EQIP Entity participates.

*Performance Year Costs = Sum (Episode Costs for all Episodes in Performance Year)* [Without any risk adjustment]

**Step 4: Determine Performance Year Savings**. Performance year savings are determined by subtracting performance year costs (from step 3) from the ATP (from step 2)

*Performance Year Savings = Performance Year Costs - Aggregate Target Price*

**Step 5: Compare ATP to the Performance Year Costs.** The EQIP Entity's performance year savings (3) must meet or exceed three percent of its ATP (i.e., the ATP multiplied by .03) before it is eligible to receive incentive payments.

There was no comparison group or other risk adjustment for this analysis.

Dobson | DaVanzo obtained both baseline and PY 1 data from HMetrix and replicated the methodology that HSCRC used to derive program savings. Results obtained were similar except that there were differences in

the data used for the baseline year corresponding to PY 1 as the update factors are applied in real time. Specifically, at the start of the performance year (Jan 2022) the team applies the inflation as of that date, however the HSCRC continues to provide update factors for each period based on the actual Maryland policy for that time window. The team does not go back and apply the new inflation factors to prior periods.

## Results

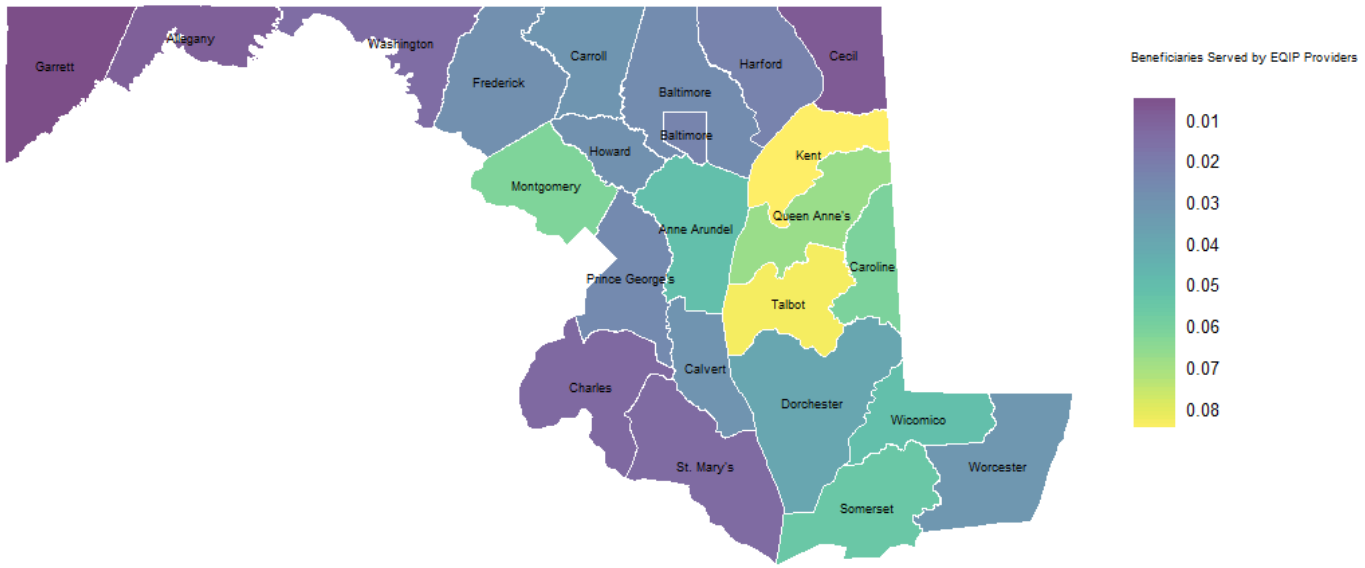
### Participant Characteristics

50 total entities enrolled in EQIP in Performance Year 1. 20 entities participated in cardiology episodes, 17 in gastroenterology, and 25 in orthopedics episodes. While the most selected episode for participation were orthopedics episodes, gastroenterology episodes represented the largest share by volume. Additionally, 28 percent (14) of entities participated in one episode type, 34 percent (17 entities) participated in two types of episodes, and 38 percent (19 entities) participated in three or more types of episodes.

**Appendix Table 1** lists the PY 1 EQIP entities including the number of PY 1 episodes, and the number of Care Partners. PY 1 Entities were mostly group practices with a varied range of care partners. The largest entity had 998 care partners while the smallest entity included one care partner.

During PY1, EQIP entities served a wide range of beneficiaries located across all Maryland counties. **Exhibit 2** shows the number of beneficiaries served in each county as a proportion of the number of eligible FFS beneficiaries. The largest proportion of beneficiaries were located in centrally located counties.

**Exhibit 2: Proportion of FFS Beneficiaries Served by EQIP Providers by County**



### Overall Savings Generated

In PY1, total episode spend across all EQIP entities was $400 million, and the aggregate baseline spending was approximately $385 million. Out of a total of 50 entities, 19 EQIP entities (or 38 percent) earned savings. Across those entities that showed positive savings, the EQIP program saved approximately $682 per episode or a total of $20 million (5.1 percent of total program costs or 7.7 percent of costs for entities showing positive savings).[4]

Despite the fact that 62 percent of PY1 entities experiencing dissavings, the program is designed such that entities are required to offset dissavings with future savings or are removed following two consecutive years of dissavings. These results are shown in **Exhibit 3**.

**Exhibit 3: Performance Year 1 Results by Clinical Episode Category**

| Clinical Episode Categories | Number of EQIP Entities | Volume of PY 1 Episodes | Aggregate Target Price (ATP) | PY 1 Episode Payments | Total Savings/ Dissavings | Savings Per Episode |
|---|---|---|---|---|---|---|
| All Entities | 50 | 37,758 | $397,464,832 | $385,701,806 | $11,763,026 | |
| Entities with Positive Savings | 19 | 29,557 | $260,925,858 | $240,774,722 | $20,151,136 | $682 |

### Distribution of Savings by Episode Category

As shown in **Exhibit 4**, the orthopedics episode category represented the largest share of episodes by percent of baseline spending and appeared to generate the largest savings when compared to cardiology and gastroenterology episodes.[5] On average, providers saved $1,419 or 5.9 percent for orthopedic episodes, as compared to a dissavings of -$105 (or -0.3 percent) for Cardiology episodes, and -$35 (or -1.8 percent) for Gastroenterology episodes.

Episode categories with higher volumes tended to result in higher average savings observed compared to those with lower volumes. As shown below, all episodes with a volume higher than 690 generated positive savings.

**Exhibit 4: Distribution of Savings by Clinical Episode Category**

| Episode Name | Number of Episodes | Percent of Baseline Spend | Savings Rate | Average Savings Per Episode |
|---|---|---|---|---|
| Acute Myocardial Infarction | 503 | 3.7% | -1.7% | -$529 |
| CABG &/or Valve Procedures | 652 | 10.8% | -4.6% | -$3,006 |
| Coronary Angioplasty | 1,165 | 8.0% | 1.0% | $267 |
| Pacemaker / Defibrillator | 1,264 | 9.8% | 3.9% | $1,216 |
| **Total Cardiology** | **3,584** | **32.3%** | **-0.3%** | **-$105** |
| | | | | |
| Colonoscopy | 15,851 | 4.5% | 1.8% | $20 |

[4] Savings rate computed for only participants that generated savings as this is an upside only model. 3 percent minimum savings rate not considered in this scenario as results shown only account for those that generated savings.
[5] Note that in this report, positive values represent savings while negative values denote dissavings.

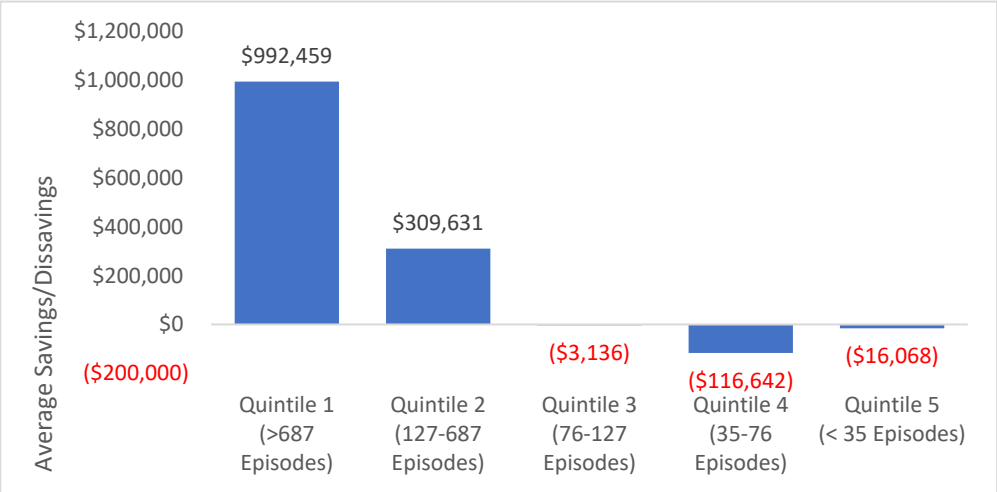
| | | | | |
|---|---|---|---|---|
| Colorectal Resection | 276 | 2.4% | -13.2% | -$4,532 |
| Gall Bladder Surgery | 460 | 1.8% | -6.3% | -$961 |
| Upper GI Endoscopy | 8,438 | 3.5% | 3.6% | $59 |
| **Total Gastroenterology** | **25,025** | **12.2%** | **-1.8%** | **-$35** |
| | | | | |
| Hip Replacement & Hip Revision | 2,139 | 12.2% | 7.9% | $1,784 |
| Hip/Pelvic Fracture | 675 | 5.8% | -8.6% | -$2,935 |
| Knee Arthroscopy | 691 | 0.7% | 8.5% | $322 |
| Knee Replacement & Knee Revision | 3,840 | 21.6% | 9.4% | $2,105 |
| Lumbar Laminectomy | 472 | 1.7% | 0.6% | $88 |
| Lumbar Spine Fusion | 794 | 10.4% | 8.9% | $4,642 |
| Shoulder Replacement | 538 | 3.2% | -6.9% | -$1,647 |
| **Total Orthopedics** | **9,149** | **55.5%** | **5.9%** | **$1,419** |

### Distribution of Savings by Entity Size

In this analysis, average savings were compared by practices grouped according to quintiles of the volume of episodes. Each quintile included 10 practices. As shown in **Exhibit 5,** practices with a higher volume of episodes (Quintile 1 and 2) were more likely to achieve positive savings compared to practices with lower volume of episodes that were less likely to generate positive savings (Quintile 4, and 5).

On average, the top quintile in terms of volume (Quintile 1) saved approximately $992 million, while the lower quintiles (Quintile 4, and 5) had dissavings of $116 million and $16 million respectively. We observed significant variation in the savings/dissavings generated among practices in all quartiles with practices in the lowest quintile having the widest range in savings rate. For instance, Quintile 5 practices had savings/dissavings that ranged between +29 percent ($538 million in savings) to -22 percent (-$516 million in dissavings). The results are shown in **Exhibit 5** below.

**Exhibit 5: Average Savings by Volume of Episodes**



## Post-Acute Care Utilization

**Exhibit 6** and **7** below show the discharge destination of beneficiaries following a hospitalization for participating Entities in the baseline year compared to PY1. The results show that in PY1 beneficiaries tended to use less SNF care, use slightly more home health and returned to the community (home) more often.

These trends were consistent by clinical episode category with orthopedics episodes experiencing the largest increases in discharges to the community and home health and the largest decreases in discharges to SNFs. This suggests that orthopedics episodes were able to generate positive savings likely because of the reduction in costly post-acute care use (SNF use reduced by half) and increased use of home health or discharge of patients to the community.

**Exhibit 6: Proportion of Episodes by First Post-Acute Care Setting, overall**

| | Community | Home Health | Hospice | Inpatient Hospital | Skilled Nursing Facility (SNF) |
|---|---|---|---|---|---|
| **Baseline** | 82.5% | 11.2% | 0.0% | 1.2% | 5.1% |
| **PY 1** | 85.7% | 11.3% | 0.0% | 1.1% | 2.0% |

**Exhibit 7: Proportion of Episodes by First Post-Acute Care Setting, by Clinical Episode Category**

| | Baseline | | | PY 1 | | |
|---|---|---|---|---|---|---|
| | Cardiology | Gastroenterology | Orthopedics | Cardiology | Gastroenterology | Orthopedics |
| **Community** | 73.3% | 99.0% | 50.0% | 73.3% | 98.9% | 54.2% |
| **Home Health** | 15.3% | 0.8% | 32.3% | 18.3% | 1.0% | 36.8% |
| **Hospice** | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Inpatient Hospital** | 3.6% | 0.0% | 2.8% | 4.1% | 0.0% | 2.7% |
| **Skilled Nursing Facility** | 7.7% | 0.2% | 14.8% | 4.3% | 0.1% | 6.3% |

## Discussion

In this section, we discuss the aspects of the EQIP program that are similar to successful bundled payment programs, comment on whether/how the results calculation methodology implemented by the state may have biased the findings and recommend areas where the EQIP program could be expanded/refined/improved.

We note that while we scanned the literature for any type of bundled payment initiative including private payer programs, the most relevant programs for comparison were Medicare's Bundled Payment Initiative (BPCI) and Comprehensive Care for Joint Replacement (CJR).

### Overview of Other Medicare Bundled Payment Initiatives

#### BPCI

BPCI offers four different voluntary Medicare bundled payment models, numbered 1-4. Each model includes a different set of services for an episode of care. All episodes in BPCI models are triggered by a hospitalization. In models 1-3, CMS reconciles participants' spending against the "target price" after the episode of care, and in Model 4, CMS makes a prospective payment based on the "target price." Starting in 2018, Center for Medicare and Medicare Innovation (CMMI) began offering "BPCI Advanced," which includes additional outpatient clinical episodes, as well as refinements to the target price methodology. BPCI Advanced episodes are triggered either by a hospitalization or an outpatient hospital procedure.

#### CJR

The CJR model effectively bundles payment for lower extremity joint (hip and/or knee) replacement episodes across all inpatient hospital services, physician services, post-acute care services, and any readmissions or other related services up to 90 days after the initial hospital discharge. Participants gain financially if actual expenditures for an episode (determined retrospectively) are below the "target price." Originally, the CJR model was mandatory for hospitals in 67 geographic areas, but CMS recently reduced the number of mandatory areas to 34, allowing voluntary participation among hospitals in the remaining 33 areas. Voluntary participation is also allowed for small and/or rural hospitals in all 67 areas.

### 1. How do results from the EQIP program PY1 map to other successful bundled payment program results?

***EQIP savings rate of 5 percent comparable to savings from other programs***

Results from the formal evaluations of CMS' bundled payment initiatives have shown varying degrees of savings across different clinical episodes and different initiatives, with overall cost savings ranging from 3 to 5 percent.[6] For example, hospitals under BPCI Model 2 showed 3.1 percent in savings, while physician

[6] https://www.cms.gov/priorities/innovation/data-and-reports/2022/wp-eval-synthesis-21models#page=0.35

group practices achieved 4.9 percent savings. By type of episode, hospitals and Physician Group Practices (PGPs) in BPCI-Advanced demonstrated savings of 2.1 and 2.0 percent savings respectively for medical episodes and 4.1 and 4.7 percent for surgical episodes—analysis of EQIP PY 1 showed a 5.9 percent savings rate for orthopedic surgical episodes. [7] Another 2020 study showed that overall BPCI per-episode spending decreased by 1.6% over three years, with savings limited to hospitals that entered the program early (before July 2015).[8]

Additional comparisons of savings by episode type are included in **Table 2** in the appendix. As shown in the appendix table, an analysis covering the first two years of CJR showed that per episode spending was reduced by 5 percent. Results for cardiac episodes were mixed with one study not finding any cost savings.[9] We did not find any results on cost-savings specific to gastroenterology episodes.

It is important to note though that some researchers have suggested that the size of the targeted spending reductions appear to drive the reduction in spending observed. In a study, authors showed that when discounts were larger than 5 percent[10], higher savings were generated, and when discounts were less than 5 percent, as in the BPCI models and CJR, savings were lower.[11]

***Consistent with other studies on bundled payment programs, procedural (surgical) episodes are more likely to generate savings***

Evaluations of Bundled Payment for Care Improvement (BPCI), which bundles provider payments for up to 48 medical conditions and procedures, suggest that the model is more effective when applied to surgical procedures, rather than medical conditions. In EQIP, the orthopedic episodes generated the largest positive savings on average.

Under BPCI Model 2 – the program with the most participation – participating providers most commonly opted to participate in hip and knee replacement episodes.[12] Studies show that BPCI participation reduced hospitals' per-episode costs of care without affecting mortality, readmissions, or related emergency department visits for orthopedic surgeries and lower extremity joint replacement (LEJR) episodes but not spinal fusion procedures,[13,14,15] revision joint arthroplasty,[16] or medical

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[7] CMS. (2022) Synthesis of Evaluation Results across 21 Medicare Models, 2012-2020. https://www.cms.gov/priorities/innovation/data-and-reports/2022/wp-eval-synthesis-21models.

[8] Navathe, A. S., Emanuel, E. J., Venkataramani, A. S., Huang, Q., Gupta, A., Dinh, C. T., ... & Liao, J. M. (2020). Spending And Quality After Three Years Of Medicare's Voluntary Bundled Payment For Joint Replacement Surgery: The spending and quality effects of Medicare's Bundled Payments for Care Improvement initiative among patients undergoing lower extremity joint-replacement. Health Affairs, 39(1), 58-66.

[9] Shashikumar, S. A., Zheng, J., Orav, E. J., Epstein, A. M., & Joynt Maddox, K. E. (2023). Changes in cardiovascular spending, care utilization, and clinical outcomes associated with participation in Bundled Payments for Care Improvement–Advanced. Circulation, 148(14), 1074-1083.

[10] In these programs, CMS applies a percent discount (e.g., 3 percent) to the Benchmark Price to calculate the Target Price for each Clinical Episode category.

[11] Yee, C. A., Pizer, S. D., & Frakt, A. (2020). Medicare's Bundled Payment Initiatives for Hospital-Initiated Episodes: Evidence and Evolution. The Milbank Quarterly, 98(3), 908-974.

[12] Dummit, L., et al. (2018). CMS Bundled Payments for Care Improvement Initiative Models 2–4: Year 5 Evaluation & Monitoring Annual Report. Lewin Group. https://downloads.cms.gov/files/cmmi/bpci-models2-4-yr5evalrpt.pdf.

[13] Bronson, W. H., Kingery, M. T., Hutzler, L., Karia, R., Errico, T., Bosco, J. A., et al. (2019). Lack of cost savings for lumbar spine fusions after Bundled Payments for Care Improvement initiative: A consequence of increased case complexity. Spine (Phila Pa 1976), 44(4), 298–304. https://doi.org/10.1097/BRS.0000000000002827.

[14] Jubelt, L. E., Goldfeld, K. S., Blecker, S. B., Chung, W. Y., Bendo, J. A., Bosco, J. A., et al. (2017). Early lessons on bundled payment at an academic medical center. Journal of the American Academy of Orthopaedic Surgeons, 25(9), 654–663. https://doi.org/10.5435/JAAOS-D-16-00279.

[15] Martin, B. I., Lurie, J. D., Farrokhi, F. R., McGuire, K. J., & Mirza, S. K. (2018). Early effects of medicare's bundled payment for care improvement program for lumbar fusion. Spine, 43(10), 705-711.

[16] Courtney, P. M., Ashley, B. S., Hume, E. L., & Kamath, A. F. (2016). Are bundled payments a viable reimbursement model for revision total joint arthroplasty?. *Clinical Orthopaedics and Related Research®*, *474*, 2714-2721.

conditions.[17,18] A 2018 study of five common conditions, congestive heart failure, pneumonia, chronic obstructive pulmonary disease, sepsis and acute myocardial infarction (a.k.a., heart attack), BPCI study found no significant changes in cost or quality between participating hospitals and a control group.[19] Studies of the Comprehensive Care for Joint Replacement (CJR) model, which bundles payments for hip and knee replacements, have documented reductions in per-episode spending with no effect on healthcare quality, although payment reductions were smaller than those observed under BPCI.[20,21]

The lack of savings for medical episodes is particularly significant among physician group practices. According to another study, physician group practices participating in bundled payments had associated savings with surgical but not medical episodes, whereas participating hospitals had savings associated with both episode types.[22]

However, in a recent study, hospital participation in Medicare's bundled payments for four medical conditions was associated with a 1-2 percent savings over three years. This suggests that it may take some time to achieve savings from bundling medical conditions. Compared to the first year of participation, the magnitude of savings was larger during the second and third years, suggesting that as hospitals gain experience in the medical bundle, they tend to increase savings.[23]

**As in EQIP, larger entities and those with higher baseline spending are more likely to generate savings.**

Under CJR, hospitals that achieved savings tended to be larger, with a higher volume of procedures, were more likely to be a nonprofit or teaching hospital and were more likely to be integrated with post-acute care facilities. In a study, authors investigated the characteristics of hospitals that achieved savings compared to those that did not under CJR. Results from the study showed that hospitals that generated savings were more likely to be large hospitals with more than 400 beds (24.0 percent vs. 14.9 percent) and provided a larger volume of Medicare procedures (6,242 vs. 4,362) during the prior year, with more joint-replacement procedures (217 vs. 133).[24]

**Savings likely due to reductions in post-acute care costs**

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[17] Glickman, A., Dinh, C., & Navathe, A. S. (2018). The current state of evidence on bundled payments. LDI issue brief, 22(3), 1-5.
[18] A 2019 study conducted by the Lewin Group assessed BPCI Model 2's impact on Medicare beneficiaries with one or more of the following "vulnerabilities:" dementia, dually eligible for Medicare and Medicaid and/or recently received institutional care. Researchers found that BPCI participation did not affect quality of care (in 12 types of clinical episodes) for these vulnerable populations. See: Maughan, Brandon C., et al., "Medicare's Bundled Payments For Care Improvement Initiative Maintained Quality Of Care For Vulnerable Patients," *Health Affairs*, Vol. 38, No. 4 (April 2019).
[19] Lown Institute (Sept. 6, 2018). See also: Joynt Maddox, K. E., Orav, E. J., Zheng, J., & Epstein, A. M. (2018). Evaluation of Medicare's bundled payments initiative for medical conditions. New England Journal of Medicine, 379(3), 260-269.
[20] Glickman, A., Dinh, C., & Navathe, A. S. (2018). The current state of evidence on bundled payments. LDI issue brief, 22(3), 1-5.
[21] Finkelstein, A., Ji, Y., Mahoney, N., & Skinner, J. (2018). Mandatory Medicare bundled payment program for lower extremity joint replacement and discharge to institutional postacute care: interim analysis of the first year of a 5-year randomized trial. Jama, 320(9), 892-900.
[22] Liao, J. M., Huang, Q., Wang, E., Linn, K., Shirk, T., Zhu, J., ... & Navathe, A. S. (2022, December). Performance of physician groups and hospitals participating in bundled payments among Medicare beneficiaries. In JAMA Health Forum (Vol. 3, No. 12, pp. e224889-e224889). American Medical Association.
[23] Rolnick, J. A., Liao, J. M., Emanuel, E. J., Huang, Q., Ma, X., Shan, E. Z., ... & Navathe, A. S. (2020). Spending and quality after three years of Medicare's bundled payments for medical conditions: quasi-experimental difference-in-differences study. bmj, 369.
[24] Navathe, A. S., Liao, J. M., Shah, Y., Lyon, Z., Chatterjee, P., Polsky, D., & Emanuel, E. J. (2018). Characteristics of hospitals earning savings in the first year of mandatory bundled payment for hip and knee surgery. Jama, 319(9), 930-932.

One study found that approximately half of hospitals' savings stemmed from changes in the utilization of post-acute care.[25] Similarly, in CJR, results suggest that spending reductions are in part driven by reduced utilization of nursing home care that often follow a joint replacement surgery. Authors of a 2020 study found that after CJR participation, the percentage of patients discharged to a nursing home declined by 2 percentage points and the percentage discharged with home health services increased by 3 percentage points.

Similarly, initial results from analysis of PY 1 utilization compared to Baseline utilization show that in PY1 beneficiaries tended to use less SNF care, use slightly more home health and returned home more often, especially for the orthopedics episodes that generated the highest savings.

### 2. How might the analytic methodology for calculating the results impact the findings?

***Savings calculated using target prices may be subject to bias.***
The HSCRC calculated EQIP PY1 program savings by comparing each entity's actual spending by episode to specific targets derived from the entity's baseline (2019) spending, trended forward by the CMS market basket for the respective PPS' and a Maryland specific-updated for regulated settings such as inpatient. That is, the chosen analytic methodology compares the entity's performance to its own past performance, rather than to a comparison group of non-participants.

This analytic choice could overstate or understate the actual savings from the program as it may not account for selective participation into the program, due to its voluntary nature, and the geographic variation in Medicare spending growth. In this case, comparing spending to the target price favors the entities in the program if health care spending in their local region grew slower than the national average. Similarly, EQIP entities in low-spending growth rate areas could achieve savings if they maintain the trend in their spending, as the growth in target price will outpace the actual spending growth. In Maryland, Medicare spending grew at a compound annual growth rate of 1.8 percent between 2018 and 2022[26], while the growth rate used to trend forward the target prices from 2019 to 2022 was 3 percent.

To evaluate the actual impact of programs such as EQIP, researchers typically apply quasi-experimental methods, such as differences-in-differences analyses that compare the spending of program participants pre- and post-implementation of the program to a comparison group of non-participants adjusted by propensity scores. The comparison group serves as a more accurate counterfactual by providing an estimate of what spending would have been in the absence of the program. The issue of methodologic choice is prominent in evaluations of the impact of the Medicare Shared Savings Program (MSSP) Accountable Care Organizations (ACOs), where researchers have found inconsistent results depending

[25] Glickman, A., Dinh, C., & Navathe, A. S. (2018). The current state of evidence on bundled payments. LDI issue brief, 22(3), 1-5.
[26] CAGR calculated using data on total Medicare payments for the state of Maryland from 2018 to 2022 obtained from CMS' Medicare Geographic Variation - by National, State & County, available at: https://data.cms.gov/summary-statistics-on-use-and-payments/medicare-geographic-comparisons/medicare-geographic-variation-by-national-state-county.

on the choice of the counterfactual. In the first few years of the program, calculations comparing spending to benchmarks underestimated actual savings and more recently, they have overstated savings because of selective participation.[27,28,29] Other analyses based on quasi-experimental methodology, including a Dobson | DaVanzo study showed moderate savings from ACO programs.[30,31]

Further, analyses of BPCI using a difference-in-differences analysis showed that the program resulted in lower spending reductions. That is, calculations using benchmarks showed that spending reductions were larger than spending reductions estimated by differences-in-differences methodology in the evaluation.[32]

***Lack of risk adjustment is less likely to impact savings given the use of historical episode spend for the same entity to calculate target price.***

The purpose of risk adjustment is to modify payment levels to account for differences in the severity of illness or medical complexity of the different patient populations served by participating providers. In the absence of adequate case mix adjustment and in voluntary programs, providers may select against the sickest patients to avoid being held accountable for their more expensive care. On the other hand, if the bundled payment amount is significantly higher for patients who are sicker or more complex, providers may try to code patients as being sicker. By design, target prices in the EQIP program are not risk adjusted. The choice against risk adjustment was informed by analysis that tested the impact of risk adjustment of episode costs using two hierarchical condition category (HCC) score and the All Patient Refined Diagnosis Related Group Severity of Illness (APR-DRG-SOI) weight (i.e., "APR-DRG weight"). The results showed that controlling HCC scores and demographic information had a limited effect on the percent error of estimates – meaning that risk adjustment did not meaningfully impact program savings estimates.

In the literature, a study by the Institute for Healthcare Policy and Innovation (University of Michigan, Ann Arbor) analyzed the impact of CMS-HCC risk adjustment on estimated CJR reconciliation payments under two scenarios: 1) when historical hospital-specific episode spending is used to calculate the target price, and 2) when historical regional episode spending is used to calculate the target price. They identified no significant association between reconciliation payments and CMS-HCC risk scores when target episode prices were set using hospital historical spending. However, when regional episode spending was used to calculate benchmarks, the authors "…found that risk adjustment consistently reduced reconciliation payments to hospitals with the lowest CMS-HCC risk scores, and consistently increased reconciliation payments to hospitals with the highest risk scores." Consequently,

[27] McWilliams, J. M. (2016). Savings from ACOs—building on early success. Annals of internal medicine, 165(12), 873-875.
[28] Chernew, M. E., Barbey, C., & McWilliams, J. M. (2017). Savings reported by CMS do not measure true ACO savings. Health Affairs Forefront.
[29] Kaiser Family Foundation. (2015, December 4). Are Medicare acos working? experts disagree. KFF Health News. https://kffhealthnews.org/news/are-medicare-acos-working-experts-disagree/.
[30] Nyweide, D. J., Lee, W., Cuerdon, T. T., Pham, H. H., Cox, M., Rajkumar, R., & Conway, P. H. (2015). Association of Pioneer Accountable Care Organizations vs traditional Medicare fee for service with spending, utilization, and patient experience. *Jama*, *313*(21), 2152-2161.
[31] McWilliams, J. M., Hatfield, L. A., Landon, B. E., Hamed, P., & Chernew, M. E. (2018). Medicare spending after 3 years of the Medicare Shared Savings Program. *New England Journal of Medicine*, *379*(12), 1139-1149.
[32] Lewing Group (2021). CMS Bundled Payments for Care Improvement Initiative Models 2 4: Year 7 Evaluation & Monitoring Annual Report. https://www.cms.gov/priorities/innovation/data-and-reports/2021/bpci-models2-4-yr7evalrpt.

risk adjustment may not be necessary if the target prices are set based on historical episode spend for the same providers rather than regional benchmarks, as in the case of the EQIP program.[33]

One limitation to the traditional clinical risk adjustment methodologies investigated above, is that those models do not account for sociodemographic risk factors (such as race/ethnicity, income). It is possible that patients with social risk factors may require more intensive care and greater costs to overcome barriers they face to achieve the same health outcomes as patients with fewer risks. Evidence from the CJR model implementation shows that traditional risk-adjustment models do not fully account for social determinants of health (SDOH) and is associated with modest worsening of racial/ethnic and socioeconomic disparities in total knee replacement use.[34] Specifically, results showed a decline in total knee replacement procedures for non-Hispanic Black beneficiaries and a widening gap in use for dually eligible patients compared to non-dually eligible patients.

***No indication of selective participation resulting from voluntary nature of EQIP***

Voluntary participation is a major feature of several healthcare reform initiatives, as allowing choice can enhance program participation. However, if selection occurs (i.e., participating providers are different from non-participating providers), this could bias program evaluation results. For example, studies have shown that compared to non-participants, BPCI Model participants have been more likely to be located in urban areas, to be larger both in terms of the number of beds and patient volume, and to have shorter lengths of stay. In contrast, mandatory initiatives, such as CJR, may be less susceptible to selection bias due to random assignment of participation. However, mandatory participation is not always achievable depending on the goals of the program, and it may be disadvantageous to providers that may not be prepared to participate. Further, if the characteristics of voluntary and mandatory participating providers are not significantly different, then mandatory bundles may be unnecessary. However, we note that this cannot be predicted until the program is initiated, and the risk of selective participation is evaluated.

The EQIP program is voluntary. Therefore, providers can choose whether or not to participate in the program. Our analysis of baseline data suggests that participating providers were not different in important ways from non-participants. EQIP participating providers tended to serve a slightly younger beneficiary population with a higher proportion of white beneficiaries as compared to non-participating providers. EQIP participating providers also appeared to serve a lower proportion of dually eligible beneficiaries and beneficiaries that are less socioeconomically disadvantaged (beneficiaries with lower average Area Deprivation Index) as compared to non-participating providers. However, there were no significant differences in the risk profile of beneficiaries served by EQIP participating providers as compared to their non-participating counterparts. While EQIP participating providers tended to have lower readmission rates in 2019, they also tended to have higher mortality rates during the same year. The contradictory results in

[33] Ellimoottil, C., Ryan, A. M., Hou, H., Dupree, J., Hallstrom, B., & Miller, D. C. (2016). Medicare's New Bundled Payment For Joint Replacement May Penalize Hospitals That Treat Medically Complex Patients. *Health affairs (Project Hope), 35*(9), 1651–1657. https://doi.org/10.1377/hlthaff.2016.0263.

[34] Thirukumaran, C. P., Kim, Y., Cai, X., Ricciardi, B. F., Li, Y., Fiscella, K. A., ... & Glance, L. G. (2021). Association of the comprehensive care for joint replacement model with disparities in the use of total hip and total knee replacement. JAMA network open, 4(5), e2111858-e2111858.

our analysis of the risk profile of beneficiaries suggest that there is no measurable difference between the beneficiaries served by EQIP participating and non-participating providers.

Beneficiaries receiving care from EQIP participating providers tended to have higher Home Health and SNF utilization as compared to non-participating providers. However, when examining the PAC settings by episode type, it becomes clear that the episode analyzed has a significant difference on where a patient is discharged. Strikingly, beneficiaries receiving care from EQIP providers tended to have more baseline E/M and physician events, indicating increased access to providers. Episode type seems not to have contributed to significant differences within this analysis although trends among individual episode types sometimes countered those experienced by the general population.

Participating providers were also significantly more likely to be smaller in size and practice in urban areas. A detailed description and discussion of these results can be found in the baseline analysis report. As a result, we expect the voluntary nature of the program had minimal impact on the program evaluation results. Although we note that unknown bias could still exist.

***Using 2019 data to calculate the target price, may not accurately reflect the case-mix increases and spend post-COVID-19 PHE***

Setting the spending targets in any bundled payment program is challenging as provider spending is susceptible to regression to the mean, where hospital spending that is unusually high in a particular year is likely to decrease in the following years, and hospital spending that is unusually low in a particular year is likely to increase in the following years. This means that random statistical noise can mask a provider's actual performance. Although historical benchmarks can limit patient selection effects, if the baseline period is not updated over time, less efficient providers during the baseline period could produce more favorable outcomes with more opportunities to earn shared savings giving those providers an advantage over more efficient competitors. In contrast, if the baseline period is updated, participating providers face a ratchet effect that makes them compete against their own success in the prior year.

In EQIP, target prices are currently calculated using 2019 data. This is of particular concern because the further away the performance year is from the 2019 baseline, the more likely it is for the baseline data to be inaccurate. With 2019 as the baseline specifically, the COVID-19 pandemic may have also changed care patterns and had an impact on case mix as patients that delayed care during the pandemic may be sicker. It is unclear whether the 2019 baseline is an accurate representation of spending in current and future performance years.

## Policy Recommendations

While initial results from the analysis of EQIP's first performance year appear promising, below we share recommendations on how the analytic methodology might be redefined and improve estimate of program performance.

Given that the 2019 historical baseline may become unreliable in future performance years, we recommend that CRISP/HSCRC consider updating the benchmarks to later years but apply adjustments to account for savings. In the Medicare Share Savings Program (MSSP) for example, CMS adjusts benchmarks to account

for prior savings, helping to mitigate decrease of an ACO's benchmark over time by returning an amount to its benchmark that reflects its success in lowering growth in expenditures from the previous agreement period. Specifically, CMS calculates a prior savings per capita value by averaging the per capita savings or losses of an ACO over the three performance years (benchmark years) before the start of its current agreement period. CMS then adds 50% of the prior savings per capita to the benchmark but limits any positive adjustments to the higher of the prior savings adjustment or the ACO's positive regional adjustment.[35]

We also recommend that a formal evaluation is conducted to isolate the "true" magnitude of cost savings, understand the drivers of cost reduction, and assess the impacts of the program on key quality of care metrics. As discussed above, results comparing the performance year costs to the target historical spend may be biased and do not paint a "true" picture of program results. There is sufficient data available from the program to conduct such an assessment using rigorous econometric methodologies such as a differences-in-differences approach or propensity score regressions methods. Propensity score methods, for example, can account for measured confounding factors and by using a rich set of covariates, allow for observational studies to be designed to approximate the results of randomized experiments.[36]

[35] Baker Donelson. (2022). CMS revises Medicare Shared Savings Program's performance benchmarking methodology to encourage continued participation by current accountable care organizations. https://www.bakerdonelson.com/cms-revises-medicare-shared-savings-programs-performance-benchmarking-methodology-to-encourage-continued-participation-by-current-accountable-care-organizations

[36] Rosenbaum, P., & Rubin, D. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika,* 70(1), 41-55.

## APPENDIX

### Table 1: EQIP Program Participants in PY 1 by Entity, Number of Episodes and Providers

| EQIP Entity | Number of Episodes | Number of Care Partners (Count of NPIs) |
|---|---|---|
| UMOA | 12 | 998 |
| The Centers for Advanced Orthopedics | 6 | 216 |
| Luminis Health CCN | 3 | 138 |
| USACS Mid Atlantic | 2 | 133 |
| Capital Digestive Care, LLC | 2 | 59 |
| LifeBridge Health | 15 | 43 |
| One Health Quality Alliance - Orthopedics | 7 | 38 |
| Gastroenterology/Colo_Endo | 2 | 22 |
| Shore Medical Group | 9 | 20 |
| One Health Quality Alliance - Cardiology/CV Surgery | 4 | 18 |
| TidalHealth Cardiology | 8 | 17 |
| Ascension Saint Agnes Hospital | 9 | 16 |
| Ortho/Hip Fx | 1 | 15 |
| Gen Surg/Gallbladder | 1 | 15 |
| Peninsula Orthopedic Associates EQIP | 5 | 14 |
| Frederick Health Medical Group PY1 | 4 | 14 |
| Capitol Cardiology Associates PA | 2 | 14 |
| Anne Arundel Gastroenterology Associates | 2 | 13 |
| Bethesda Chevy Chase Orthopedic Associates, LLC | 7 | 13 |
| Cardiology/Pacemaker/JHUSOM | 1 | 13 |
| Ortho/THA_TKA | 2 | 11 |
| Ortho/LL_LF | 2 | 11 |
| Cardiology/PCI/JHUSOM | 1 | 9 |
| Padder Health Services, LLC | 2 | 8 |
| University of Maryland Baltimore Washington Medical Center | 3 | 8 |
| MBSP | 2 | 8 |
| Mid Atlantic Surgical Group | 3 | 7 |
| Gen Surg/Colorectal | 1 | 7 |
| Greater Baltimore Medical Center GI | 4 | 7 |
| Greater Baltimore Medical Center - Ortho | 5 | 6 |
| SJMC Total Joint Entity | 2 | 6 |
| Associates in Cardiology | 1 | 5 |
| Peninsula Surgical Group | 4 | 5 |
| SJMc General Surgery Entity | 1 | 5 |
| Tidal Health Specialty | 3 | 5 |
| Neurosurgery/LL_LF | 2 | 5 |
| Ortho/TSA | 1 | 5 |
| One Health Quality Alliance - General Surgery | 3 | 4 |
| Mercy Medical Center | 2 | 4 |
| UM Upper Chesapeake Health System | 2 | 4 |
| SJMC OHS Entity | 2 | 3 |
| Cardiology/CABG/JHH | 1 | 3 |
| Cardiology/Pacemaker/JHCP | 1 | 3 |

| | | |
|---|---|---|
| MCRS | 2 | 3 |
| SJMC Total Shoulder Entity | 1 | 2 |
| SJMC Spine Entity | 2 | 2 |
| Cardiology/CABG/Suburban | 1 | 2 |
| Shumile Zaidi | 2 | 1 |
| Cardiology/Pacemaker/JHRP | 1 | 1 |
| Cardiology/Mitral Valve Surgery | 1 | 1 |

## Table 2: Comparison of EQIP Results to Other Bundled Payment Programs

| Episodes | Existence in other Bundled Payment Models | Episode Definitions in other Bundled Payment Models | Cost-Savings |
|---|---|---|---|
| **Cardiology**<br>Pacemaker/Defibrillator (30 days)<br>Acute Myocardial Infarction (30 days)<br>CABG &/or Valve Procedures (90 days)<br>Coronary Angioplasty (90 days) | • BPCI<br>• BPCI Advanced<br>• Medicare Participating Heart Bypass Center Demonstration (CABG)<br>• Geisinger's ProvenCare | • *CABG and Coronary Angioplasty are similarly defined in other models.*<br>• *Pacemaker and AMI are defined differently in BPCI.*<br>• *All BPCI episodes are 90-days post.* | • Cost savings results from the cardiac episodes are mixed.<br>• Research on BPCI and BPCI-A has demonstrated no significant cost or quality improvements for cardiology.[37,38,39]<br>• Medicare cost decreased 15.5 percent and individual cost decreased from 2-23 percent under CABG.<br>• Demonstrated a hospital cost reduction of 5 percent under Geinsinger's ProvenCare.<br>• In BPCI, the adjusted average episode cost decreased by $2,999 for cardiac episodes[40] |
| **Gastroenterology**<br>Colonoscopy (14 days)<br>Colorectal Resection (90 days)<br>Gall Bladder Surgery (90 days)<br>Upper GI Endoscopy (14 days) | • BPCI Advanced | • *Gastroenterology episodes differently defined in BPCI-A than EQIP.*<br>• BPCI Advanced (includes surgical (bariatric surgery and major bowel procedure) and care episodes (liver disorders, GI hemorrhage, GI obstruction, IBD).<br>• Colonoscopy not included in any bundled payment models; the basis of a | • Reducing readmissions and post-acute care (PAC) cost imperative to reducing overall costs.[42,43] |

[37] SE, Blumenthal DM. Factors Associated With Participation in Cardiac Episode Payments Included in Medicare's Bundled Payments for Care Improvement Initiative. JAMA Cardiol. 2018 Aug 1;3(8):761-6

[38] S.gov [Internet]. Baltimore, MD: U.S. Centers for Medicare & Medicaid Services; c2020. The Lewin Group. CMS Bundled Payments for Care Improvement Initiative Models 2-4: Year 5 Evaluation & Monitoring Annual Report; 2018 Oct [cited 2020 Aug 13]. Available from: https://downloads.cms.gov/files/cmmi/bpci-models2-4-yr5evalrpt.pdf.

[39] Oseran AS, Howard Shahikumar, SA, et al. Changes in Cardiovascular Spending, Care Utilization, and Clinical Outcomes Associated With Participation in Bundled Payments for Care Improvement Advanced. Circulation 2023; 1-10.

[40] Jubelt, LE, et al. Early Lessons on Bundled Payment at an Academic Medical Center (2017)

[42] Collins, CR, et al. Preparing for participation in the centers for Medicare and Medicaid Services' bundle care payment initiative—advanced for major bowel Surgery. Perioperative Medicine

[43] Siddique, SM & Mehta, SJ. Bundled Payments for Hospitalized Patients With Gastrointestinal Disease: Current Opportunities and Challenges for Gastroenterology Practices. Clin Gastroenterol Hepatol 2021; 19(2);215-218.

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| | | colonoscopy bundle has been established by the American Gastroenterological Association (AGA).<br>• Study on IBD **(*as in BPCI-A*)** concluded that the 27 practices comprising 1,300 providers should not participate in the IBD BPCI-A due to low volume and low capture rates[41] | |
| **Orthopedics**<br>Hip Replacement & Revision (90 days)<br>Hip/Pelvic Fracture (30 days)<br>Knee Arthroscopy (90 days)<br>Knee Replacement & Revision (90 days)<br>Lumbar Laminectomy (90 days)<br>Lumbar Spine Fusion (180 days)<br>Shoulder Replacement (90 days) | • LEJR, CJR<br>• BPCI<br>• BPCI Advanced<br>• MIPS | • <u>Orthopedics bundles have the most expansive literature as they have existed the longest.</u><br>• CJR is the only mandatory model.<br>• CJR only covers LEJR (Knee Arthroscopy, Knee Replacement & Revision, Hip Replacement & Revision)<br>• Lumbar Fusion covered under BPCI-A, but episode length differs.<br>• Shoulder Replacement and Lumbar Laminectomy not in any bundled payment model | • Facility payments and post-discharge (SNF, IRF, and HHA) payments were the highest cost contributors.[44]<br>• The CJR bundled model decreased spending by three percent. The majority of the spending decrease was due to a 5 percent decrease in spending post-surgery, which includes post-acute care facilities and specialized nursing facilities.[45]<br>• Total Medicare Part A spending decreased by $582 per episode (2.5 percent) over the first two years of the CJR program.[46]<br>• Some research has demonstrated that BPCI has reduced Medicare payments with no change in quality outcomes measures. Other studies have demonstrated both a reduction in cost and an improvement in quality outcomes.[47]<br>• For lumbar fusion, approximately 50 percent of cost variation could be explained by surgeon procedure choice alone.[48]<br>• There were no significant differences in episode payments for spinal fusion, revision joint arthroplasty, and other medical conditions. Only LEJR episodes |

[41] Houck, B., Weintraub, D., Brill, J., & Kosinski, L. R. (2020). Bundled Payments for Care Improvement Advanced (BPCI-A): a decision-based case study. Clinical Gastroenterology and Hepatology, 18(13), 2856-2858.
[44] Kahn, E. N., Ellimoottil, C., Dupree, J. M., Park, P., & Ryan, A. M. (2018). Variation in payments for spine surgery episodes of care: implications for episode-based bundled payment. *Journal of Neurosurgery: Spine*, *29*(2), 214-219.
[45] Barnett, M. L., Wilcock, A., McWilliams, J. M., Epstein, A. M., Joynt Maddox, K. E., Orav, E. J., ... & Mehrotra, A. (2019). Two-year evaluation of mandatory bundled payments for joint replacement. New England Journal of Medicine, 380(3), 252-262.
[46] Haas, D. A., Zhang, X., Kaplan, R. S., & Song, Z. (2019). Evaluation of economic and clinical outcomes under Centers for Medicare & Medicaid Services mandatory bundled payments for joint replacements. JAMA internal medicine, 179(7), 924-931.
[47] McLawhorn, A. S., & Buller, L. T. (2017). Bundled payments in total joint replacement: keeping our care affordable and high in quality. Current reviews in musculoskeletal medicine, 10, 370-377.
[48]Hwang, R. W., Golenbock, S. W., & Kim, D. H. (2023). Drivers of cost in primary single-level lumbar fusion surgery. *Global Spine Journal*, *13*(3), 804-811.

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|---|---|
| | demonstrated Medicare cost savings.[49]<br>• Lower extremity joint replacement episodes achieved episode cost savings of $3,017; spinal fusion increased by $8,291 per episode[50] |

[49] Agarwal, R., Liao, J. M., Gupta, A., & Navathe, A. S. (2020). The Impact Of Bundled Payment On Health Care Spending, Utilization, And Quality: A Systematic Review: A systematic review of the impact on spending, utilization, and quality outcomes from three Centers for Medicare and Medicaid Services bundled payment programs. Health Affairs, 39(1), 50-57.

[50] Jubelt, L. E., Goldfeld, K. S., Blecker, S. B., Chung, W. Y., Bendo, J. A., Bosco, J. A., ... & Horwitz, L. I. (2017). Early lessons on bundled payment at an academic medical center. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, *25*(9), 654-663.