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# CMS Comprehensive Care for Joint Replacement Model: Performance Year 7 Evaluation In-Depth Report

## *Seventh Annual Report*

**HEALTH CARE AND HUMAN SERVICES POLICY, RESEARCH, AND ANALYTICS — WITH REAL-WORLD PERSPECTIVE.**

*Prepared for:* **Centers for Medicare & Medicaid Services**

*Submitted by:* **The Lewin Group, Inc. with our partners: GDIT and Telligen**

*December 2025*

# CMS Comprehensive Care for Joint Replacement Model: Performance Year 7 Evaluation In-Depth Report

## Seventh Annual Report

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### December 2025

# Table of Contents

# I.    CJR Model Evaluation Background

Lower extremity joint replacements (LEJRs) for hips, knees, and ankles represent the most common surgeries Medicare patients receive. The Centers for Medicare & Medicaid Services (CMS) implemented the Comprehensive Care for Joint Replacement (CJR) Model for LEJRs on April 1, 2016, as part of its strategy to use alternative payment models to slow fee-for-service (FFS) Medicare spending growth by rewarding value rather than volume of services.[1]

CJR incentivized hospitals to provide high-quality and cost-effective care. The model required hospitals in a set of randomly selected metropolitan statistical areas (MSAs) to participate and held them financially accountable for the cost and quality of health care services during and after an LEJR. The CJR Model encouraged participant hospitals to coordinate care with the physicians, post-acute care (PAC) providers, and other providers and clinicians involved in the LEJR throughout 90-day episodes of care. Through an annual reconciliation process, participant hospitals earned additional payments if they achieved cost and quality targets or faced repayments to Medicare if they fell short of these targets.

| Acronyms[2] | |
|---|---|
| ACO | Accountable Care Organization |
| ASC | Ambulatory Surgical Center |
| CFR | Code of Federal Regulations |
| CJR | Comprehensive Care for Joint Replacement |
| CMS | Centers for Medicare & Medicaid Services |
| DDD | difference-in-difference-in-differences |
| DiD | difference-in-differences |
| FFS | fee-for-service |
| HCC | Hierarchical Condition Categories |
| IPO | Inpatient Only |
| IPPS | Inpatient Prospective Payment System |
| LEJR | Lower Extremity Joint Replacement |
| MCC | major complications or comorbidities |
| MSA | metropolitan statistical area |
| MS-DRG | Medicare Severity-Diagnosis Related Group |
| NPPGP | non-physician practitioner group practices |
| OP | outpatient |
| OPPS | Outpatient Prospective Payment System |
| PAC | post-acute care |
| PGP | Physician group practice |
| PY | Performance Year |
| RIF | research identifiable files |
| THA | total hip arthroplasty |
| TKA | total knee arthroplasty |

In 2021, the CJR Model was extended for three additional performance years (PYs 6–8), which are referred to as the "extension period" throughout this report. This evaluation report focuses on the impact of CJR in PY 7, which includes episodes that ended between January 1, 2023, and December 31, 2023. The PY 7 impacts are reported both separately and together with PY 6 to comprehensively understand the effects of the new model methodology implemented in the extension period. For more information on evaluations of CJR in prior PYs, please refer to the CMS webpage for the CJR Model.[3]

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[1]    Centers for Medicare & Medicaid Services. (n.d.). *Comprehensive Care for Joint Replacement Model*.
       https://www.cms.gov/priorities/innovation/innovation-models/cjr
[2]    A list of all acronyms used in this report, as well as a glossary of terms, is available in **Appendix A: List of Acronyms and Glossary Terms**.
[3]    Centers for Medicare & Medicaid Services. (n.d.). *Comprehensive Care for Joint Replacement Model*.
       https://www.cms.gov/priorities/innovation/innovation-models/cjr

## A.  Model Design and Changes in the Extension Period

### 1.  Episode Definition

Under the CJR Model, an LEJR episode of care begins with the hospitalization of an eligible Medicare FFS patient at a hospital paid under the Inpatient Prospective Payment System (IPPS) or procedure under the Outpatient Prospective Payment System (OPPS) and extends through the 90 days after hospital discharge, including the date of discharge (**Exhibit I-1**). The episode bundle includes related Medicare Part A- and Part B-covered care, services, and equipment provided during this period, with some exclusions.[4] All providers and suppliers involved in the episode continue to be paid under Medicare's FFS payment system during the episode period.

**Exhibit I-1:     The Lower Extremity Joint Replacement Episode of Care**
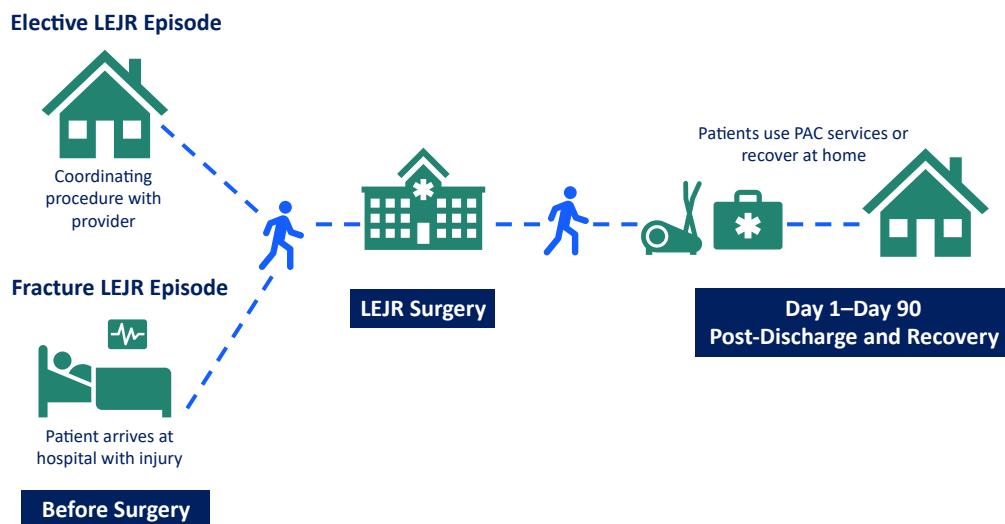


*Source:*   CJR evaluation team analysis of the CMS Final Rule Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

*Notes:*    CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; LEJR = lower extremity joint replacement; PAC = post-acute care.

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**Four Medicare Severity-Diagnosis Related Groups (MS-DRGs) identify qualifying surgeries:**

- **MS-DRG 469**: Major Hip and Knee Joint Replacement or Reattachment of Lower Extremity with Major Complications or Comorbidities (MCC)

- **MS-DRG 470**: Major Hip and Knee Joint Replacement or Reattachment of Lower Extremity without MCC

- Outpatient procedures under CPT codes 27447 (TKA) and 27130 (THA) are grouped with MS-DRG 470 for target pricing and reconciliation

- **MS-DRG 521**: Hip Replacement with Principal Diagnosis of Hip Fracture with MCC

- **MS-DRG 522**: Hip Replacement with Principal Diagnosis of Hip Fracture without MCC

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[4]   "Unrelated services" are excluded from the episode. These are services for acute clinical conditions that did not arise from existing episode-related chronic clinical conditions or from complications of the LEJR surgery and chronic conditions that are generally not affected by the LEJR procedure or post-surgical care.

For the extension period that began in PY 6, CMS implemented multiple changes to the model design that carried through to PY 8.[5]

### Inclusion of Outpatient Procedures

CMS policy changes removed Total Knee Arthroplasty (TKA) and Total Hip Arthroplasty (THA) procedures from the Medicare Inpatient Only (IPO) list in 2018 and 2020, respectively. CMS began including outpatient TKAs and THAs in the CJR Model in PY 6.

- CMS changed the CJR Model rules to include procedures performed in a hospital outpatient (OP) setting beginning in PY 6; therefore, we examined differences in OP LEJR rates between CJR and control hospitals.

- The share of overall LEJRs occurring in ambulatory surgical centers (ASCs) has slowly but steadily increased, although less than 10% of LEJRs occur in ASCs for both CJR and control MSAs. However, CMS does not include OP LEJRs performed at ASCs in the CJR Model, so all measures in this report exclude LEJRs at an ASC.

### 2. CJR Model Sampling Design and Hospital Participation

CMS required hospitals paid under IPPS in mandatory MSAs to participate in the CJR Model. All Medicare FFS patients who received an LEJR categorized under the MS-DRGs listed above at a hospital in a mandatory MSA were included in the CJR Model, with some exclusions. **Appendix B: Data and Methods** provides a full list of MSAs included in the CJR Model for the CJR and control samples.

The original mandatory, randomized design of the CJR Model resulted in a diverse group of CJR participant hospitals in 67 randomly selected MSAs. This included hospitals that might not voluntarily participate in an episode-based payment model and allowed for a broad test of the CJR Model. CMS identified the original 67 mandatory MSAs from 171 MSAs eligible for participation in the model, with sampling based on a combination of MSA population size, split at the median size, and average MSA historical episode payments, measured in quartiles. An MSA's probability of selection increased with the payment quartiles to oversample high-payment MSAs for participation in the CJR Model. During model design, CMS hypothesized that higher-payment areas had a greater need and more opportunities for payment reductions. The eligible MSAs that were not selected became a natural control group for evaluating the impact of the CJR Model. Within the selected MSAs, CMS required all acute care hospitals paid under the Medicare IPPS to participate in the model with few exceptions for the first 2 PYs.

In PY 3, CMS scaled back the CJR Model to the 34 MSAs with the highest historical episode payments (mandatory MSAs). CMS required hospitals in these mandatory MSAs not designated as low volume or rural to continue their participation in the CJR Model. This change reduced the number of hospitals required to participate in the CJR Model from 831 hospitals to 395 hospitals. CMS allowed the remaining hospitals in the 33 lower-payment MSAs (voluntary MSAs) and all

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[5]   Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

hospitals designated as low volume or rural a one-time opportunity to opt in to the CJR Model for PYs 3–5. Of the 310 hospitals in the 33 voluntary MSAs, 75 opted to continue their participation in the model.

### *Model Extension Period Excludes Rural, Low-volume, and Opt-in Hospitals*

CMS made two main changes to the CJR Model participants for the extension period.

1. Changes to hospitals in voluntary MSAs: CMS excluded opt-in hospitals located in voluntary MSAs from the CJR Model beginning in PY 6. This included both opt-in hospitals, who were in MSAs that were no longer mandatory in PY 3 (voluntary MSAs), and low-volume or rural hospitals in mandatory MSAs who chose to continue participating in PY 3.

2. Changes to hospitals in mandatory MSAs: CMS also excluded rural and low-volume hospitals in mandatory MSAs from the CJR Model beginning in PY 6. Hospitals were designated as rural through Section 401 of the Medicare, Medicaid, and SCHIP Balanced Budget Refinement Act and must have received their designation by July 4th, 2021, to no longer be required to participate in the model. Hospitals were designated as low-volume if they had less than 20 episodes over a 3-year historical period (2012 to 2014).

Excluding the rural, low-volume, and voluntary opt-in hospitals from the model resulted in a total of 323 CJR hospitals in the 29 mandatory CJR MSAs participating in the extension period. This model change removed 72 unique CJR hospitals and five unique CJR MSAs from the sample compared with PYs 3–5. As we designed our evaluation control group to mimic the CJR treatment group as closely as possible, we also applied this model change to the control group, which similarly reduced the number of control hospitals from PYs 3–5 to PYs 6–8. The number of control MSAs decreased from 43 to 41, and the number of control hospitals decreased from 398 to 317 (**Exhibit I-2**).

**Exhibit I-2:**   **During the Extension Period, PYs 6–8, 323 Hospitals of the Original 731 Hospitals Remain Required to Participate in the CJR Model After Years of Policy Changes**
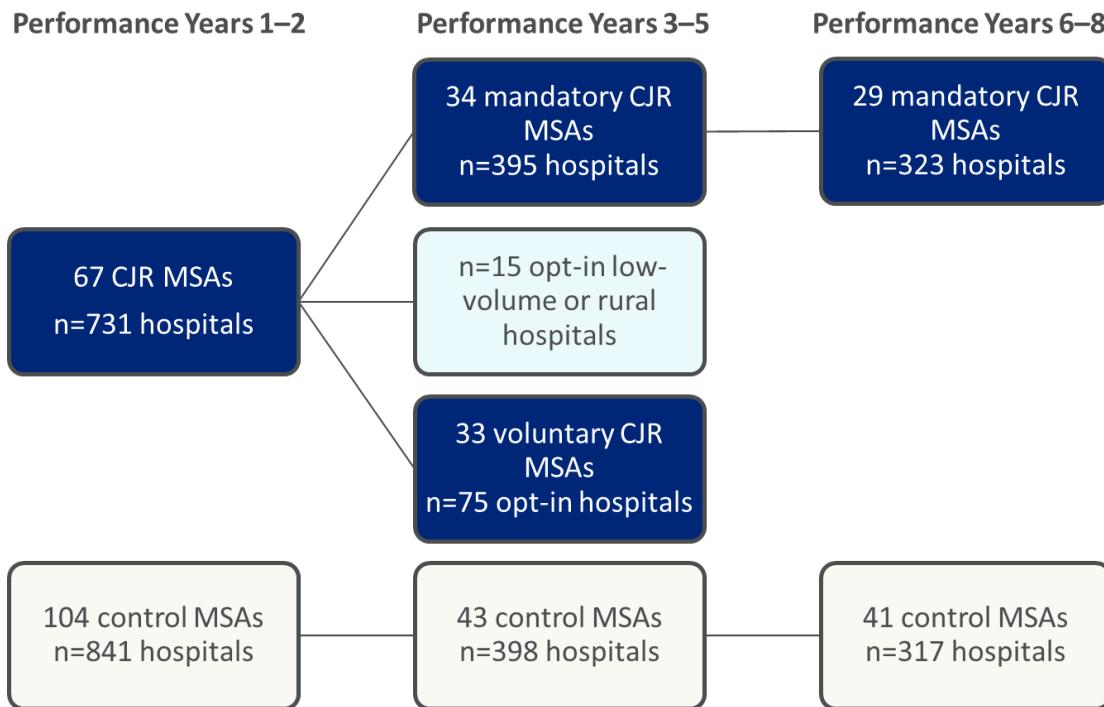
**Performance Years 1–2**     **Performance Years 3–5**     **Performance Years 6–8**

| | |
|---|---|
| 34 mandatory CJR MSAs n=395 hospitals | 29 mandatory CJR MSAs n=323 hospitals |

67 CJR MSAs
n=731 hospitals

n=15 opt-in low-volume or rural hospitals

33 voluntary CJR MSAs
n=75 opt-in hospitals

| 104 control MSAs n=841 hospitals | 43 control MSAs n=398 hospitals | 41 control MSAs n=317 hospitals |
|---|---|---|

*Source*:   CJR evaluation team analysis of the *Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing Performance Year 6 Mid-Year Report*.

*Notes*:   The number of CJR participant hospitals in PY 1–PY 2 (April 6, 2016–December 31, 2017) was lower than the total number of hospitals chosen for participation because hospitals with no episode volume in the baseline and intervention periods were excluded. The 15 opt-in low-volume or rural hospitals in PY 3–PY 5 (January 1, 2018–September 30, 2021) were located in mandatory MSAs. The extension period refers to PY 6–PY 8 (October 1, 2021–December 31, 2024). CJR = Comprehensive Care for Joint Replacement; MSA = metropolitan statistical area; PY = performance year.

The mandatory CJR MSAs are primarily in the Middle Atlantic and South Atlantic census divisions, while the control MSAs are primarily in the East North Central and West South Central census divisions (**Exhibit I-3**). The decision to remove rural and low-volume hospitals from the extension also reduced the variation in hospital size, population dispersion, and rurality within participant hospitals' referral regions. For more information on the CJR population and the effect of policy changes, see **Chapter II: Overview of the CJR Population**.

**Exhibit I-3:     The CJR Model Comprised 29 CJR and 41 Control MSAs in the Extension Period**
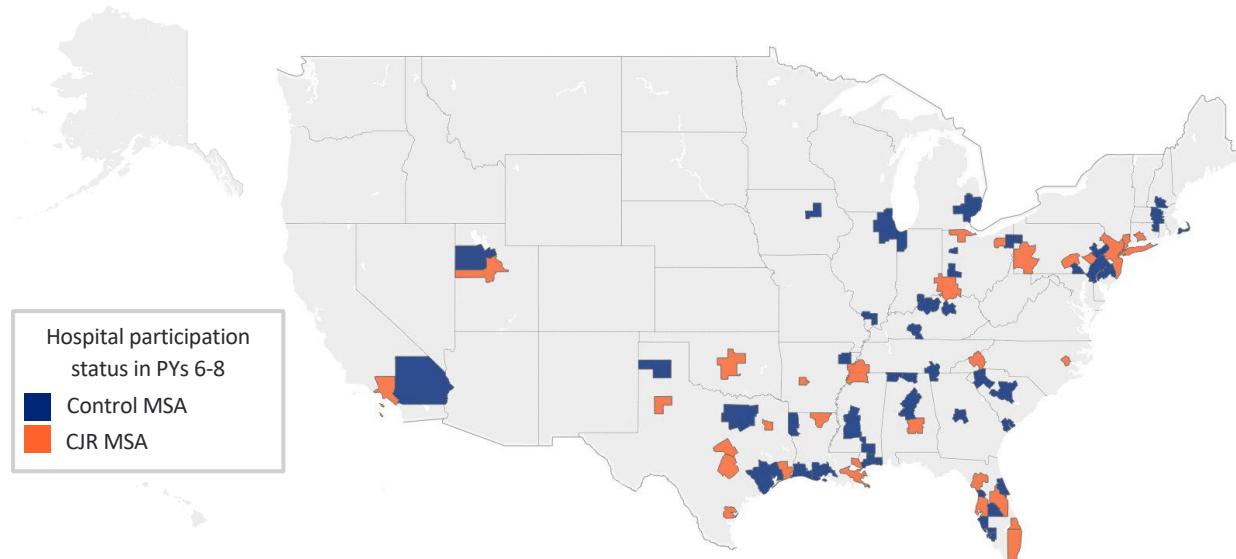


*Source*:   CJR evaluation team analysis of hospital enrollment data and the CMS Final Rule Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

*Notes*:   CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; MSA = metropolitan statistical area; PY = performance year.

## 3.  Target Pricing and Annual Reconciliation

### a.   Target Pricing

CMS provides each CJR hospital with a regional standardized preliminary target price for each MS-DRG before each PY. The target prices represent the average spending within that hospital's region for each of the four MS-DRGs in the CJR Model based on historical spending data, with a 3% discount applied. The 3% discount serves as Medicare's portion of the savings.

### *Adaptable Preliminary Target Prices*

CMS revised the methods used to calculate the target prices in the extension period. CMS implemented these changes to better align target prices with actual spending, reflect the types of joint replacements and care settings involved, and to establish an "adaptable payment methodology that can sustain adjustments in practice and payment systems over time."[6] These changes may have improved the model's ability to generate estimated savings:

- CMS incorporated outpatient TKA/THA episodes in target price calculations.[7]

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[6]   Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

[7]   CMS included OP TKA/THA episodes performed at an outpatient setting in PY 6 target price calculations, although the OP episodes used to determine these prices were not included as part of the model during that time.

- CMS changed the target price calculation from one based on 3 years of claims data to the most recent 1 year of data.

### *Revisions for Accurate and Adaptable Target Pricing*

CMS made substantial changes to how the target prices are adjusted during the reconciliation process for the extension period to account for hospital and patient variation that may have improved the model's ability to generate estimated savings:

- CMS added risk-adjustment factors to adjust target prices at the episode level based on the patient's age, dual-eligibility status, and count of Hierarchical Condition Categories (HCCs). The new risk adjustments and inclusion of outpatient LEJR procedures may have led to more accurate target prices for mandatory CJR hospitals.

- CMS added a retrospective market trend factor that is applied at the reconciliation stage.

- To better reward high-quality care during the extension period, CMS revised the quality discount factors so that hospitals with "good" quality performance receive a 1.5 percentage point discount, while those with "excellent" quality performance are not subject to any discount (0 percentage points), thereby maximizing their potential reconciliation payments.

- To mitigate the risk of inaccurately capping high-cost cases, CMS also altered the application of spending caps in the calculation so that episode costs are capped at the 99th percentile amount within each region/MS-DRG combination. This replaced the previous high episode spending cap methodology, which set the cap at 2 standard deviations above the mean regional episode payment across all MS-DRGs.

- Given that all the previous listed changes were intended to capture the variability in payments more accurately, CMS removed the use of the anchor factor and regional- and hospital-specific anchor weights.

### b. Annual Reconciliation

After the end of each PY, CMS adjusts the target price based on a hospital's composite quality score— a summary score reflecting hospital performance and improvement on two LEJR-related quality measures.[8] CMS then reconciles each participant hospital's LEJR episode payments against its quality-adjusted target price. For PY 7, CMS based hospitals' quality-adjusted target prices on a regional average of historical data from 2021. During reconciliation, CMS compares the actual total spending for all episodes at a participant hospital in a given PY with the aggregate target price for those episodes. The episode is attributed to the participant hospital where the patient underwent the initial LEJR surgery. Depending on the hospital's quality and episode spending performance, it may receive an additional payment from Medicare or be required to repay Medicare for a portion of the episode spending (**Exhibit I-4**).

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[8] These two measures are Consensus-Based Entity (CBE) ID 1550: *Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)* and CBE ID 0166: *Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey.*

**Exhibit I-4:**     **Episode Spending, Target Pricing, and Quality Measures Result in Positive or Negative Annual Reconciliation Payments for Participant CJR Hospitals**
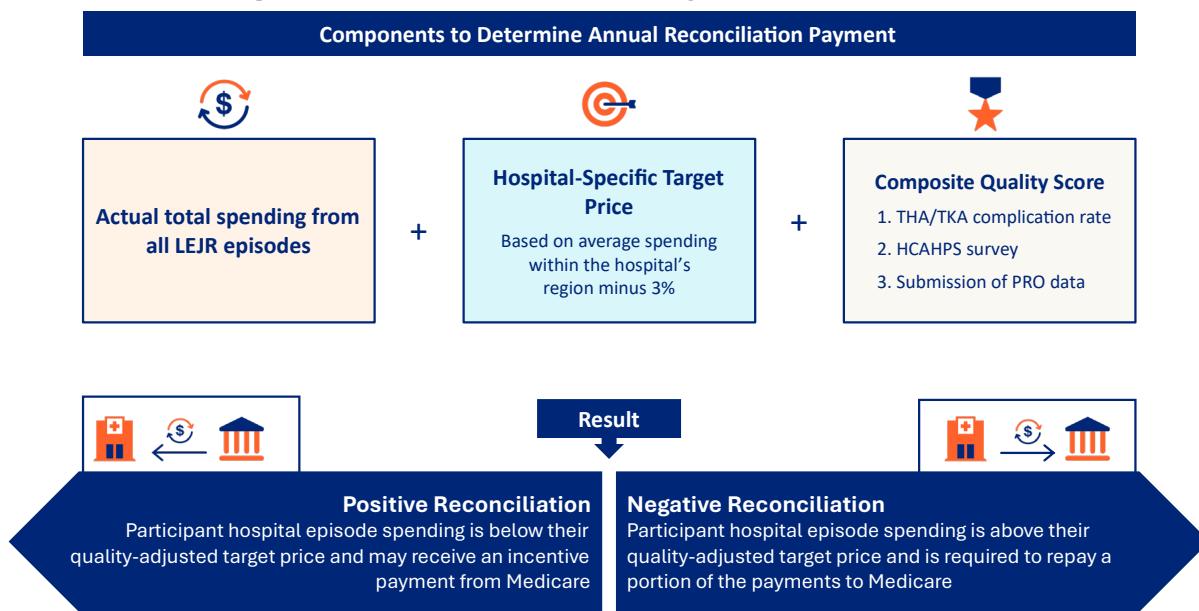


*Source*:   CJR evaluation team analysis of the CMS Final Rule Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

*Notes*:   CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems, LEJR= lower extremity joint replacement; PRO = patient-reported outcomes; THA = total hip arthroplasty; TKA = total knee arthroplasty.

## *Adjustments to the Reconciliation Process*

CMS also made changes to the reconciliation process for the extension period that may have alleviated administrative burden:

- CMS replaced the reconciliation process that provided both an initial reconciliation after a two-month runout period and a final reconciliation after a 14-month runout period with the current reconciliation process that only provides one reconciliation after a six-month runout period. This change was designed to reduce the administrative burden for participating hospitals and to improve CMS' ability to account for changes in payment policy and market trends in utilization.

- CJR participant hospitals could engage in financial arrangements that allowed hospitals to make gainsharing payments to certain providers and collaborators engaged in providing care for patients that received an LEJR. These include Accountable Care Organizations (ACOs), therapy group practices, physician group practices (PGPs), and non-physician practitioner group practices (NPPGPs). To align with rules changes for other programs and policies, CMS eliminated the 50% cap on gainsharing payments, distribution payments, and downstream distribution payments when the recipient of these payments was a physician, non-physician practitioner, PGP, or NPPGP.

- The patient notification requirement on discharge planning was updated to accommodate the cases where patients would be discharged the same day following an outpatient procedure.

**Exhibit I-5** shows an overview of the model implementation timeline and key policy changes discussed throughout this chapter. A detailed discussion of target pricing and reconciliation results is available in **Chapter IV: Medicare Program Savings**.

**Exhibit I-5:    Overview of the CJR Model Timeline and Policy Changes**

**April 2016** → **CJR Model Begins**

*Performance Years 1 - 4*
- Model intended to run from 2016 - 2020
- 2018: Half of MSAs move to voluntary participation
- 2018: OP TKAs removed from Medicare IPO list
- 2020: OP THAs removed from Medicare IPO list

**Feb. 2020** → CMS Proposes New Rule

Proposed Rule for The CJR Model included:
- 3-year model extension from 2021 to 2024
- Changing the episode definition
- Adjusting the method for episode pricing

**Mar. 2020** → COVID-19 Caused Interim Changes

*Performance Year 5*
- Performance Year 5 extended
- 2020: Downside risk waived during COVID-19

**Jul. 2021** → New CJR Final Rule is Effective

The Final Rule states that the 3-year extension of The CJR Model begins on October 1, 2021.

**Oct. 2021** → **CJR Model Extension Begins**

Model extension modifications:
- Inclusion of OP LEJRs
- Excluded voluntary opt-in, rural, & low-volume hospitals
- Adjustments to target pricing and reconciliation
- Update to beneficiary discharge notification for OP LEJRs

*Performance Years 6 - 8*

**Dec. 2024** → **End of CJR Model**

*Source*:    CJR evaluation team analysis of the CMS Final Rule Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

*Notes*:    CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; IPO = inpatient only; LEJR= lower extremity joint replacement; MSA = metropolitan statistical area; OP = outpatient; THA = total hip arthroplasty; TKA = total knee arthroplasty.

## B.  CJR Participant Experiences and Care Transformation Strategies

During the CJR Model, hospitals implemented a range of enhanced or new initiatives across episodes of care (before hospitalization, during hospitalization, and after discharge) to decrease the level of intensity of PAC use (**Exhibit I-6**). Since CJR hospitals had implemented care strategies since the model began, the model changes in PY 6–PY 7 may not have affected their care strategies or costs. Examples from telephone interviews with participants have shown hospitals

offered presurgical joint classes to educate patients, provided physical therapy before surgery, and prioritized early identification and intervention for higher-risk patients to optimize outcomes.

**Exhibit I-6:     Care Transformation Strategies Across the CJR Episode of Care**

**Activities occurring throughout episode:**
› Patient education
› Care coordination
› Use of data to track patient outcomes and improve quality

**Before Surgery**

**Mitigate risk and optimize patient outcomes for elective patients**

Engaging patients well before the hospital admission to begin discharge planning, education, and identify high-risk patients for patient optimization to facilitate safe discharge home and optimize patient outcomes.

**During Surgical Stay**

**Reduce/maintain length of stay, optimize patients for safe discharge to lowest safe level of post-acute care**

Early ambulation and changes to pain management and physical therapy to reduce length of stay, facilitate safe discharge home and improve quality

**Post-discharge and Recovery**

**Reduce length of stay at skilled nursing facility, mitigate risk of readmissions**

Increased coordination and communication with post-acute providers, creation of preferred post-acute care networks, and longer periods of patient follow-up to reduce length of stay in skilled nursing facilities and mitigate risk of readmissions

*Source*:    The CJR Evaluation's Drivers of Transformation: Cumulative Care Transformation Findings from Comprehensive Care for Joint Replacement Model report.
*Notes*:     CJR = Comprehensive Care for Joint Replacement.

A detailed discussion about how and why hospitals transformed care under the CJR Model, is available in *Drivers of Care Transformation* report. [9]

Hospitals in CJR and control MSAs also transformed care in response to incentives from other value-based care programs, including ACOs, Medicare Advantage programs, and contracts with commercial payers. A detailed discussion of ACO Overlap findings is available in **Chapter VI: ACO Overlap in the CJR Model**. Additionally, the CJR Model operated in a complex health care landscape with multiple concurrent programs and policies that may also have had an impact on the CJR and control hospitals. The potential influence of these concurrent

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[9]    https://www.cms.gov/priorities/innovation/data-and-reports/2024/cjr-py6-ar-drivers-transformation

programs and policies should be considered in the interpretation of the observed impact of the model in the extension period. The evaluation's approach to examining the impact of the CJR Model and the interpretation of these findings accounts for both the impact of the model design and the influence of these other value-based programs. A detailed discussion of the impact of the CJR Model is available in **Chapter III: Impact of the Model**.

## C.  Evaluation Approach

We used Medicare claims, payment, and enrollment data, as well as CJR programmatic data, IPPS Final Rule data, ACO provider Research Identifiable Files (RIFs), and telephone interviews with CJR participants to evaluate the model's impact.

For claims-based outcomes, we assessed the impact of the model in the extension period (PY 6–PY 7) compared with the baseline period. We analyzed quantitative data using descriptive statistics and regression-based techniques, including difference-in-differences (DiD) and difference-in-difference-in-differences (DDD) analyses. The DiD approach was used to examine overall model impact for key outcomes of interest while the DDD approach was used to examine impact of the model on patients who were dually eligible for Medicare and Medicaid in comparison to patients who were not dually eligible.

To estimate the impact of the CJR Model on Medicare program savings and changes in reconciliation payments, we estimated savings on both a total and a per-episode basis due to the model in PYs 6–7, estimated the distribution of reconciliation payments across CJR participants, and assessed changes in the distribution of reconciliation payments between PYs 6–7 and prior PYs. These estimates also use the DiD approach.

A detailed discussion of potential unintended consequences of the CJR Model and other considerations are available in **Chapter VII: Analysis of Potential Unintended Consequences of the CJR Model** and **Chapter VIII: Additional Considerations**.

For the PY 7 evaluation, we conducted telephone interviews alongside a descriptive analysis to further understand the experiences of safety-net hospitals in the CJR Model. We determined safety-net hospital status based on the proportion of patients who were dually eligible for Medicare and Medicaid or eligible for Medicare Part D Low-Income Subsidy as determined by CMS, from which we derived our interview sample. We conducted thematic analyses on the qualitative data collected to summarize these findings. A detailed discussion of findings is available in the accompanying *Safety-Net Hospital Report*.

Please refer to **Appendix B: Data and Methods** for more information on the evaluation approach and methodology used to estimate CJR Model impacts.

## II.    Overview of the CJR Population

In this section, we discuss the lower extremity joint replacement (LEJR) population served by hospitals participating in the Comprehensive Care for Joint Replacement (CJR) Model. Understanding the makeup and characteristics of this population is vital to fully understand the model, as well as to understand the impacts of the model.

We examine how the CJR population has changed over time and how it has compared with the control population. The analyses in this section focus on CJR hospitals, and the corresponding hospitals in the control group, which were mandatory participants as of performance year (PY) 6 and PY 7 (October 2021 through December 2023). First, we examined the volume of LEJRs for all CJR PYs for overall, fracture,

| Acronyms | |
|---|---|
| BPCI | Bundled Payments for Care Improvement |
| CJR | Comprehensive Care for Joint Replacement |
| ESRD | end-stage renal disease |
| IPPS | Inpatient Prospective Payment System |
| IRF | inpatient rehabilitation facility |
| LEJR | lower extremity joint replacement |
| MSA | metropolitan statistical area |
| OP | outpatient |
| PAC | post-acute care |
| pp | percentage point |
| PY | Performance Year |
| SNF | Skilled Nursing Facility |
| THA | total hip arthroplasty |
| TKA | total knee arthroplasty |

and elective episodes in CJR and control hospitals. We also compared outpatient (OP) elective total knee arthroplasty (TKA) and OP elective total hip arthroplasty (THA) rates over time in CJR and control hospitals. Additionally, we discuss the composition of patients who received an LEJR at CJR and control hospitals. We examine patient demographics, health status, prior utilization in an acute care setting, and U.S. Census Divisions.

### A.   How Has CJR Participation Changed Over Time?

#### 1.   Summary of Findings

- **OP procedures grew over the course of the model and in PY 7 comprised 75% of all elective episodes across CJR and control hospitals combined.**

- **Consistent with prior years, control hospitals performed relatively more LEJR procedures in an OP setting than CJR hospitals in PY 7. The difference was smaller than observed in previous years.**

- **The composition of patients receiving LEJRs changed slightly at both CJR and control hospitals in similar ways, with proportionally fewer patients who were dually eligible for Medicaid.**

#### 2.   Results

##### a.   Volume of LEJR Episodes Over the Course of the CJR Model

Overall, the number of LEJR episodes slightly increased in both the CJR and control groups from the beginning of the CJR Model in 2016 to the end of PY 7 in December 2023 (**Exhibit II-1** and **Exhibit II-2**). The number of LEJR episodes due to fracture remained steady throughout the model, whereas elective episodes fluctuated. Those fluctuations can be explained, at least in part, by eligibility rules used to determine which LEJR episodes qualify for CJR— rules which we

applied to both the CJR, and control group episodes included in this trend graph. These rules include exclusions for episodes included in the Bundled Care for Improvement Initiative (BPCI), the volume of which fluctuated over time, and the change to include outpatient episodes after PY 6.[10] CMS allowed Medicare coverage of TKAs and THAs performed in the hospital OP setting in January 2018 and January 2020, respectively. LEJR procedures in the OP setting (referred to as OP LEJR) were not captured as CJR episodes before PY 6. As shown in **Exhibit II-1**, the number of elective episodes decreased sharply in PY 5 (2020 and 2021) in conjunction with the growing popularity of OP LEJRs (see Section 2) and the COVID-19 public health emergency. In PY 6 (2021 and 2022), when CJR began to include OP LEJRs as episodes, the number of elective LEJR episodes increased sharply. In PY 7 (2023), the number of elective LEJR episodes increased slightly for CJR hospitals and remained stable for control hospitals compared to PY 6.

**Exhibit II-1:    In CJR Hospitals, the Number of Elective Episodes Grew Slightly in PY 7 (2023), Following a Sharp Increase in PY 6 (2021 and 2022)**
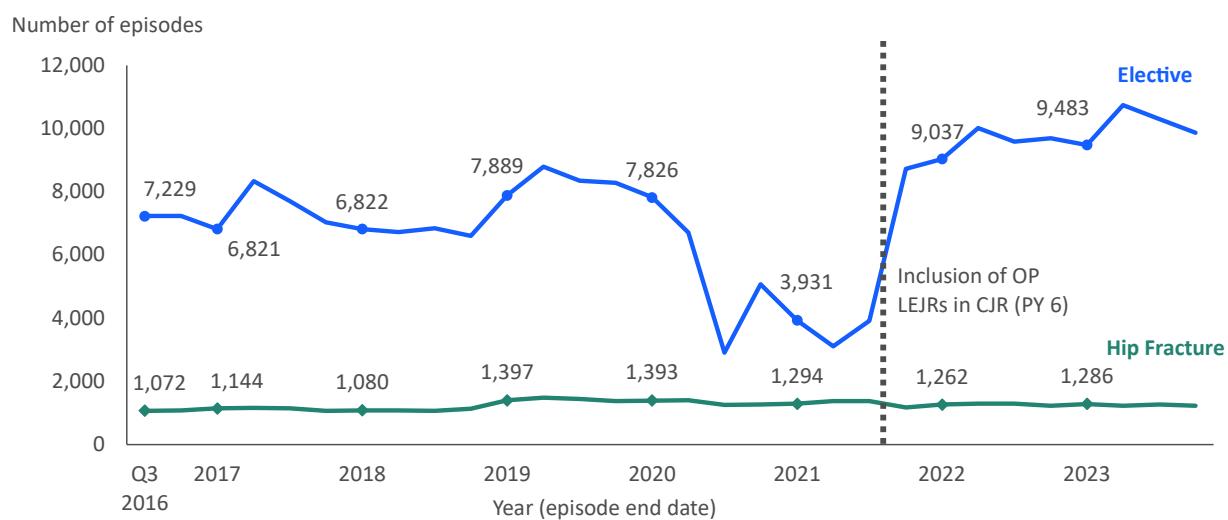


*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for LEJRs that meet the CJR eligibly rules at the time of the LEJR surgery, for episodes that ended between July 2016 (PY 1) and December 2023 (PY 6–PY 7).

*Notes:*   CJR = Comprehensive Care for Joint Replacement Model; LEJR = lower extremity joint replacement; OP = outpatient; PY = performance year; Q = quarter.

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[10]   Moreover, Medicare began to cover LEJRs performed in ambulatory surgical centers in 2020. These LEJRs are not considered CJR episodes and are thus not included in any analyses. See **Chapter VIII: Additional Considerations** for more information.

**Exhibit II-2:** **In Control Hospitals, the Number of Episodes Remained Stable in PY 7 (2023) Following a Sharp Increase in PY 6 (2021 and 2022)**
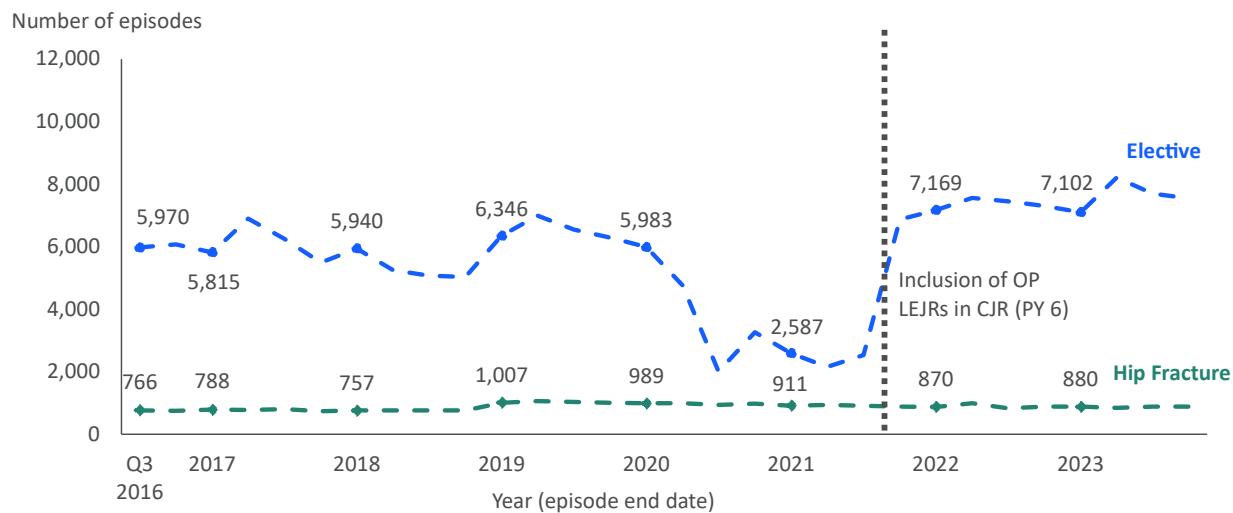
Number of episodes



*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for LEJRs that meet the CJR eligibly rules at the time of the LEJR surgery, for episodes that ended between July 2016 (PY 1) and December 2023 (PY 6–PY 7).

*Notes:* CJR = Comprehensive Care for Joint Replacement Model; LEJR = lower extremity joint replacement; OP = outpatient; PY = performance year; Q = quarter.

## b. *Effect of the Outpatient TKA and THA Policy Changes on the CJR Model*

To understand the effect of the TKA and THA policy changes which removed the procedures from the inpatient only list, we calculated the proportion of all elective LEJRs that were performed at an OP setting at CJR and control hospitals since the policy changes. Since the inclusion of OP LEJRs in the CJR Model starting from PY 6 (episodes that ended between October 2021 and December 2022), the proportion of OP LEJR episodes has continued to increase for CJR and control hospitals (**Exhibit II-3** and **Exhibit II-4**). Although the proportion of OP LEJRs increased over time, the rates were different between CJR and control hospitals. In PY 7, around 75% to 80% of elective episodes for both CJR and control hospitals were in the OP setting. However, a gap remains between CJR and control hospital OP LEJR rates. The share of OP TKAs and THAs in mandatory CJR hospitals was about 3 to 5 percentage points (pp) below the share in control group hospitals throughout PY 7.

**Exhibit II-3:    In PY 6–PY 7, Most TKAs Occurred in the OP setting, but Mandatory CJR Hospitals Continued to Perform Relatively Fewer TKAs in the OP Setting than Control Group Hospitals**
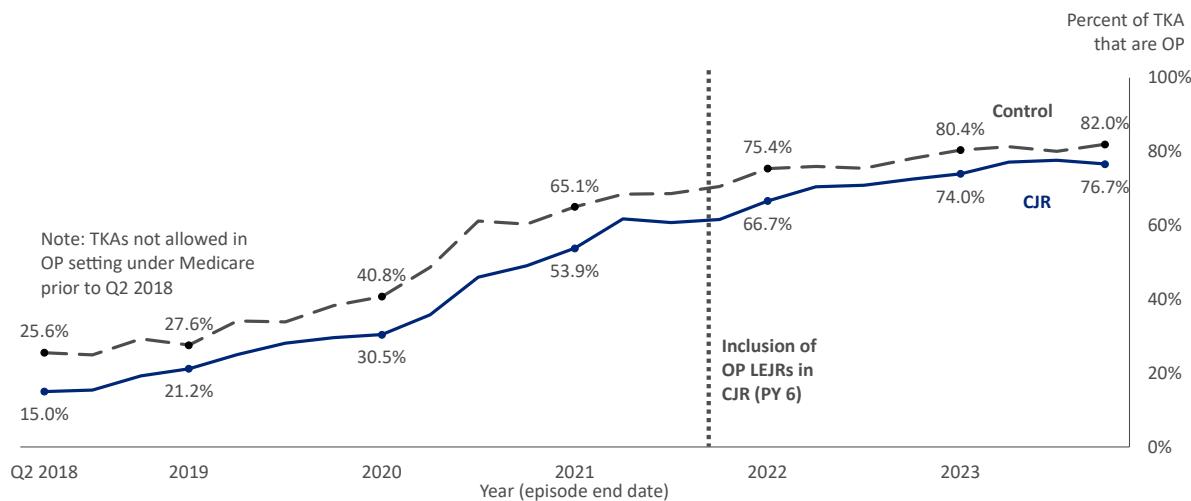


*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for LEJR episodes that ended between April 2018 and December 2023.

*Notes:*  While TKAs were allowed under Medicare starting Q1 2018, those procedures had episode end dates starting in Q2 2018 due to the 90-day episode length. CJR = Comprehensive Care for Joint Replacement Model; LEJR = lower extremity joint replacement; OP = outpatient; PY = performance year; Q = quarter; TKA = total knee arthroplasty.

**Exhibit II-4:    Like TKAs, in PY 6–PY 7, Most THAs Occurred in the OP Setting, but Mandatory CJR Hospitals Continued to Perform Fewer THAs in the OP Setting than Control Group Hospitals**
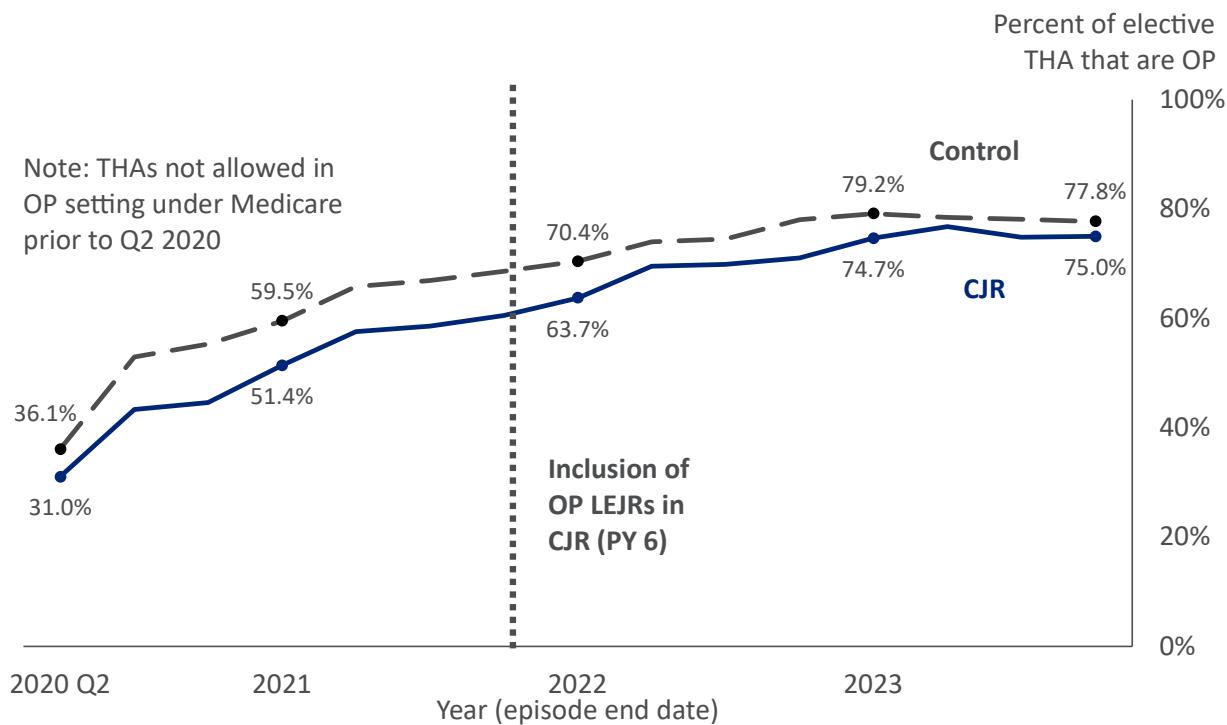


*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for LEJR episodes that ended between April 2020 and December 2023.

*Notes:*   While THAs were allowed under Medicare starting Q1 2020, those procedures had episode end dates starting in Q2 2020 due to the 90-day episode length. CJR = Comprehensive Care for Joint Replacement Model; LEJR = lower extremity joint replacement; OP = outpatient; PY = performance year; Q = quarter; TKA = total knee arthroplasty; THA = total hip arthroplasty.

### c.  *CJR and Control Patient Characteristics*

For the CJR and control populations, some patient characteristics changed between the baseline period (April 2012 through March 2015) and the intervention period of PY 6–PY 7 (October 2021 through December 2023), as shown in **Exhibit II-5** and **Exhibit II-6**.[11] For example, there was a decrease in the percentage of patients with dual eligibility for Medicare and Medicaid (from 13.7% to 7.5% for CJR) or who were eligible for Medicare through disability, not including end-stage renal disease (ESRD) (from 15.2% to 10.6% for CJR). Changes in demographic characteristics were similar between CJR and control groups.[12]

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[11]   Results presented throughout this chapter summarize the characteristics of CJR and control episodes, not CJR and control patients. This implies, for instance, if an individual patient had two episodes over the course of the sample period, their characteristics would be counted twice when calculating averages.

[12]   We further examined changes in additional patient demographic characteristics for both elective and fracture populations for CJR and control. We observed similar patterns between both CJR and control groups (see **Appendix C: Descriptive Statistics of the CJR Population** for detailed results).

**Exhibit II-5:  CJR and Control Populations Experienced Demographic Shifts Between the Baseline and PY 6–PY 7**
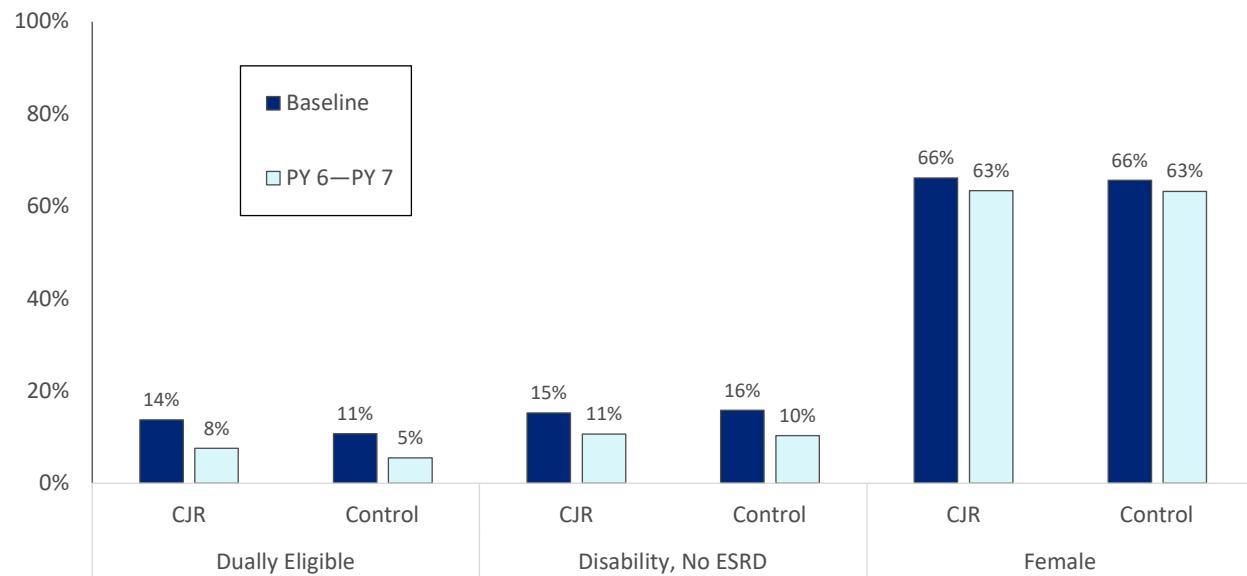


*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* (See **Appendix C: Descriptive Statistics of the CJR Population** for more detailed results.)
CJR = Comprehensive Care for Joint Replacement Model; ESRD = end-stage renal disease; PY = performance year.

Between the baseline period and PY 6–PY 7, the percentage of patients classified as obese increased in both the CJR and control groups, with obesity rates more than doubling. Changes in other patient characteristics over the same period were comparatively smaller in magnitude.

**Exhibit II-6:    CJR and Control Groups Had Similar Rates of Chronic Conditions and Comorbidities in both the Baseline and PY 6–PY 7, Despite a Substantial Increase in Obesity Over Time**
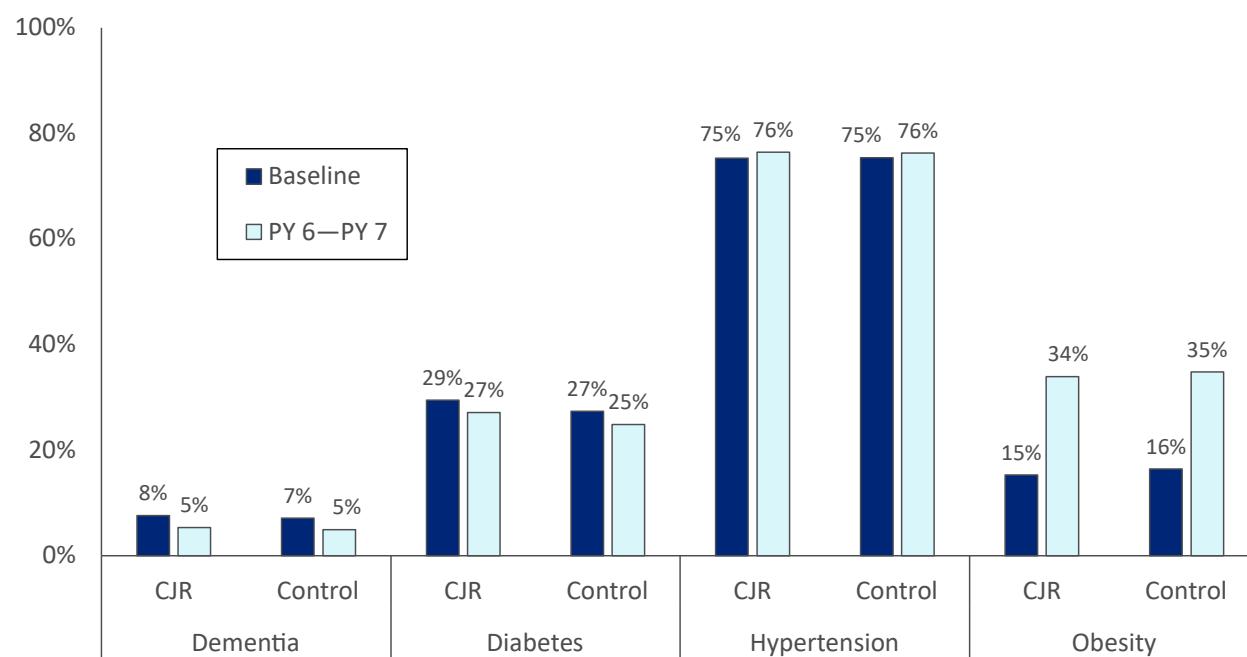


*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*    These results are for claims-based measures of chronic conditions and comorbidities. (See **Appendix C: Descriptive Statistics of the CJR Population** for more detailed results.) CJR = Comprehensive Care for Joint Replacement Model; PY = performance year.

### d.   *Health Care Use Before LEJR Surgery*

As healthcare utilization prior to the joint replacement is often a measure of predicted LEJR complexity, we examined four unique aspects of prior healthcare utilization: home health, inpatient rehabilitation facility (IRF), skilled nursing facility (SNF), and other inpatient facilities within the Inpatient Prospective Payment System (IPPS), as well as a composite measure of any utilization. For the CJR and control patient populations, we observed decreases in utilization of these services prior to the LEJR from baseline to PY 6–PY 7, particularly for prior IPPS and SNF use. We observed similar patterns between CJR and control, with the utilization being within one pp of each other for all other measured settings (**Exhibit II-7**).

**Exhibit II-7:    Average Prior Utilization in a Post-Acute Care Setting Decreased Relative to the Baseline Period, Although Utilization Remained Similar Between CJR and Control Patients**
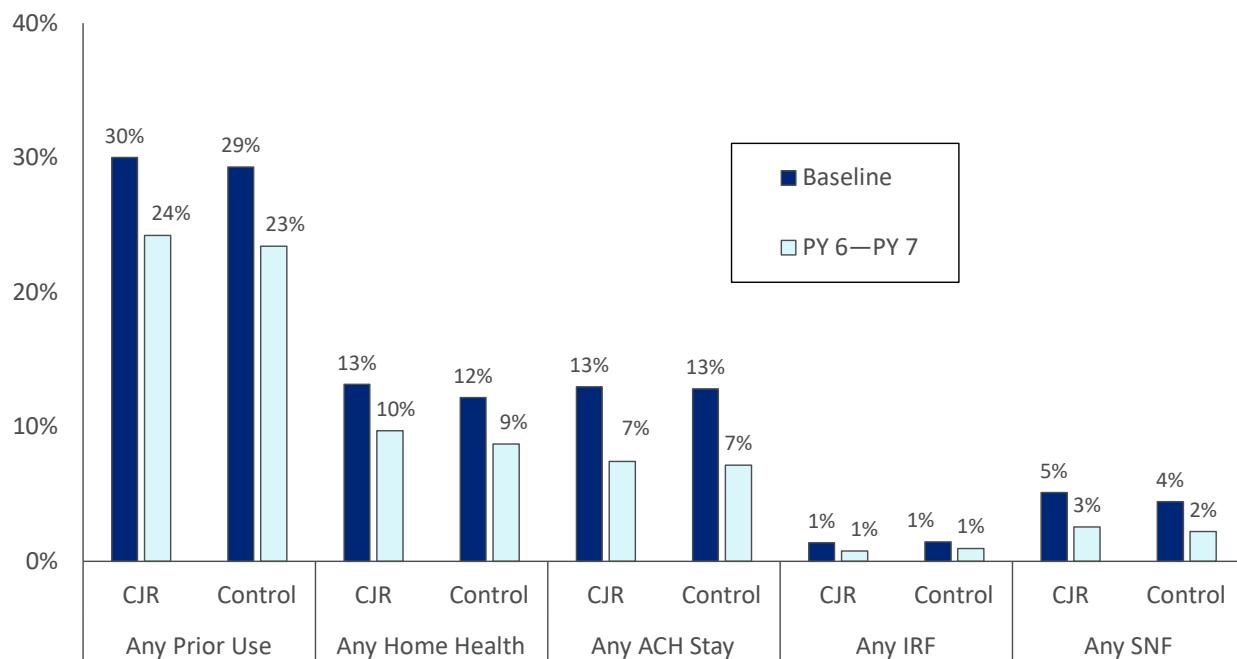


***Source:*** CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

***Notes:*** (See **Appendix C: Descriptive Statistics of the CJR Population** for more detailed results.) ACH = acute care hospital; CJR = Comprehensive Care for Joint Replacement Model; IRF = inpatient rehabilitation facility; PY = performance year; SNF = skilled nursing facility.

## e.   *Geographic Location*

The CJR Model was a geographic-based mandatory model in which randomly selected metropolitan statistical areas (MSAs) were chosen to participate. While there have been some changes over time in which hospitals are required to participate (see **Chapter I: CJR Model Background** for more information), 34 MSAs were mandatory as of PY 6. In PY 6–PY 7, the majority of CJR episodes were located in the Middle Atlantic, South Atlantic, and West South Central U.S. Census Divisions (**Exhibit II-8**). The MSA that contains New York City was the MSA with the most CJR episodes in PY 6 and PY 7 combined, with more than 25% of all episodes.

**Exhibit II-8:    Patients in the CJR Population Were Primarily Located in the Middle Atlantic, South Atlantic, and West South Central Census Divisions**



*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* CJR = Comprehensive Care for Joint Replacement Model; PY = performance year.

## III.   Impact of the Model

In this section, we report the estimated impact of the Comprehensive Care for Joint Replacement (CJR) Model during performance year (PY) 6 and PY 7 (October 2021 through December 2023). We calculated impacts over the combined last two PYs to comprehensively understand the average impact of the model in the extension period.[13] To study whether the CJR Model achieved its goals of lowering payments and improving quality, we analyzed the impact of the CJR Model on three groups of outcomes: (A) payments, (B) post-acute care (PAC) utilization, and (C) quality of care.

| Acronyms | |
|---|---|
| **CI** | confidence interval |
| **CJR** | Comprehensive Care for Joint Replacement |
| **DDD** | difference-in-difference-in-differences |
| **DiD** | difference-in-differences |
| **HCC** | hierarchical condition category |
| **HH** | home health |
| **IRF** | inpatient rehabilitation facility |
| **LCI** | lower confidence interval |
| **LEJR** | lower extremity joint replacement |
| **OP** | outpatient |
| **PAC** | post-acute care |
| **P** | p-value |
| **PP** | percentage point |
| **PT/OT** | physical therapy or occupational therapy |
| **PY** | performance year |
| **SNF** | skilled nursing facility |
| **UCI** | upper confidence interval |

These outcomes reflected care during 90-day episodes following a lower extremity joint replacement (LEJR) surgery. During PY 6–PY 7, CJR and control groups performed 98,744 and 105,150 such episodes, respectively. The majority of episodes (88.9% overall) were for elective LEJRs, but we analyzed all LEJR episodes and elective and inpatient hip fracture episodes separately to account for important differences in patient characteristics and care for hip fractures. We also report results separately for the population of patients that were dually eligible for Medicare and Medicaid.

All impacts were estimated using a difference-in-differences (DiD) model which compares outcomes for patients with LEJRs at CJR hospitals relative to patients with LEJRs at control hospitals, both in the baseline (April 2012 through March 2015) and intervention period (defined as the combination of PY 6 and PY 7).[14] For all impact estimates, we report 90% confidence intervals (CIs) and p-values (p). In addition, we indicate when there is substantial evidence that the parallel trends assumption, a necessary assumption of causal DiD models, is not met for a given outcome. For these outcomes, we do not believe the reported impacts are causal impacts of the CJR Model.[15]

### A.   What Was the Impact of the CJR Model on Total Episode Payments?

The first set of results in this chapter addresses how the CJR Model affected total episode payments by examining the change in average payments for CJR hospitals from the baseline period until the intervention period, relative to the control group. We looked at the impact of the CJR Model on

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[13]   Overall, results were similar in both PY 6 and PY 7. See **Appendix D: Additional Findings** for results broken out for PY 6 and PY 7 separately.

[14]   Additional details of the outcome measures we analyzed and methods we utilized can be found in **Chapter II: Data and Methods**.

[15]   Additional information on parallel trends can be found in **Appendix B: Data and Methods** and **Appendix D: Additional Findings**.

total episode payments, as well as the components that made up the total episode payments.[16] It is important to note that the analysis of total episode payments in this chapter does not incorporate reconciliation payments made to the CJR participant hospitals. An analysis of Medicare savings, which considers how the CJR Model affected both total episode payments and reconciliation payments, is presented in **Chapter IV: Medicare Program Savings.**

### 1.  Summary of Findings

- **Results strongly suggest that CJR hospitals reduced total episode payments relative to control hospitals through reductions in payments for elective LEJRs. The reductions in episode payments were mostly driven by reductions in inpatient rehabilitation facility (IRF) payments.**

- **CJR hospitals did not have statistically significant reductions in total episode payments relative to control hospitals for fracture LEJRs but did have large increases in skilled nursing facility (SNF) and large decreases in IRF payments.**

### 2.  Results

#### a.  All Episodes

Results strongly suggest that in PY 6–PY 7, the CJR Model led to a reduction in total per-episode payments. The estimated relative reduction of $975 (90% CI: -$2,002 to $52, $p = 0.12$), was driven by an estimated $533 (90% CI: -$1,007 to $11, $p = 0.11$) decrease in IRF payments (**Exhibit III-1**).

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[16]    Additional details of the outcome measures we analyzed can be found in **Appendix B: Data and Methods**.

**Exhibit III-1:    During PY 6–PY 7, for the All-LEJR Sample, a Reduction in Total Episode Payments was Driven by Reductions in IRF Payments**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| Total episode payments | -$975 | -3.4 | 0.12 | -$2,002 | $52 |
| SNF payments | -$137 | -2.3 | 0.66 | -$644 | $371 |
| IRF payments | -$533 | -24.3 | 0.11 | -$1,077 | $11 |
| HH payments[a] | $176 | 7.4 | 0.36 | -$143 | $496 |
| Readmission payments | -$134 | -11.4 | 0.17 | -$294 | $25 |
| Anchor payments | -$4 | -0.0 | 0.90 | -$55 | $48 |
| Other Part A payments | $48 | 38.6 | 0.23 | -$18 | $114 |
| Other Part B payments[a] | -$216 | -4.4 | 0.12 | -$443 | $10 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012 – December 31, 2014, that ended between April 1, 2012-March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:    The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]    Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

### b.   Elective Episodes

Findings for elective-only LEJRs were like the all-LEJR findings, which is expected given nearly 90% of the all-LEJR sample are elective LEJRs. In PY 6–PY 7, the CJR Model led to a reduction in total payments for elective LEJRs. The estimate of the reduction due to CJR was $1,172 (90% CI: -$2,342 to -$3, p = 0.10), driven by an estimated $413 (90% CI: -$815 to -$10, p = 0.09) decrease in IRF payments (**Exhibit III-2**). We also found a $251 (90% CI: -$494 to -$8, p = 0.09) reduction in other Medicare Part B payments however, there was substantial evidence that the CJR and control populations were on differential trends in the baseline period. As such, we do not interpret the estimate as a causal impact of the CJR Model, and we do not believe the CJR Model reduced other Part B payments.[17,18]

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[17]    Other Medicare Part B payments include payments for services such as OP PT/OT, imaging and lab services, and DME. See **Appendix B: Data and Methods** for more information.

[18]    See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more discussion of parallel trends.

**Exhibit III-2: During PY 6–PY 7, for the Elective-LEJR Sample, a Reduction in Total Episode Payments was Driven by Reductions in IRF Payments**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| **Total episode payments** | -$1,172 | -4.5 | 0.10 | -$2,342 | -$3 |
| **SNF payments** | -$333 | -8.0 | 0.22 | -$778 | $113 |
| **IRF payments** | -$413 | -25.1 | 0.09 | -$815 | -$10 |
| **HH payments**[a] | $185 | 7.8 | 0.38 | -$165 | $535 |
| **Readmission payments**[a] | -$128 | -13.6 | 0.16 | -$280 | $23 |
| **Anchor payments** | -$21 | -0.2 | 0.54 | -$79 | $37 |
| **Other Part A payments** | $31 | 53.5 | 0.17 | -$6 | $68 |
| **Other Part B payments**[a] | -$251 | -5.3 | 0.09 | -$494 | -$8 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012 – December 31, 2014, that ended between April 1, 2012-March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]   Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

### c.   Fracture Episodes

For the fracture population, the estimate of CJR's impact on total payments is small and statistically insignificant. This suggests the large impact estimated in the all-LEJR sample was driven by the model's effects on elective LEJRs. However, within the fracture sample, meaningful changes occurred in some of the payment components. We estimated a relative $1,431 increase (90% CI: $228 to $2,634, p = 0.05) in SNF payments, paired with a relative $1,205 decrease (90% CI: -$2,446 to $35, p = 0.11) in IRF payments (**Exhibit III-3**). Parallel trend analyses show substantial evidence that the CJR and control populations had different trends in the baseline period for these outcomes in ways that would lead to the SNF payment impact estimate being biased downwards (too small) and the IRF payment impact estimate being biased upwards (too large). This indicates that it is likely the true causal impact on SNF payments was larger than $1,431, while the true causal impact on IRF payments was smaller than a $1,205 reduction (that is, more negative).[19] Although we are not confident of the exact amounts, we believe there is strong evidence the CJR Model led to a substantial increase in SNF payments and a substantial decrease in IRF payments.

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[19]   See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more discussion of parallel trends.

**Exhibit III-3:** **During PY 6–PY 7, for the Fracture-LEJR Sample, There Were Large, Offsetting Changes in IRF and SNF Payments, Resulting in No Change for Total Payments**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| Total episode payments[a] | -$153 | -0.3 | 0.85 | -$1,465 | $1,159 |
| SNF payments[a] | $1,431 | 8.6 | 0.05 | $228 | $2,634 |
| IRF payments[a] | -$1,205 | -22.1 | 0.11 | -$2,446 | $35 |
| HH payments | -$22 | -0.9 | 0.76 | -$141 | $97 |
| Readmission payments | -$135 | -5.2 | 0.37 | -$383 | $114 |
| Anchor payments | $52 | 0.4 | 0.38 | -$47 | $151 |
| Other Part A payments | $97 | 17.1 | 0.47 | -$126 | $319 |
| Other Part B payments | -$25 | -0.4 | 0.85 | -$246 | $196 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012–December 31, 2014, that ended between April 1, 2012–March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

## B.  What Was the Impact of the CJR Model on Post-Acute Care Use?

The second set of results in this chapter addresses how the CJR Model affected PAC use for the CJR LEJR population. We analyzed the PAC setting that patients were first discharged to, as well as how frequently PAC settings were utilized throughout the 90-day episode. We present the results for the all-LEJR population, the elective population, and the fracture population.

### 1.  Summary of Findings

- **CJR hospitals decreased the proportion of patients first discharged to IRF for both elective and fracture LEJRs relative to control hospitals.**

- **CJR hospitals increased the proportion of patients first discharged home with home health (HH) for fracture LEJRs relative to control hospitals.**

## 2. *Results*

### a. *All Episodes*

The CJR Model led to a decrease in the proportion of patients first being discharged to an IRF (**Exhibit III-4**).[20] The estimate of the decrease is 3.70 percentage points (90% CI: -7.37 to -0.04, p = 0.10). Although we also estimated statistically significant changes in the proportion of patients being discharged home with HH, there is substantial evidence that the CJR and control groups were on differential trends in the baseline period for these outcomes. As such, we do not believe our DiD estimates for the proportion of patients being discharged home with HH are unbiased causal estimates of the impact of the CJR Model.[21] Last, while not statistically significant, there is some evidence the CJR Model led to a decrease in the proportion of patients first being discharged home with outpatient physical therapy or occupational therapy (OP PT/OT). Note, as many of the same services are provided under OP PT/OT and HH, it is likely some of the observed changes in utilization occurred due to substitutions between HH use and OP PT/OT use. In this scenario, it is likely patients would be receiving physical therapy in either setting.

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[20] See **Appendix B: Data and Methods** for complete definitions of all outcomes, including the first discharge destination outcomes.

[21] See **Appendix D: Additional Findings** for more discussion of parallel trends.

**Exhibit III-4:    During PY 6–PY 7, for the All-LEJR Sample, CJR Hospitals Shifted Away from Discharging Patients First to IRF**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| **First PAC SNF** [a] | -1.34 pp | -3.2 | 0.53 | -4.83 pp | 2.15 pp |
| **First PAC IRF** | -3.70 pp | -27.1 | 0.10 | -7.37 pp | -0.04 pp |
| **First PAC HH** [a] | 11.79 pp | 32.7 | 0.02 | 3.40 pp | 20.18 pp |
| **First PAC OP PT/OT** | -4.31 pp | -76.1 | 0.12 | -8.91 pp | 0.28 pp |
| **First PAC home without HH or OP PT/OT** | -2.44 pp | -91.0 | 0.22 | -5.67 pp | 0.80 pp |
| **SNF days** [a] | 0.5 | 1.9 | 0.53 | -0.9 | 1.9 |
| **IRF days** | 0.0 | 0.1 | 0.98 | -0.5 | 0.5 |
| **HH visits** [a] | -0.5 | -3.1 | 0.39 | -1.5 | 0.5 |
| **Any HH use** [a] | 8.35 pp | 11.4 | 0.18 | -1.99 pp | 18.69 pp |
| **Outpatient PT/OT visits** | 0.1 | 1.2 | 0.76 | -0.7 | 1.0 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:    The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]    Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

### b.   *Elective Episodes*

Similar to the all-LEJR sample, the CJR Model led to a reduction in the proportion of patients in elective LEJR episodes who were initially discharged to an IRF (**Exhibit III-5**). The estimate of the decrease is 3.08 percentage points (90% CI: -6.09 to -0.06, p = 0.09). We also estimated a statistically significant change in the proportion of patients discharged home with HH; however, again there was substantial evidence that the CJR and control groups were on different trends in the baseline period for these outcomes. Thus, we do not believe these DiD estimates are an unbiased causal estimate of the impact of the CJR Model.[22]

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[22]    See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more discussion of parallel trends.

**Exhibit III-5: During PY 6–PY 7, for the Elective-LEJR Sample, CJR Hospitals Shifted Away from Discharging Patients First to IRF**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| **First PAC SNF** [a] | -2.33 pp | -6.0 | 0.35 | -6.39 pp | 1.74 pp |
| **First PAC IRF** | -3.08 pp | -26.8 | 0.09 | -6.09 pp | -0.06 pp |
| **First PAC HH** [a] | 13.21 pp | 32.4 | 0.02 | 4.04 pp | 22.39 pp |
| **First PAC OP PT/OT** | -4.94 pp | -77.1 | 0.13 | -10.25 pp | 0.37 pp |
| **First PAC home without HH or OP PT/OT** | -2.87 pp | -101.0 | 0.19 | -6.47 pp | 0.73 pp |
| **SNF days** | -0.4 | -2.0 | 0.59 | -1.7 | 0.8 |
| **IRF days** | 0.1 | 0.6 | 0.79 | -0.3 | 0.5 |
| **HH visits** [a] | -0.6 | -3.9 | 0.34 | -1.7 | 0.5 |
| **Any HH use** [a] | 9.76 pp | 13.2 | 0.17 | -2.01 pp | 21.53 pp |
| **Outpatient PT/OT visits** | 0.1 | 0.9 | 0.81 | -0.7 | 1.0 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

### c. Fracture Episodes

In PY 6–PY 7, the CJR Model increased the proportion of patients initially discharged home with HH by an estimated 3.51 percentage points (90% CI: 1.24 to 5.78, p = 0.01). There is also strong evidence that the CJR Model contributed to a substantial decrease in the proportion of patients discharged to IRFs and an increase in discharges to SNFs. However, violations of the parallel trends assumption limit the ability to precisely quantify the magnitude of these effects.[23]

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[23] We also estimated a nearly-statistically significant change in the percentage of patients being discharged to an IRF, but there was substantial evidence that the CJR and control groups were on differential trends for this outcome (**Exhibit III-6**). Additionally, there was substantial evidence that the CJR and control groups were on differential trends for the proportion of patients first discharged to a SNF in the baseline period. However, as was the case with SNF and IRF payments for the fracture population, it is likely the true causal impact on first being discharged to an IRF was smaller (that is, more negative) than the estimated -5.46 percentage points, while the true causal impact on being discharged to a SNF was larger than the estimate 1.82 percentage points. See **Appendix D: Additional Findings** for more discussion of parallel trends.

**Exhibit III-6:    During PY 6–PY 7, for the Fracture-LEJR Sample, There Was a Large Shift Toward Patients First Discharged Home with Home Health**

| Measure | Impact (DiD) | Impact as a percent (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| First PAC SNF [a] | 1.82 pp | 2.8 | 0.48 | -2.44 pp | 6.09 pp |
| First PAC IRF [a] | -5.46 pp | -19.9 | 0.13 | -11.35 pp | 0.43 pp |
| First PAC HH | 3.51 pp | 65.7 | 0.01 | 1.24 pp | 5.78 pp |
| First PAC OP PT/OT | 0.03 pp | 2.9 | 0.91 | -0.35 pp | 0.41 pp |
| First PAC home without HH or OP PT/OT [a] | 0.10 pp | 7.5 | 0.81 | -0.58 pp | 0.78 pp |
| SNF days [a] | 1.8 | 4.3 | 0.11 | -0.1 | 3.8 |
| IRF days | -0.1 | -0.9 | 0.68 | -0.7 | 0.4 |
| HH visits | 0.1 | 0.7 | 0.78 | -0.7 | 1.0 |
| Any HH use | -1.35 pp | -1.9 | 0.21 | -3.11 pp | 0.42 pp |
| Outpatient PT/OT visits | 0.5 | 4.4 | 0.27 | -0.2 | 1.2 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:    The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = lower extremity joint replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]    Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See **Appendix B: Data and Methods** and **Appendix D: Additional Findings** for more details on parallel trend analyses.

## C.   What Was the Impact of the CJR Model on Quality of Care?

The third set of results in this chapter addresses how the CJR Model affected the quality of care for patients receiving an LEJR. We analyzed quality of care through claim-based measures of unplanned readmission rates, emergency department (ED) use, mortality rates, and complication rates.[24]

### 1.   Summary of Findings

- **The CJR Model did not lead to changes in quality of care.**

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[24]    Additional details of the outcome measures we analyzed can be found in **Appendix B: Data and Methods**.

### 2.    Results

#### a.    All Episodes

The CJR Model did not lead to changes in quality of care for any of the four quality of care claims-based outcomes in the all-LEJR sample (**Exhibit III-7**).

**Exhibit III-7:    During PY 6–PY 7, for the All-LEJR Sample, Quality of Care Did Not Change**

| Measure | Impact (DiD; pp) | Impact as a percent (%) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|
| Unplanned readmission rate | -0.39 | -4.0 | 0.23 | -0.94 | 0.15 |
| ED use rate | 0.20 | 1.6 | 0.63 | -0.49 | 0.88 |
| Mortality rate | -0.06 | -2.6 | 0.58 | -0.24 | 0.12 |
| Complication rate | -0.20 | -5.1 | 0.27 | -0.50 | 0.10 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*    The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = lower extremity joint replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

#### b.    Elective Episodes

The CJR Model did not lead to changes in quality of care for any of the four quality of care outcomes in the elective sample (**Exhibit III-8**).

**Exhibit III-8:    During PY 6 and PY7, for the Elective-LEJR Sample, Quality of Care Did Not Change**

| Measure | Impact (DiD; pp) | Impact as a percent (%) | p-value (pp) | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|
| Unplanned readmission rate | -0.27 | -3.3 | 0.33 | -0.72 | 0.18 |
| ED use rate | 0.36 | 3.0 | 0.41 | -0.35 | 1.06 |
| Mortality rate | -0.05 | -9.4 | 0.29 | -0.12 | 0.03 |
| Complication rate | -0.18 | -6.1 | 0.26 | -0.45 | 0.09 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*    The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = lower extremity joint replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

### c.   *Fracture Episodes*

The CJR Model did not lead to changes in quality of care for any of the four quality of care outcomes in the fracture sample (**Exhibit III-9**). Although the CJR Model led to fewer IRF discharges and greater discharges to HH and SNF for fracture episodes, these changes in care settings did not appear to affect quality of care.

**Exhibit III-9:   During PY 6–PY 7, for the Fracture-LEJR Sample, Quality of Care Did Not Change**

| Measure | Impact (DiD; pp) | Impact as a percent (%) | p-value (pp) | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|
| **Unplanned readmission rate** | -1.11 | -5.2 | 0.24 | -2.66 | 0.45 |
| **ED use rate** | -0.63 | -3.6 | 0.45 | -2.01 | 0.74 |
| **Mortality rate** | -0.07 | -0.6 | 0.91 | -1.06 | 0.91 |
| **Complication rate** | -0.26 | -2.6 | 0.60 | -1.09 | 0.57 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:   The estimates in this exhibit are the result of a DiD model. Impacts as percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is located in **Appendix D: Additional Findings**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = lower extremity joint replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

## D.   What Was the Impact of the CJR Model on Patients Dually Eligible for Medicare and Medicaid?

As implemented in 2016, the CJR Model did not contain any explicit model design considerations to treat patients who were dually eligible for Medicare and Medicaid; however, it is possible that the same model design could lead to different impacts based on the unique needs of this population. To study the impact of the CJR Model on patients who were dually eligible we examined (1) differences in health outcomes experienced by patients who were dually eligible compared to patients who were not dually eligible; and (2) whether CJR impacted those differences.

Our approach benchmarks the outcomes of patients who were dually eligible against those who were not dually eligible. Because patients who were dually eligible may have different health conditions and health care needs compared to patients who were not dually eligible, the CJR model may affect these groups differently. If the model leads to changes that bring the health outcomes of the two groups closer together, the estimated impact may differ between them. As a result, it can be difficult to interpret the differences—or changes in those differences—between the two populations without knowing the "optimal" level of the outcome for either group.

For both patients who were dually eligible for Medicare and Medicaid, and patients who were not dually eligible, we studied unadjusted outcome levels and model impacts on various outcomes, including cost, quality, and utilization.

Our claims-based impact analyses consider only elective LEJRs. We originally performed separate analyses for elective LEJRs and fracture LEJRs to assess model impact—however, the sample size available for patients who were dually eligible for Medicare and Medicaid and had fracture LEJRs was insufficient to provide results which were informative. As a result, we omitted those results from this report.

## 1.  Summary of Findings

- **Across all outcome measures, in both baseline and intervention, patients who were dually eligible had less favorable results compared to patients that were not dually eligible.**

- **The CJR Model likely reduced average episode payments for both dually eligible and not dually eligible populations. Estimated reductions were statistically significant for patients who were dually eligible, and larger relative to patients who were not dually eligible.**

- **The estimated payment reductions for patients who were dually eligible were primarily driven by changes in PAC discharge destination. The dually eligible population had larger estimated decreases in first PAC discharges to IRF and SNF relative to the non-dually eligible population.**

- **Evidence suggests that CJR increased ED use for patients who were dually eligible, though the increase was not statistically significant.**

## 2.  Results

Patients who were dually eligible for Medicare and Medicaid had substantially different outcomes in the baseline and the intervention periods compared to patients who were not dually eligible–particularly in terms of episode payments, ED use, and SNF Days (**Exhibit III-10**).

**Exhibit III-10:  Patients who were Dually Eligible for Medicare and Medicaid had Substantially Different Average Outcomes in Both the Baseline and in PY 6–PY 7 Compared to Patients who were Not Dually Eligible**

| Dual Eligibility Status | Baseline Episode Payments | PY 6–PY 7 Episode Payments | Baseline ED Use (%) | PY 6–PY 7 ED Use (%) | Baseline SNF Days | PY 6–PY 7 SNF Days |
|---|---|---|---|---|---|---|
| **Dually Eligible** | $30,529 | $26,254 | 19.1 | 17.5 | 26.5 | 28.4 |
| **Not Dually Eligible** | $25,321 | $21,281 | 11.2 | 11.6 | 18.6 | 19.0 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated at CJR hospitals between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*  Unadjusted averages for episode payments, ED use rates during an episode, and SNF Days during the baseline and during PY 6–PY 7. ED = emergency department; PY = performance year; SNF = skilled nursing facility.

Moreover, patients who were dually eligible tended to be more clinically complex. For example, they had higher average hierarchical condition category (HCC) scores, a greater proportion of fracture episodes, and higher incidence of diabetes and obesity compared to patients who were not dually eligible.

### a.   Did the CJR Model Impact the LEJR Cost, Utilization, and Quality Outcomes for Patients who were Dually Eligible?

In addition to average episode payments, we studied three groups of claims outcomes: quality measures, first PAC discharge destination, and PAC utilization measures.

To analyze the impact of the CJR Model on payments, utilization, and quality for dually eligible populations, we used a DDD approach. The DDD approach for cost, utilization, and quality outcomes generated three estimates for each outcome:

1.   Estimated model impact for patients who were dually eligible

2.   Estimated model impact for patients who were not dually eligible

3.   Estimate of the difference between the impacts (the differential impact)

The differential impact is interpreted as the impact of the CJR Model on the baseline differences in risk-adjusted outcome levels between the two populations. For more details on the DDD approach, see **Appendix B**.

### b.   Differential Impact for Total Episode Payments

The CJR Model likely reduced total episode payments for both studied populations (**Exhibit III-11**). Patients who were dually eligible had an estimated reduction in total episode payments of $1,596 (90% CI: -$3,070 to -$122, p = 0.08), which was $510 (90% CI: $169 to $1,189, p = 0.21) larger than the reduction experienced by patients who were not dually eligible. Patients who were dually eligible had higher average episode payments in the baseline, and they continued to have higher average episode payments in the combined PY 6–PY 7 intervention period despite the greater reduction in payments.

**Exhibit III-11: The CJR Model Likely Reduced Total Episode Payments for Elective LEJR Episodes for Both Dually Eligible and Non-Dually Eligible Populations, but Reduced Total Episode Payments More for Patients who were Dually Eligible for Medicare and Medicaid**

| Dual Eligibility Status | Impact (DiD) | p-value (DiD) | 90% LCI (DiD) | 90% UCI (DiD) | Differential Impact (DDD) | p-value (DDD) | 90% LCI (DDD) | 90% UCI (DDD) |
|---|---|---|---|---|---|---|---|---|
| Dually Eligible | -$1,596 | 0.08 | -$3,070 | -$122 | -$510 | 0.21 | -$1,189 | $169 |
| Not Dually Eligible | -$1,086 | 0.12 | -$2,248 | $77 | | | | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. The estimates were calculated using the unadjusted means. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and unadjusted means, is located in **Appendix D: Additional Findings** and outcome definitions are in **Appendix B: Data and Methods.** DDD = difference-in-difference-in-differences; DiD = difference-in-differences; LCI = lower confidence interval; UCI = upper confidence interval.

### c.   *Differential Impact for Quality and PAC Utilization*

Patients who were dually eligible for Medicare and Medicaid had estimated decreases in IRF and SNF discharge rates that were slightly larger than the decreases for patients who were not dually eligible, but neither the IRF nor SNF differential impact was statistically significant (**Exhibit III-12**). The model led to a nearly statistically significant decrease in the IRF discharge rate of 2.94 percentage points (90% CI: -5.91 to 0.02, p = 0.10) for patients who were not dually eligible. The decrease for patients who were dually eligible was larger but failed to achieve statistical significance, which was expected given the much smaller sample of episodes.[25]

Both patients who were dually eligible and patients who were not dually eligible had large and statistically significant increases for discharge to home with home health. Patients who were dually eligible had an estimated increase of 11.89 percentage points (90% CI: 5.2 to 18.5, p < 0.01), and patients who were not dually eligible had an estimated increase of 13.13 percentage points (90% CI: 3.7 to 22.5, p = 0.02). The differential impact was small and not statistically significant.

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[25]   Smaller samples reduce the power of statistical analysis to "detect" impacts in the sense of finding statistically significant results. This is because standard error increases as sample size decreases.

**Exhibit III-12: Patients who were Dually Eligible Had a Statistically Significant Increase in First Discharge Home with Home Health, but No Significantly Different Impact Existed Relative to Patients who were Not Dually Eligible**

| First PAC discharge | Dual Eligibility Status | Impact (DiD; pp) | p-value (DiD) | 90% LCI (DiD; pp) | 90% UCI (DiD; pp) | Differential Impact (DDD; pp) | p-value (DDD) | 90% LCI (DDD; pp) | 90% UCI (DDD; pp) |
|---|---|---|---|---|---|---|---|---|---|
| SNF | Dually Eligible | -3.78 | 0.21 | -8.72 | 1.17 | -1.65 | 0.34 | -4.47 | 1.17 |
| | Not Dually Eligible | -2.13 | 0.39 | -6.17 | 1.91 | | | | |
| IRF | Dually Eligible | -3.91 | 0.13 | -8.18 | 0.36 | -0.97 | 0.50 | -3.33 | 1.39 |
| | Not Dually Eligible | -2.94 | 0.10 | -5.91 | 0.02 | | | | |
| Home health | Dually Eligible | 11.89 | <0.01 | 5.23 | 18.54 | -1.25 | 0.69 | -6.42 | 3.92 |
| | Not Dually Eligible | 13.13[a] | 0.02 | 3.73 | 22.53 | | | | |
| OP PT/OT | Dually Eligible | -2.31 | 0.37 | -6.54 | 1.92 | 2.90 | 0.33 | -2.03 | 7.82 |
| | Not Dually Eligible | -5.21 | 0.12 | -10.77 | 0.35 | | | | |
| Home without HH or OP PT/OT | Dually Eligible | -1.89 | 0.22 | -4.40 | 0.63 | 0.96 | 0.48 | -1.29 | 3.22 |
| | Not Dually Eligible | -2.85 | 0.20 | -6.53 | 0.84 | | | | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. The estimates were calculated using the unadjusted means. DDD estimates that are significant at the 1%, 5% or 10% significance levels are indicated by red, orange, yellow shaded cells, respectively. A full table of results, including sample counts and unadjusted means, is located in **Appendix D: Additional Findings** and outcome definitions are in **Appendix B: Data and Methods.**
CJR = Comprehensive Care for Joint Replacement; DDD = difference-in-difference-in-differences; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; OP = outpatient; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] The sample for this estimate failed tests for parallel trends in the baseline period.

Neither population had statistically significant estimates for home health visits, SNF length of stay, or IRF length of stay (**Exhibit III-13**).

**Exhibit III-13: Patients who were Dually Eligible Had a Decrease in SNF Length of Stay, but the Decrease Was Not Statistically Significant**

| PAC utilization | Dual Eligibility Status | Impact (DiD) | p-value (DiD) | 90% LCI (DiD) | 90% UCI (DiD) | Differential Impact (DDD) | p-value (DDD) | 90% LCI (DDD) | 90% UCI (DDD) |
|---|---|---|---|---|---|---|---|---|---|
| SNF Days | Dually Eligible | -0.8[a] | 0.51 | -2.8 | 1.2 | -0.4 | 0.71 | -2.1 | 1.3 |
| | Not Dually Eligible | -0.4 | 0.57 | -1.6 | 0.8 | | | | |
| IRF Days | Dually Eligible | 0.1 | 0.85 | -0.8 | 1.1 | 0.0 | 0.94 | -0.9 | 1.0 |
| | Not Dually Eligible | 0.1 | 0.79 | -0.4 | 0.5 | | | | |
| HH Visits | Dually Eligible | 0.4[a] | 0.67 | -1.1 | 1.8 | 1.1 | 0.29 | -0.6 | 2.7 |
| | Not Dually Eligible | -0.7[a] | 0.31 | -1.8 | 0.4 | | | | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. The estimates were calculated using the unadjusted means. DDD estimates that are significant at the 1%, 5% or 10% significance levels are indicated by red, orange, yellow shaded cells, respectively. A full table of results, including sample counts and unadjusted means, is located in **Appendix D: Additional Findings** and outcome definitions are in **Appendix B: Data and Methods.**
CJR = Comprehensive Care for Joint Replacement; DDD = difference-in-difference-in-differences; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; PAC = post-acute care; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] The sample for this estimate failed tests for parallel trends in the baseline period.

The CJR Model maintained quality for both patients who were and were not dually eligible (**Exhibit III-14**). There is some evidence that the model could have increased ED visits for patients who were dually eligible by almost 2 percentage points, but the estimates for both patients who were dually eligible and patients who were not dually eligible were not statistically significant.

**Exhibit III-14: Patients who were Dually Eligible had Estimated Decreases in their Mortality Rates and Readmission Rates and an Estimated Increase in ED Use, but These Estimates were Not Statistically Significant**

| Measure | Dual Eligibility Status | Impact (DiD; pp) | p-value (DiD) | 90% LCI (DiD; pp) | 90% UCI (DiD; pp) | Differential Impact (DDD; pp) | p-value (DDD) | 90% LCI (DDD; pp) | 90% UCI (DDD; pp) |
|---|---|---|---|---|---|---|---|---|---|
| Mortality Rate | Dually Eligible | -0.09 | 0.63 | -0.38 | 0.21 | -0.04 | 0.84 | -0.34 | 0.27 |
|  | Not Dually Eligible | 0.05 | 0.27 | -0.12 | 0.02 |  |  |  |  |
| ED use | Dually Eligible | 1.96 | 0.15 | -0.26 | 4.17 | 1.75 | 0.17 | -0.35 | 3.84 |
|  | Not Dually Eligible | 0.21 | 0.60 | -0.44 | 0.86 |  |  |  |  |
| Readmission rate | Dually Eligible | -0.17 | 0.82 | -1.39 | 1.06 | 0.17 | 0.81 | -1.03 | 1.37 |
|  | Not Dually Eligible | -0.34 | 0.28 | -0.85 | 0.18 |  |  |  |  |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. The estimates were calculated using the unadjusted means. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, yellow shaded cells, respectively.

A full table of results, including sample counts and unadjusted means, is located in **Appendix D: Additional Findings** and outcome definitions are in **Appendix B: Data and Methods.** CJR = Comprehensive Care for Joint Replacement; DDD = difference-in-difference-in-differences; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; pp = percentage point; UCI = upper confidence interval.

[a] The sample for this estimate failed tests for parallel trends in the baseline period.

## IV.   Medicare Program Savings

Medicare achieved savings under the Comprehensive Care for Joint Replacement (CJR) Model when the reductions in episode payments at CJR hospitals exceeded the net reconciliation payments made from CMS to CJR hospitals. Over the first five performance years (PYs), the CJR Model resulted in overall estimated losses to Medicare. However, these losses were driven by voluntary participant hospitals, who are no longer participants, and flexibilities offered during the COVID-19 PHE,

| Acronyms | |
|---|---|
| **CJR** | Comprehensive Care for Joint Replacement |
| **DiD** | difference-in-differences |
| **HCC** | hierarchical condition category |
| **LCI** | lower confidence interval |
| **LEJR** | lower extremity joint replacement |
| **M** | million |
| **MS-DRG** | Medicare Severity-Diagnosis Related Group |
| **NPRA** | Net Payment Reconciliation Amount |
| **PY** | performance year |
| **SNH** | safety-net hospital |
| **UCI** | upper confidence interval |

which have expired. The CJR Model Evaluation's Fifth Annual Report presents detailed results for previous PYs of the CJR Model.

CMS made substantial changes to the CJR Model for the extension period (PY 6 through PY 8) that may have improved the model's ability to generate savings:

1.   The model required all voluntary CJR hospitals to cease participation at the start of PY 6. The remaining hospitals had higher estimated savings in the first four PYs.

2.   CMS added outpatient lower extremity joint replacements (LEJRs) to the model as episodes.

3.   CMS added episode-level risk-adjustment to target prices, allowing the MS-DRG-specific target price for individual episodes to vary based on patient age, dual eligibility status, and count of existing medical conditions as measured by HCCs.

4.   CMS made changes to the calculation of target prices, incorporating a market trend adjustment and using only the most recently available year of past data.

Target prices for PY 7 episodes were calculated using 2021 as the base period. Thus, target prices for PY 7 incorporated payment reductions achieved by hospitals in 2021.

This chapter presents estimated Medicare Savings for PY 6 and 7, which includes episodes that ended between October 1, 2021, and December 31, 2023. In addition to Medicare Savings estimates, we report results from analyses of reconciliation payments and repayments[26]. All our analyses were based on CJR participants required to participate during the model extension period.

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[26]   Reconciliation payments are payments made from CMS to hospitals when those hospitals achieve average episode spending below their target price. Repayments are payments made from hospitals to CMS when those hospitals have average episode spending above their target price.

### After Accounting for Reconciliation Payments, Did the CJR Model Result in Medicare Savings?

#### 1. Summary of Findings

- **The CJR Model resulted in estimated savings of $112.7 million (M) across PYs 6–7.**

- **The CJR Model resulted in estimated savings of $58.8 M in PY 7, continuing a pattern of savings from PY 6.**

- **The distribution of net payment reconciliation amounts and repayments across hospitals in PY7 was uneven, with the top 10% of hospitals receiving $16.3 M and the bottom 10% repaying $21.1 M.**

- **PY 7 had substantially higher repayments from hospitals to CMS than PY 6. The increase in repayments compared to PY 6 was driven by relatively small repayments owed on a large volume of episodes across hospitals, rather than by high repayments from specific kinds of episodes or hospitals.**

#### 2. Results

##### a. Medicare Program Savings in PY 6–7

We estimated Medicare program savings by estimating the reduction in Medicare payments caused by the CJR Model and subtracting from that amount the total net payment reconciliation amounts (NPRA) made by CMS to participant hospitals. For more detail on the methods involved in this analysis, refer to **Appendix B**.

Cumulatively, across PY 6–PY 7, we estimate that CJR reduced Medicare payments by $914 per episode with average repayments from hospitals to CMS of $228 per episode, amounting to estimated savings of $1,142 per episode (**Exhibit IV-1**). Total estimated savings across PY 6–PY 7 was $112.7 M. Accounting for the uncertainty in the estimated reduction in Medicare payments, savings were likely between $211.6 M and $13.9 M.

**Exhibit IV-1:   Across PYs 6–7, CJR Hospitals Generated an Estimated $112.7 M in Medicare Savings**

| Savings component | Value | 90% LCI | 90% UCI |
|---|---|---|---|
| Reduction in nonstandardized paid amounts per episode | $914 | -$87 | $1,915 |
| Repayments to CMS per episode | $228 | N/A | N/A |
| Medicare savings per episode | $1,142 | $141 | $2,143 |
| Number of PY 6 and PY 7 episodes | 98,744 | N/A | N/A |
| Aggregate Medicare savings | $112.7 M | $211.6 M | $13.8 M |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention) as well as CJR payment contractor data for CJR participant hospitals in PYs 6–7.

*Notes*:   Reductions in nonstandardized paid amounts are based on estimates from a DiD model of per-episode standardized paid amounts that have been multiplied by –1 and converted to nonstandardized amounts. We do not report confidence intervals for repayments per episode and number of PY 7 episodes because these were not estimated but observed with certainty. We calculated aggregate Medicare savings by multiplying Medicare savings per episode by the number of PY 7 episodes. Medicare savings per episode equals the estimated reduction in nonstandardized paid amounts per episode plus the average repayments per episode. The range reported for Medicare savings is based on the 90% confidence interval for the reduction in episode spending. CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; DiD = difference-in-differences; LCI = lower confidence interval; M = million; N/A = not applicable; PY = performance year; UCI = upper confidence interval.

Cumulative savings estimates over multiple years can mask large changes from year to year, so we also estimate performance year-specific savings. In PY 7 alone, the CJR Model resulted in estimated Medicare savings of $58.8 M. Accounting for uncertainty in the estimated reduction in Medicare payments, savings were likely between $10.3 M and $107.3 M (**Exhibit IV-2**). On average, this amounts to $1,295 in savings per episode–composed of an estimated reduction in episode payments of $891 and a per-episode repayment of $404. PY 7 is the second PY after PY 6 in which the average episode resulted in repayments. Repayments grew substantially on a per-episode basis to $404 in PY 7, compared to $78 in PY 6.

**Exhibit IV-2:   During PY 7, CJR Hospitals Generated an Estimated $58.8 M in Medicare Savings**

| Savings component | Value | 90% LCI | 90% UCI |
|---|---|---|---|
| **Reduction in nonstandardized paid amounts per episode** | $891 | -$178 | $1,959 |
| **Repayments to CMS per episode** | $404 | N/A | N/A |
| **Medicare savings per episode** | $1,295 | $226 | $2,363 |
| **Number of PY 7 episodes** | 45,428 | N/A | N/A |
| **Aggregate Medicare savings** | $58.8 M | $10.3 M | $107.3 M |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between January 1, 2023, and December 31, 2023 (PY 7 intervention) as well as CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes*:   Reductions in nonstandardized paid amounts are based on a estimates from a DiD model of per-episode standardized paid amounts that have been multiplied by –1 and converted to nonstandardized amounts. We do not report confidence intervals for repayments per episode and number of PY 7 episodes because these were not estimated but observed with certainty. We calculated aggregate Medicare savings by multiplying Medicare savings per episode by the number of PY 7 episodes. Medicare savings per episode equals the estimated reduction in nonstandardized paid amounts per episode plus the average repayments per episode. The range reported for Medicare savings is based on the 90% confidence interval for the reduction in episode spending. CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; DiD = difference-in-differences; LCI = lower confidence interval; M = million; N/A = not applicable; PY = performance year; UCI = upper confidence interval.

### b.   Distribution of NPRA

In addition to estimating Medicare Savings, we analyzed the distribution of NPRA across hospitals. PY 7 is the second consecutive year in which the average episode generated repayment obligations for hospitals, and cumulative repayments in PY 7 ($404 per episode) were substantially larger than in PY 6 ($78 per episode).

In prior evaluation reports, we found that NPRA varied widely across hospitals, and PY 7 was no different. The top 10% of hospitals received reconciliation payments totaling $16.3 M in PY 7, while the bottom 10% of hospitals made repayments totaling $21.1 M (**Exhibit IV-3**). In general, the distribution mirrors that of earlier PYs, but with a shift towards greater repayments.

**Exhibit IV-3:   In PY 7, the Top 10% of CJR Hospitals Had Large Gains in Total NPRA, While the Bottom 10% Had Large Losses**
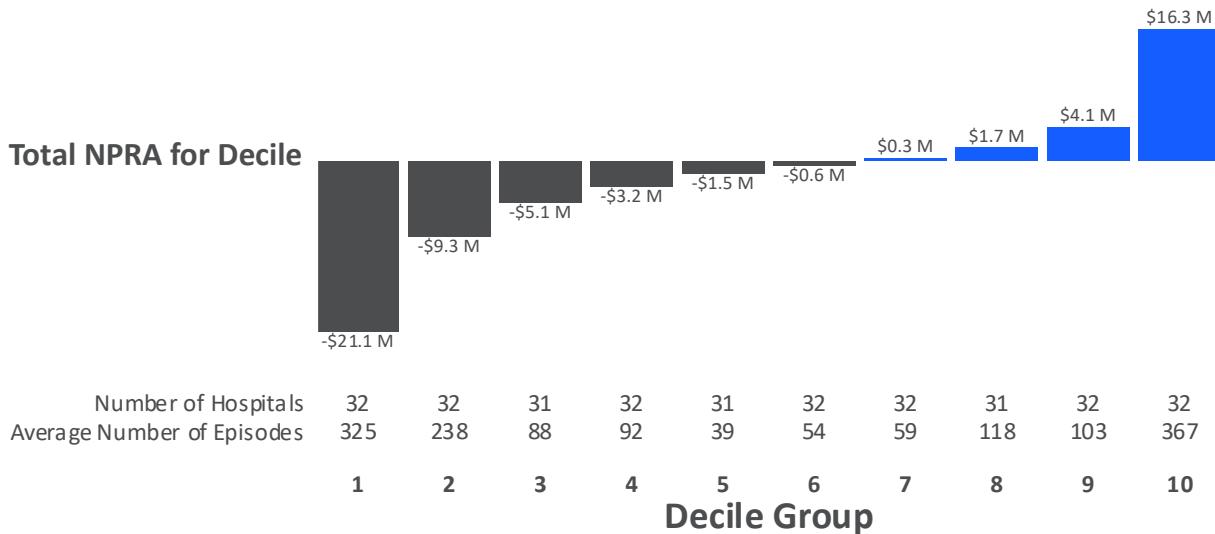


| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of Hospitals | 32 | 32 | 31 | 32 | 31 | 32 | 32 | 31 | 32 | 32 |
| Average Number of Episodes | 325 | 238 | 88 | 92 | 39 | 54 | 59 | 118 | 103 | 367 |

**Decile Group**

*Source:*   CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes*:   Distribution of total NPRA across hospital deciles. Decile 10 contains the top 10% of PY 7 participant hospitals in terms of NPRA receipt, while decile 1 contains the bottom 10% of PY 7 participant hospitals in terms of NPRA receipt. Text adjacent to each bar indicates the cumulative reconciliation received by hospitals in that decile. Text at the bottom of the figure indicates number of hospitals in each decile and the average number of PY 7 LEJR episodes for hospitals in that decile. CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; M = million; NPRA = net payment reconciliation amounts; PY = performance year.

Approximately 60% of hospitals owed repayments in PY 7, slightly more than in any prior PY. Before PY 7, PY 4 had the highest proportion of hospitals owing repayments, with a share nearly as large as that in PY 7. However, hospitals that earned reconciliation in PY 4 earned dramatically more than in PY 7. This continued a trend that began in PY 6, where the top deciles of hospitals received substantially less reconciliation than during the first five years of the model.

Hospitals in the top 30% of the NPRA distribution in PY 7 were, relative to hospitals in the bottom 30%, less likely to be safety-net hospitals (SNHs) (**Exhibit IV-4**). The LEJR volume in PY 7 was similar for both groups. Hospitals in the top 30% were more likely to have an 'Excellent' quality rating and less likely to have a 'Below Acceptable' quality rating[27]. However, as quality ratings determine the quality discount in target prices, this is unsurprising–all else equal, a hospital with a lower quality rating will receive less NPRA.

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[27]   This result is mechanical – hospitals that receive a "Below Acceptable" rating cannot receive reconciliation payments even if their average spending is below their average target price, hence no hospitals in the top 30% have a "Below Acceptable" rating.

**Exhibit IV-4:    High-NPRA Hospitals in PY 7 Were Less Likely to be Safety-Net Hospitals and Moderately More Likely to Have Excellent or Good Quality Ratings**

| Outcome | Hospitals in the bottom 30% | | Hospitals in the top 30% | |
|---|---|---|---|---|
| **Average NPRA in PY 7** | $373,673 repayment per hospital | | $232,501 reconciliation per hospital | |
| **Average number of PY 7 LEJR episodes** | 218 | | 197 | |
| **Number (%) defined as safety-net hospitals** | 27 (28.4%) | | 15 (15.8%) | |
| **Composite quality ratings** | Excellent | 8.4% | Excellent | 18.9% |
| | Good | 67.4% | Good | 69.5% |
| | Acceptable | 10.5% | Acceptable | 11.6% |
| | Below acceptable | 13.7% | Below acceptable | 0.0% |
| **Average composite quality discount** | 1.7% | | 1.4% | |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between January 1, 2023, and December 31, 2023 (PY 7), CJR payment contractor data for CJR participant hospitals in PY 7, and CMMI data identifying SNHs.

*Notes:*    The top and bottom 30% of hospitals in the PY 6 NPRA distribution each comprise 95 hospitals. CMMI = Center for Medicare & Medicaid Innovation; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; NPRA = net payment reconciliation amounts; PY = performance year; SNH = safety-net hospital.

We also studied hospitals that have consistently owed repayments or received reconciliation payments over the course of the model. Only a minority of hospitals satisfy these criteria, but there are notable differences between hospitals that have consistently owed repayments and those that have consistently received reconciliation payments.

Hospitals that consistently owed repayments have higher average bed counts, but lower average LEJR volume, suggesting that they are larger hospitals for whom the LEJR service line is of limited importance. By contrast, hospitals that have consistently earned reconciliation payments are smaller in terms of bed count but performed more than five times as many LEJRs in PY 7– suggesting that they are more likely to be hospitals that specialize in LEJRs (**Exhibit IV-5**).

**Exhibit IV-5:    Hospitals that Have Consistently Owed Repayments Tended to Have More Beds but Substantially Fewer Episodes Compared to Hospitals that Have Consistently Earned Reconciliation**

| Outcome | Hospitals that consistently owed repayments | Hospitals that consistently received reconciliation |
|---|---|---|
| Number of hospitals | 18 | 40 |
| Average bed count | 311 | 210 |
| Average PY 7 episodes | 48 | 252 |
| Average PY 7 NPRA | -$164,064 | $334,343 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between January 1, 2023, and December 31, 2023 (PY 7), CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes:*    Hospitals that consistently owed repayments are hospitals which owed nonzero repayments in every performance year except PY 1 (downside risk was waived for all hospitals in PY 1). Hospitals that consistently received reconciliation are hospitals which received nonzero reconciliation payments in every performance year. CJR = Comprehensive Care for Joint Replacement; NPRA = net payment reconciliation amounts; PY = performance year.

We also examined how hospitals performed relative to their target price in proportional terms, which is a proxy for how "achievable" their target price was. On a per-episode basis, a plurality of hospitals had average episode spending within 5% of their average target price (**Exhibit IV-6**). However, compared to PY 6, a larger proportion of hospitals had average episode spending more than 5% removed from their average target price. Compared to PY 6, a smaller proportion of hospitals in PY 7 'beat' their target price by more than 5% and a larger proportion of hospitals exceeded their target price by more than 5%. Overall, this suggests that increased repayments in PY 7 were driven by the average target price for hospitals being a more difficult target, driving slightly reduced NPRA on a per-episode basis across a large volume of episodes.

**Exhibit IV-6:    Hospitals in the Bottom 30% of Total NPRA were Evenly Distributed Among Hospitals who Exceeded Their Average Target Price**
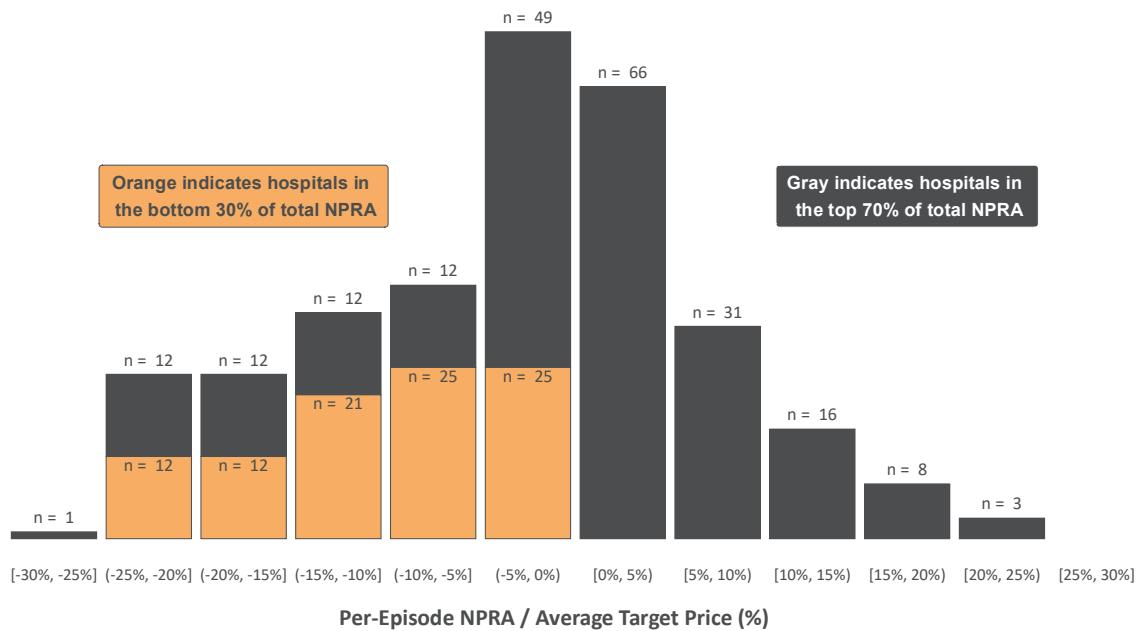


*Source:*   CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes:*   We calculated for each hospital the ratio of per-episode NPRA and average target price, a proxy for quality-adjusted average episode spending. The figure plots a histogram of hospitals based on this value. Positive values on the X axis reflect hospitals that had positive per-episode NPRA–indicating that they had average episode spending below their target price. Negative values on the X axis reflect hospitals that had negative per-episode NPRA, indicating the opposite. The color coding indicates where a hospital lands in the total NPRA distribution – orange indicates hospitals in the bottom 30% of the total NPRA distribution for PY 7. The single hospital in the leftmost bar had the highest average episode repayments as a percentage of target price, but did not have enough volume to accumulate large overall repayments, thus remaining in the top 70% of the total NPRA distribution. CJR = Comprehensive Care for Joint Replacement; n = number of hospitals; NPRA = net payment reconciliation amounts; PY = performance year.

In addition, hospitals in the bottom 30% of the total NPRA distribution were evenly distributed among hospitals that exceeded their target price. This is illustrative – hospitals that have relatively high repayment obligations in PY 7 'achieved' those repayment obligations by having a high volume of episodes that generated moderate repayment obligations, as opposed to having a smaller number of episodes that generated large repayment obligations on average. High overall repayment obligations are thus explained by a combination of two factors: 1) exceeding the target price on average and 2) performing a large number of episodes. Hospitals in the bottom 30% of overall NPRA did not exceed their target price by notably more than other hospitals making repayments. As seen in **Exhibit IV-3**, hospitals with high repayments or high reconciliation payments had notably higher LEJR volume than hospitals with lower repayment or reconciliation payments.

### c.   *Evolution of Target Prices over Time*

Over the course of the CJR Model, target prices changed considerably for all episodes. These changes were driven by both the built-in 'updating' of target prices that occurred each year and by model rule changes beginning in PY6. Understanding how target prices evolved over time is

particularly important to shed light on how both PY 6 and PY 7 generated average episode repayment obligations.

Over the entire course of the CJR Model, the proportion of hospitals owing repayments grew substantially (**Exhibit IV-7**). Each vertical bar in the exhibit depicts the distribution of hospitals for a given performance year, and the 'ribbons' between each performance year show how hospitals moved across the NPRA categories over time. In PY 1, CMS waived downside risk and no hospitals owed repayments. From PY 2 to PY 4, the proportion of mandatory participating hospitals owing repayments grew from approximately a quarter to more than half of hospitals. In PY 5, the proportion of hospitals owing repayments dropped substantially due to COVID-19 related flexibilities offered by CMS, which functioned similarly to a downside risk waiver for a large proportion of PY 5 episodes.

**Exhibit IV-7:  The Proportion of Hospitals Owing Repayments Has Grown Over Time, with an Interruption Due to COVID-19 Related Payment Flexibilities in PY 5**
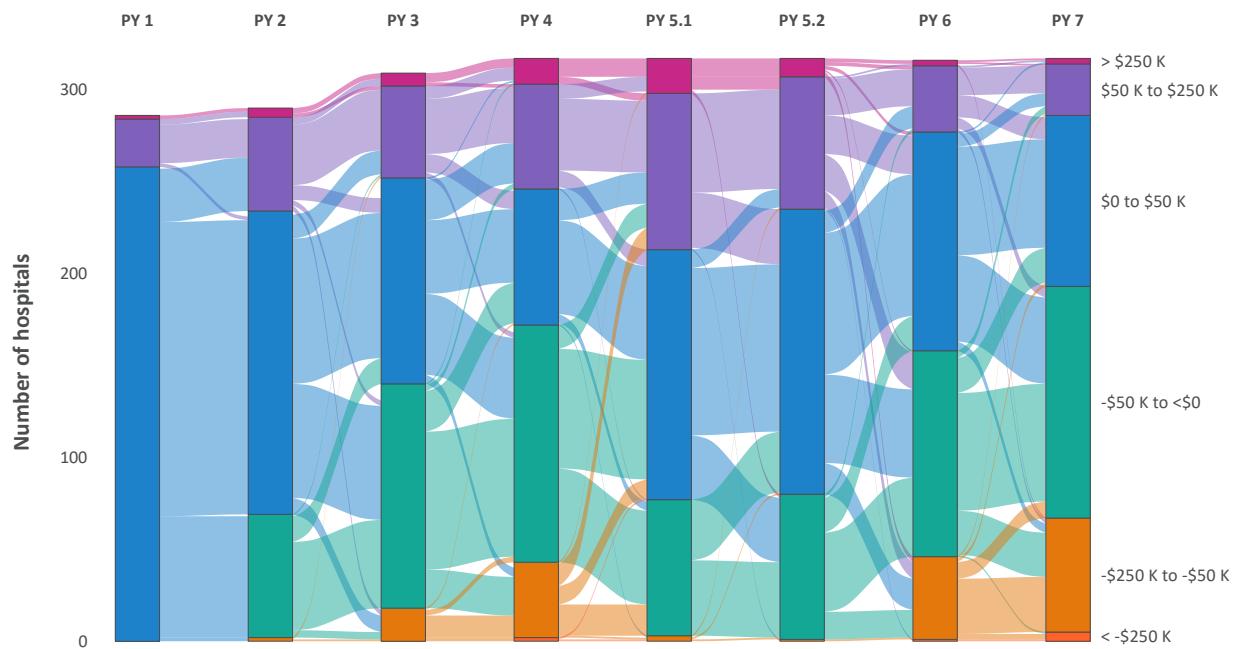


*Source:*  CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY1–PY 7.

*Notes:*  Each color category of the Sankey diagram represents a range of dollar amounts reflecting quarterly NPRA for a hospital (to account for PYs not all being the same length). CJR = Comprehensive Care for Joint Replacement; K = thousand; PY = performance year.

The pattern of an increasing proportion of hospitals owing repayments reemerged in PY 6 and continued into PY 7, which ultimately recorded the highest proportion of hospitals owing repayments of any PY to date.

For the extension period, the methodology for constructing target prices changed substantially. There were several factors that could change on a year-to-year basis that could cause target price

movements. **Exhibit IV-8** details a selection of the key factors in the calculation of final target prices for CJR episodes.

**Exhibit IV-8:    There Were Several Important Factors in the PY 6–8 Target Price Algorithm that Could Have Caused Year-to-Year Movement in Target Prices**

| Factor | Description |
|---|---|
| **Base period for target price calculations** | The base period provided the initial spending data that was used to calculate target prices. Starting in PY 3, the base period began including time when the CJR Model was active. Because the target price calculation built in a 3% prospective discount for CMS, target prices for PY 6 and 7 required larger payment reductions than in prior PYs to avoid repayment obligations, unless offset by payment increases at non-CJR hospitals. |
| **MS-DRG-level normalization factor** | An MS-DRG-level normalization factor was applied to target prices. The normalization factor ensured that the average target price did not change as a result of risk adjustment. However, the normalization factor was calculated using a sample of all national LEJR episodes – mechanically, this ensured that the average national episode target price did not change, but the average CJR episode target price could have changed. |
| **Region/MS-DRG-level market trend factor** | A market (Region + MS-DRG combination) level adjustment was made to account for changes in spending over time. The adjustment increased or decreased the target price based on the change in unadjusted episode spending between the base period and the PY. This factor ensured that target prices reflected actual shifts in regional and MS-DRG-specific spending over time. |
| **Hospital-level quality adjustment** | The hospital-level quality adjustment changed the size of the discount built into the target prices. Hospitals that received a rating of "Acceptable" had target prices that incorporated the full 3% discount for CMS, while hospitals that received higher ratings ("Good" or "Excellent") had smaller discounts built into their target prices – and so higher target prices. Shifts in the overall hospital quality rating distribution thus caused shifts in the overall target price distribution. |
| **Episode-level risk adjustment** | Starting in PY6 episode-level target prices were adjusted based on characteristics of the patient–specifically, count of HCC flags, the age bucket into which the patient fell, and the patient's dual eligibility status. This factor resulted in a hospital's aggregate target price varying from year-to-year based on changes in patient characteristics. |

*Source:*   CJR Target Price and Reconciliation specifications documents provided by the CJR implementation contractor.

*Notes:*    CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; HCC = Hierarchical Condition Category; MS-DRG = Medicare Severity Diagnosis-Related Group; PY = performance year.

Most of the factors outlined above first came into effect in PY 6. As can be seen from **Exhibit IV-9,** there was a large impact on target prices for the three most complex MS-DRGs. At the same time, the target price for elective MS-DRG 470 episodes–the least complex episode type– fell. The overall average episode target price also fell in PY 6, although this was driven mostly by an increase in the proportion of elective 470 episodes. In PY 7, target prices for MS-DRGs 521 and 469 (fracture and elective episodes with major comorbidities or complications) continued to grow. Target prices for MS-DRGs 522 and 470 (fracture and elective episodes without major comorbidities or complications) grew slightly. MS-DRG 470 episodes comprised over 85% of all episodes in PY 7, so the overall effect on the average episode target price was a small increase.

**Exhibit IV-9:    Target Prices for the Three More Medically Complex Episodes Increased Substantially Starting in PY 6, While the Target Price for the Least Complex Elective LEJRs Decreased**
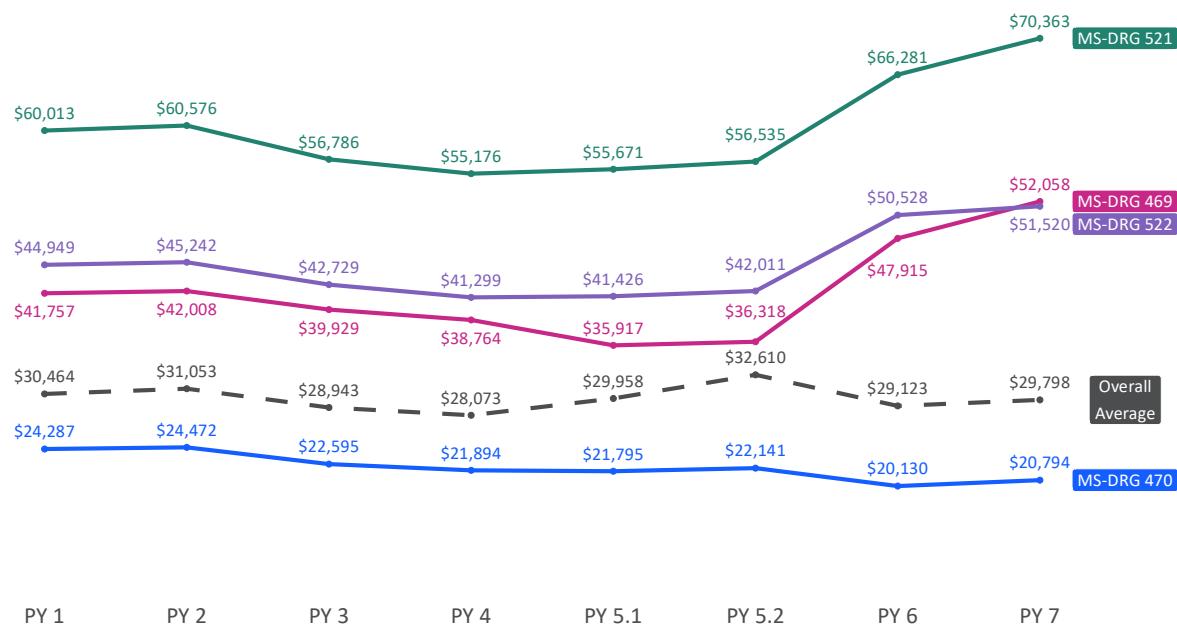


*Source*:    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between January 1, 2023, and December 31, 2023 (PY 7 intervention) as well as CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes*:    Each colored line presents the average target price across participant hospitals for a given episode MS-DRG over time. MS-DRG 470 (469) episodes are elective LEJRs without (with) major comorbidities or complications. MS-DRG 522 (521) episodes are fracture LEJRs without (with) major comorbidities or complications. We restrospectively applied the MS-DRG 521 and 522 categorizations to all episodes, even those before the introduction of those codes. The dashed grey "Overall Average" line presents the target price for the average episode regardless of type–in other words, the weighted average of target prices with weights reflecting the relative proportions of each episode type. CJR = Comprehensive Care for Joint Replacement; MS-DRG = Medicare Severity Diagnosis Related Group; LEJR = lower extremity joint replacement; PY = performance year.

One contributing factor to the increased target prices in PY 7 was an improved distribution of quality ratings for participating hospitals in PY 7, seen in **Exhibit IV-10**. In fact, a larger proportion of hospitals achieved "Good" or "Excellent" composite quality ratings in PY 7 than in any prior PY. Overall, this drove down the CMS discount built into target pricing, which resulted in higher target prices.

**Exhibit IV-10: A Larger Proportion of Hospitals Achieved "Good" or "Excellent" Quality Ratings in PY 7 Than in Any Prior Performance Year**
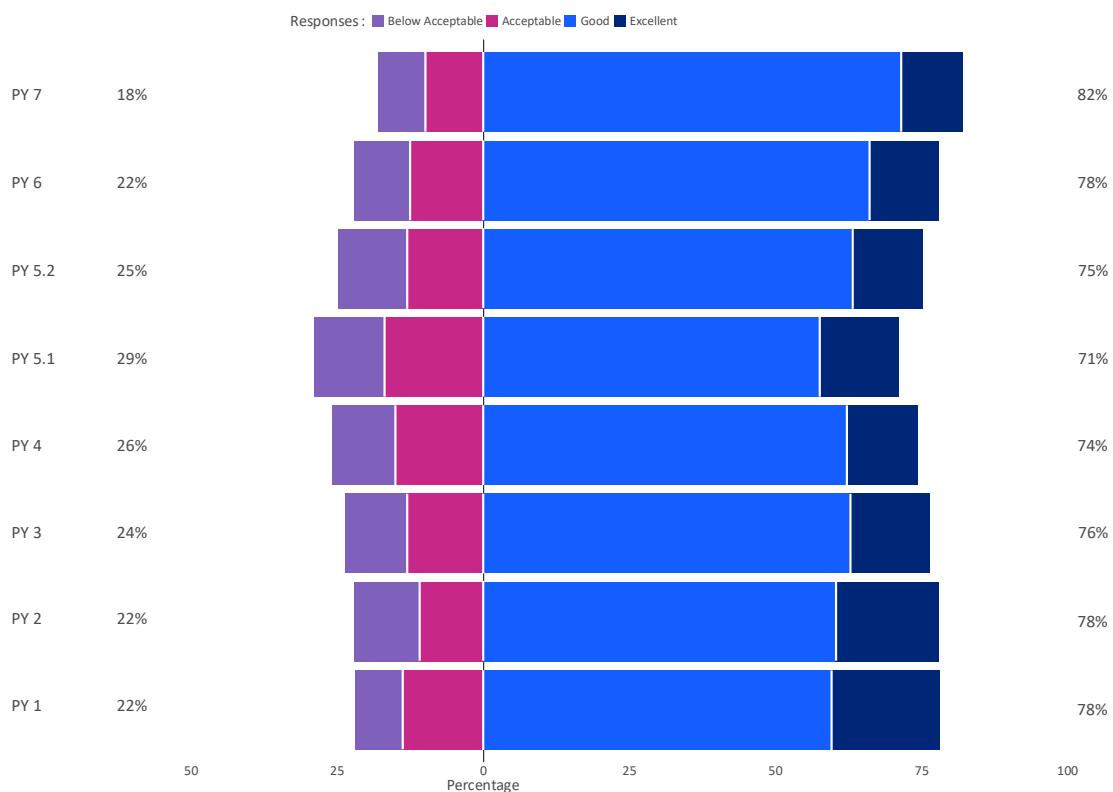


*Source:*　CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between April 6, 2016, and December 31, 2023 (PY 7) and CJR payment contractor data for CJR participant hospitals in PYs 1-7.

*Notes:*　This figure summarizes the composite quality ratings for PY 7 participant hospitals over the duration of the model. Composite quality ratings are either "Below Acceptable", "Acceptable", "Good", or "Excellent". A rating of "Below Acceptable" precludes hospitals from earning reconciliation, although they may still owe repayments. Higher quality ratings reduce the discount for CMS that is built in to target prices, effectively raising the hospital's target prices. Numbers on the left and right indicate the percentage of hospitals that have "Below Acceptable" or "Acceptable" ratings (on the left) and "Good" or "Excellent" ratings (on the right). CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; PY = performance year.

Since the average quality rating improved from PY 6 to PY 7, the impact of quality ratings on target prices cannot be an explanation for the increased repayments in PY 7. Rather, our analysis suggests that, to the extent that the increased repayments in PY 7 reflect target prices being less generous, the cause is one or more of the other factors outlined above in **Exhibit IV-8**.

# V.　Safety-Net Hospital Experience in the CJR Model

This section presents quantitative findings related to Safety-Net Hospital (SNH) performance in the model and information on SNH experiences in the model from qualitative interviews. For our analysis, to be considered a SNH in 2023, hospitals had to satisfy one of two criteria: at least 28.2% of their Medicare fee-for-service patients had to be dually eligible for Medicare and Medicaid or at least 28.8% of their Medicare patients had to qualify for the Part D Low-Income Subsidy (LIS). [28]

| Acronyms | |
|---|---|
| BPCI Advanced | Bundled Payments for Care Improvement Advanced |
| CJR | Comprehensive Care for Joint Replacement |
| CMMI | Center for Medicare & Medicaid Innovation |
| COVID-19 | Coronavirus Disease 2019 |
| EMR | Electronic Medical Record |
| HCC | Hierarchical Condition Category |
| HPES | High Post-Episode Spending |
| LEJR | Lower Extremity Joint Replacement |
| LIS | Low-Income Subsidy |
| MSA | Metropolitan Statistical Areas |
| NPRA | Net Payment Reconciliation Amount |
| PY | Performance Year |
| SNF | Skilled Nursing Facility |
| SNH | Safety-Net Hospital |

A particular concern in evaluating mandatory models is the potential for the model to have negative impacts on a subset of participants, even if the average impact is positive. Participant hospitals in the Comprehensive Care for Joint Replacement (CJR) Model did not have the option to cease participation, except by dint of extreme measures like closing their lower extremity joint replacement (LEJR) service line. Adverse impacts to a subset of hospitals would constitute unintended consequences of the model.

Our analysis of SNHs entailed both quantitative and qualitative work. The quantitative work focuses on how SNH participants differ from non-SNHs, how SNH participants have performed in terms of incentive payments relative to non-SNHs, and how certain features of the model rules have resulted in different experiences for SNHs and non-SNHs. The qualitative work focuses on distinguishing characteristics of SNHs, how SNHs identify and care for patients with unmet non-medical needs, what strategies SNHs use to address unmet non-medical needs, and challenges faced by SNHs in addressing unmet non-medical needs. [29] The interviewed hospitals were in urban or suburban areas in four metropolitan statistical areas (MSAs) in California, New York, and Florida. Patients at the interviewed hospitals face complex non-medical needs such as housing and food insecurity, limited transportation, and lack of caregiver support; health challenges related to comorbid conditions and behavioral health needs; and difficulty accessing healthcare due to language barriers and insufficient insurance coverage.

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[28]　There is no consensus definition of a SNH. Academic literature has used definitions based on dual eligibility, Part-D LIS eligibility, insurance status, uncompensated care, disproportionate share indexes, deprivation indexes, non-profit status, and other metrics. Some hospital interviewees reported they did not consider their hospital a SNH, despite meeting the CMMI eligibility criteria.

[29]　Centers for Medicare & Medicaid Services. (2025). *Safety-Net Hospital Experiences in a Bundled Payment Model.*

## How Did Safety-Net Hospitals Perform in the CJR Model?

### 1.  Summary of Findings

- **SNHs had a lower volume of LEJR procedures than non-SNHs and treated more complex patients.**

- **SNHs consistently performed poorly relative to non-SNHs in terms of reconciliation payments.**

### 2.  Results

This sub-section describes episode characteristics and financial performance in the model (based on reconciliation payments) for CJR hospitals classified as SNHs, compared to non-SNHs. These statistics include components of reconciliation payments, including quality ratings, target pricing, and pricing methods that account for high spending.

#### How did SNHs and Non-SNHs Perform in CJR?

SNH participants in the CJR Model differed notably from non-SNHs. On average, SNHs performed fewer LEJRs (less than 25% as many in PY 7), treated more complex patients (for example higher dual eligibility, higher HCC scores, and longer anchor stays), and were less likely to perform outpatient procedures. Historically, SNHs also earned lower average NPRA than non-SNHs across all performance years, sometimes by a wide margin (for example, in PY 4, the average SNH earned less than the 25th percentile non-SNH). In PYs 6–7, with the introduction of risk-adjusted target prices and other reconciliation changes during the extension period, the performance gap narrowed—primarily due to declining non-SNH performance rather than improvements among SNHs.

SNHs have consistently been more likely to receive a "Good" quality rating than any other rating, including "Excellent." They are also less likely than non-SNHs to receive "Below Acceptable" or "Acceptable" ratings—a gap that widened from 1 percentage point in PY 1 to 7 points in PY 7. For more discussion of quality ratings and their implications for NPRA, see **Chapter IV: Medicare Program Savings**.

In the first two PYs, when target prices were based on a blend of historical and regional spending, SNHs generally had higher average target prices than non-SNHs for all four MS-DRGs (**Exhibit V-1**) due to higher historical spending levels. However, in later PYs, as the blend shifted towards regional spending so that hospitals would compete with other hospitals in their region rather than their own historical spending, the gap between SNH and non-SNH target prices for each MS-DRG reversed. In PY 7, SNHs had slightly lower average target prices for the three more complex MS-DRGs, and a slightly higher average target price for MS-DRG 470 episodes. Despite generally lower MS-DRG-specific prices, SNHs' higher share of complex episodes kept their average all-episode target prices above those of non-SNHs.

**Exhibit V-1:  SNHs had Higher Target Prices in PYs 1–3 and Lower Target Prices for PYs 4–7 After the Move Towards Regional Target Prices**
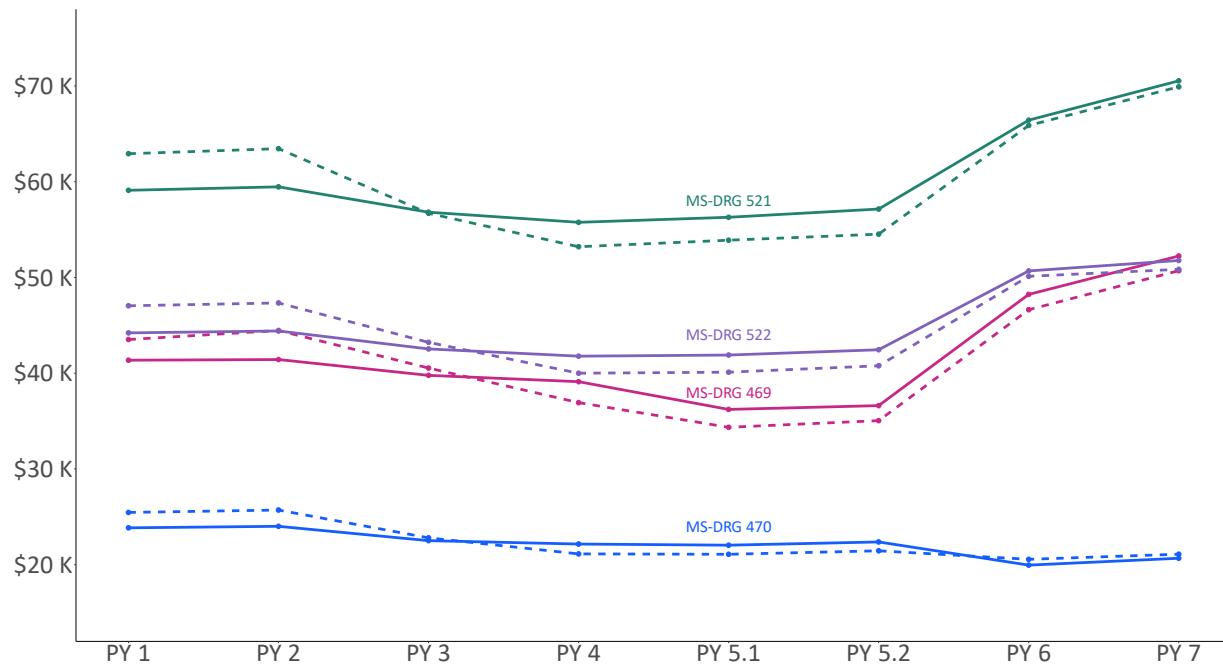


*Source:*  CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes:*  This figure plots the average target price for episodes in each MS-DRG at SNHs and non-SNHs over the duration of the CJR Model. Dashed lines represent SNH target prices and solid lines non-SNH target prices. Target prices vary from hospital to hospital due to wage factor adjustments, differences in the benchmark price, and episode-level target price risk-adjustment during and after PY 6. CJR = Comprehensive Care for Joint Replacement; K = thousand; MS-DRG = Medicare Severity Diagnosis Related Group; PY = performance year; SNH = safety-net hospital.

The CJR Model includes high post-episode spending (HPES) recoupments for episodes with post-episode spending exceeding 3 standard deviations above regional averages. These recoupments were designed to discourage participants from shifting care outside of the episode. Though rare, SNHs were about twice as likely as non-SNHs to incur them. While HPES recoupments accounted for just 0.1% of total repayments in PY 7, interviews suggest they may disproportionately affect SNHs. Because HPES recoupments apply after the stop-loss limit, they can exceed the anchor payment, which is especially impactful for low-volume hospitals. In PY 7, HPES recoupments made up as much as 29.2% of total repayments for some hospitals (average: 6.3%); in PY 6, the maximum was 69.2% (average: 22.8%).

# VI.   Accountable Care Organization (ACO) Overlap in the CJR Model

This section explores the overlap of hospital participation in the Comprehensive Care for Joint Replacement (CJR) Model and ACOs. ACOs are teams of healthcare providers, including doctors, hospitals, and other medical professionals, incentivized to provide high-quality, coordinated care for patients. Hospitals participating in an ACO can concurrently participate in other value-based

| Acronyms | |
|---|---|
| **ACO** | Accountable Care Organization |
| **CJR** | Comprehensive Care for Joint Replacement |
| **HCC** | Hierarchical Condition Categories |
| **LEJR** | Lower Extremity Joint Replacement |
| **NPRA** | Net Payment Reconciliation Amount |
| **PY** | Performance Year |
| **SSP** | Shared Savings Program |

payment models, which included CJR. During the CJR Model, the number of ACOs increased overall, but to varying degrees by region. Hospitals made decisions to join a Medicare ACO in the context of their overall value-based care strategy and some indicated that participation in a Medicare ACO had an influence on their lower extremity join replacement (LEJR) service-line care protocols and strategies to improve cost and quality of care.[30] For this evaluation, we examined the patterns of concurrent participation, specifically participation in a Shared Savings Program (SSP) ACO, between the CJR evaluation baseline (2013), and performance year (PY) 7 (2023).

This section describes patterns of concurrent participation and the association between concurrent or previous participation in ACOs and changes in net payment reconciliation amount (NPRA), quality scores, Hierarchical Condition Categories (HCC), and total episode cost. This chapter reports a descriptive analysis and should be considered hypothesis generating rather than hypothesis testing.

### What was the Pattern of CJR and Control Hospital Concurrent Participation in an ACO Over Time and Were There Differences in Outcomes Associated with Concurrent Participation?

#### 1.   Summary of Findings

- **SSP ACO participation rates were similar between CJR and control hospitals, but varied over time and by region.**

- **There is no clear link between ACO participation and total episode cost or quality ratings.**

- **CJR hospitals in SSP ACOs had higher per-episode NPRA than non-SSP ACO participants.**

#### 2.   Results

We examined SSP ACO participation for CJR and control hospitals from 2013 to 2023. Due to their broader reach compared to other ACO models (for example Pioneer, NextGen, REACH),

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[30]   Centers for Medicare & Medicaid Services. *Comprehensive Care for Joint Replacement Model: Performance Year 6 Evaluation In-Depth Report.*
https://www.cms.gov/priorities/innovation/data-and-reports/2024/cjr-py6-annual-report

SSP ACOs had the greatest overlap with both the CJR and control group (**Exhibit D-66** in **Appendix D: Additional Findings**). To study concurrent participation in CJR and ACOs during the extension period, we included only mandatory CJR and control hospitals with at least one episode in PY 6 or PY 7, which included 321 CJR hospitals and 315 control hospitals (**Exhibit VI-1**).

Most CJR hospitals (57.0%) never participated in an SSP ACO, while a slight majority of control hospitals (54.3%) participated for at least one year. Very few hospitals participated every year from 2013 to 2023. Among participating hospitals, the median duration in an SSP ACO was 6 years, and this duration was similar for CJR and control hospitals (**Exhibit D-50** in **Appendix D: Additional Findings**).

**Exhibit VI-1:   Overall SSP ACO Participation Rates Were Similar Between CJR and Control**

| Measures | CJR | | Control | |
| --- | --- | --- | --- | --- |
| | N | Percent (%) | N | Percent (%) |
| **Total number of hospitals** | 321 | 100.0 | 315 | 100.0 |
| **Number of hospitals that never participated in an SSP ACO** | 183 | 57.0 | 144 | 45.7 |
| **Number of hospitals that participated in an SSP ACO at least one year between 2013 and 2023** | 138 | 43.0 | 171 | 54.3 |
| **Number of hospitals that participated in an SSP ACO all years between 2013 and 2023** | 2 | 0.3 | 10 | 3.2 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   The counts in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; N = number; PY = Performance year; SSP = Shared Savings Program.

ACO participation varied by region. CJR hospitals in the South Atlantic, West South Central, and Pacific regions had high non-participation rates (≥50% never participating in an SSP ACO). Control hospitals showed similar patterns, except in the South Atlantic, where they were more likely to participate than CJR hospitals. These regional differences may reflect factors such as managed care prevalence, regional pricing dynamics, and state-level regulations.

CJR hospitals that concurrently participated in an SSP ACO had higher average per-episode NPRA in PY 6–PY 7 than CJR hospitals that never participated. Per-episode NPRA varied more widely among non-participating hospitals, suggesting greater diversity in their model experiences. Hospitals with intermittent SSP participation had similar per-episode NPRA to those with continuous participation. There was no observed relationship between SSP ACO participation and quality ratings in PY 6–PY 7. Among both CJR and control hospitals, total episode payments were similarly distributed across ACO participation groups. Full details about our ACO Overlap findings can be found in **Appendix D: Additional Findings**.

# VII. Analysis of Potential Unintended Consequences of the CJR Model

In this chapter, we present analyses that investigated potential unintended consequences of the Comprehensive Care for Joint Replacement (CJR) Model. Since the model only included Medicare spending during the 90-day lower extremity joint replacement (LEJR) episode and the end date of the episode is easy for providers to calculate, CJR hospitals may have tried to lower their episode spending by delaying or moving services beyond the 90-day window. To investigate this type of potentially delayed care, we looked at the impact of the CJR Model on 30-day post-episode payments. In addition, since there is often discretion in whether a patient should have an elective LEJR surgery, the CJR Model had the risk of influencing the volume of surgeries performed by CJR hospitals. Hospitals may have attempted to increase the number of

| Acronyms | |
|---|---|
| **ASC** | Ambulatory Surgical Center |
| **CI** | confidence interval |
| **CJR** | Comprehensive Care for Joint Replacement |
| **DDD** | difference-in-difference-in-differences |
| **DiD** | difference-in-differences |
| **FFS** | fee-for-service |
| **HH** | home healtH |
| **IRF** | inpatient rehabilitation facility |
| **LCI** | lower confidence interval |
| **LEJR** | lower extremity joint replacements |
| **MSA** | metropolitan statistical area |
| **NPRA** | net payment reconciliation amount |
| **PAC** | post-acute care |
| **p** | p-value |
| **pp** | percentage point |
| **PY** | performance year |
| **SNF** | skilled nursing facility |
| **UCI** | upper confidence interval |

LEJRs surgeries they perform due to the additional financial incentive from the model, or alternatively hospitals may have reduced the number of elective surgeries they performed for patients they perceived as likely to have episode spending above their target price. To understand whether the model could have increased or reduced the number of LEJRs that hospitals performed, we studied changes in LEJR rates in CJR and control metropolitan statistical areas (MSAs).

## A. Did the CJR Model Impact Payments in the 30 Days Following the Episode?

Under the CJR Model, CJR hospitals were financially accountable for the cost and quality of health care services during a 90-day episode of care following an LEJR procedure. The episode of care began with the hospitalization for the surgery and extended through the 90 days after hospital discharge (including the date of discharge). Any services provided immediately after the 90 days were not included in the episode; thus, there could have been a financial incentive for CJR hospitals to delay care so that it either started after the end of the episode or started later than it would have during the episode so more of the associated payments are pushed to after the end of the episode. Because the spending during the 90-day episode of care is used in the model to determine net reconciliation amounts, any spending pushed to after the episode could have helped participants improve their net reconciliation. However, postponing services could have implications for patients' long-term health. To study this possible unintended consequence, we monitored payments during a 30-day period immediately following the episode to identify whether CJR hospitals postponed services to reduce episode payments.

We estimated all impacts using a difference-in-differences (DiD) model which compares outcomes for patients with LEJRs at CJR hospitals relative to patients with LEJRs at control hospitals, both

in the baseline (April 2012 through March 2015) and during the intervention period combining performance year (PY) 6 and PY 7 (October 2021 through December 2023).[31]

## 1. Summary of Findings

- **For patients with hip fractures, CJR hospitals increased Medicare spending 30 days after the episode by $411 per episode relative to control hospitals.**

## 2. Results

We estimated the impact of the CJR Model during PY 6–PY 7 on post-episode payments for three populations: all LEJR episodes, elective LEJR episodes, and hip fracture episodes. If CJR hospitals were intentionally postponing services to meet their target prices, we would expect to find a relative increase in payments after the episode period. For all LEJR episodes, we found that the CJR Model led to a relative increase in payments 30 days after the episode. The estimated increase is $60 (90% Confidence Interval (CI): $10 to $110, p = 0.05) (**Exhibit VII-1**). There was evidence that the CJR and control groups were on differential trends in the baseline period for this outcome; however, the differential trends between the CJR and control groups prior to the start of the model were in the direction that, had they continued absent the CJR Model, our impact would have been an underestimate, by almost $300, of the relative increase in post-episode spending. See **Appendix D: Additional Findings** for more discussion and results on our assessment of parallel trends. When examining changes in post-episode payments by episode type, we found that hip fracture episodes were driving the increase in post-episode payments in the all-LEJR population. For elective episodes, CJR had no impact on post-episode spending (90% CI: -$49 to $51, p = 0.97), but for hip fracture episodes, CJR had a relative increase in payments 30 days after the episode of $411 (90% CI: $153 to $669, p = 0.01). Although this relative increase of $411 was small compared with the average fracture episode total payment, it was a 12.2% increase in 30-day post-episode payments from the baseline.[32]

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[31] Additional details of the outcome measures we analyzed and methods we utilized can be found in **Appendix B: Data and Methods**.

[32] The average risk-adjusted hip fracture LEJR episode was $49,654 in PY 6 for CJR hospitals.

**Exhibit VII-1: The CJR Model Led to an Increase in 30-Day Post-Episode Payments for Hip Fracture LEJRs**

| Population | Impact | Impact as a percentage[a] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|
| **All LEJR episodes**[a] | $60 | 4.2 | 0.05 | $10 | $110 |
| **Elective LEJR episodes**[a] | $1 | 0.1 | 0.97 | -$49 | $51 |
| **Hip fracture LEJR episodes** | $411 | 12.2 | 0.01 | $153 | $669 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:   The estimates in this exhibit were the result of a DiD model. Impacts as a percentage were calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. A full table of results, including sample counts and risk-adjusted means, is in **Appendix D: Additional Findings, Exhibit D-15.** CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower extremely joint replacement; PY = performance year; UCI = upper confidence interval.

[a]   Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. See Appendix B for more details on parallel trend analyses.

Given that we only observed this result for patients with hip fractures, the potential implications were unclear. While we cannot say with certainty why CJR patients with a fracture had relatively higher payments in the 30 days after the episodes, we have no evidence to suggest it was caused by deliberate moving of care outside of the episode window. Through examination of post-acute care (PAC) utilization, we found no evidence of shifting of care away from the last days of the episode to the first days of the post-episode-period (**Exhibit VII-2**). For example, looking at the days leading up to the end of the episode, days 80-90, and comparing them to the days immediately following the episode, days 91-101, we see no observable change in the patterns or trends of the CJR PAC locations for patients with a fracture. If CJR hospitals were intentionally shifting care beyond the episode, we would expect to see a relative increase in PAC utilization starting shortly after day 90. However, we did observe that CJR patients with a fracture were more likely to be in a skilled nursing facility (SNF) on the last day of the episode (day 90), compared to the control group (**Exhibit VII-3**).

**Exhibit VII-2: There is No Evidence of Shifting of PAC Care Outside of the Episode Window for CJR Patients with a Fracture**
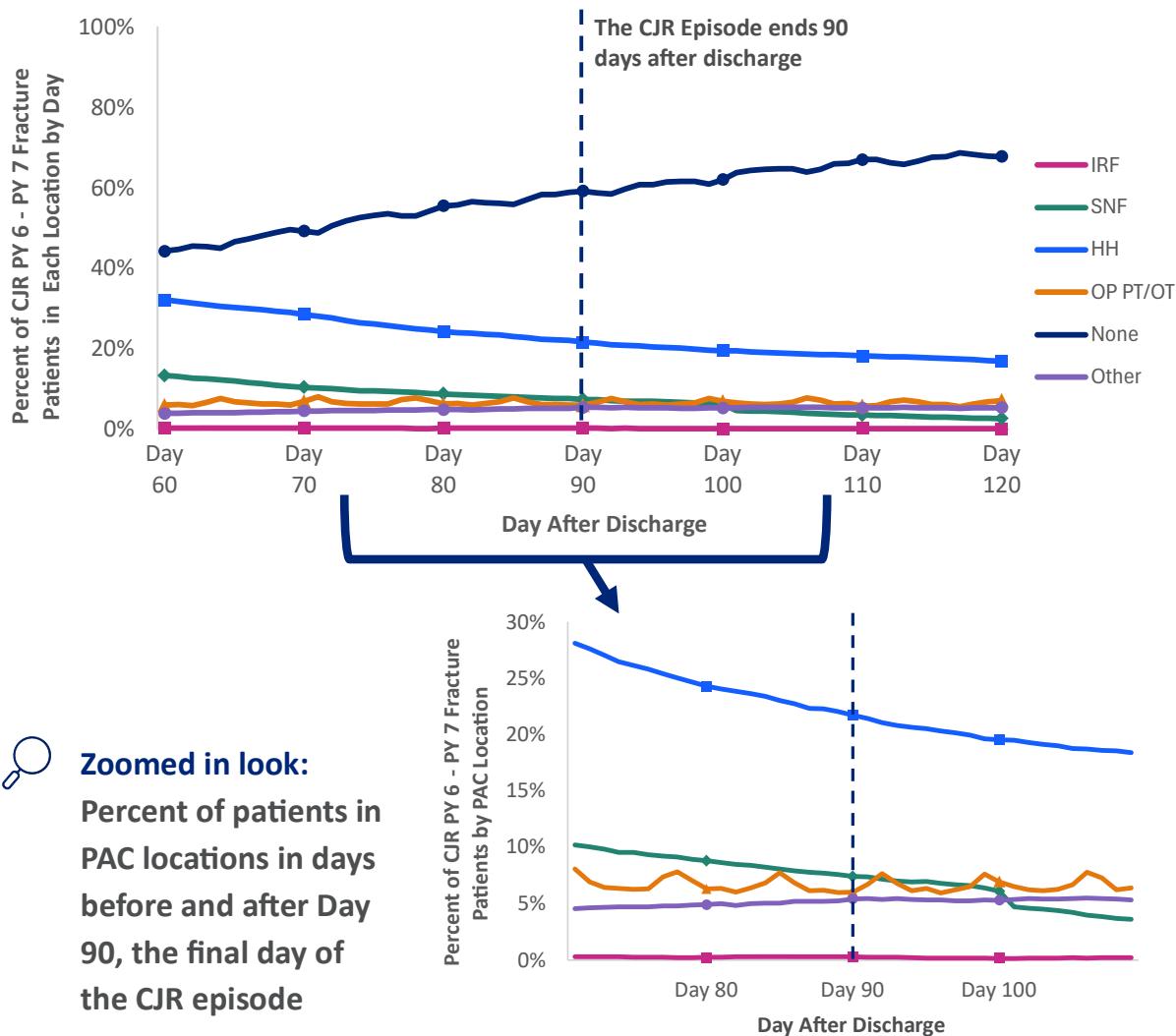


***Source:*** CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

***Notes:*** These results are not risk-adjusted. CJR = Comprehensive Care for Joint Replacement; HH = home health; IRF = inpatient rehabilitation facility; OP = outpatient; OT = occupational therapy; PAC = post-acute care; PT = physical therapy; PY = performance year; SNF =skilled nursing facility.

**Exhibit VII-3: CJR Patients with a Fracture were Relatively More Likely to be in a SNF at the End of the Episode Window**

| Measure of PAC Use on Day 90 | CJR Patients with a Fracture | | Control Patients with a Fracture | | Relative Difference (pp) |
|---|---|---|---|---|---|
| | Baseline (%) | PY 6–7 (%) | Baseline (%) | PY 6–7 (%) | |
| IRF | 0.2 | 0.3 | 0.2 | 0.4 | -0.04 |
| SNF | 11.0 | 7.4 | 11.8 | 5.5 | 2.69 |
| HH | 23.2 | 21.7 | 24.9 | 22.3 | 1.12 |
| Outpatient PT/OT | 3.6 | 6.0 | 3.2 | 5.6 | 0.05 |
| Other | 5.0 | 5.4 | 5.1 | 6.2 | -0.70 |
| None | 57.0 | 59.2 | 54.8 | 60.1 | -3.13 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: These results are not risk-adjusted. CJR = Comprehensive Care for Joint Replacement; HH = home health; IRF = inpatient rehabilitation facility; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF =skilled nursing facility.

Combined with the finding in **Chapter III: Impact of the Model** that CJR patients with a fracture were more likely to be discharged to SNF than the control, our results suggest that these patients tended to gradually leave the SNF over time but that SNF rates remained higher for CJR than control even after the 90-day episode. Hence, this does not seem to be evidence of deliberate delaying and shifting of care outside of the episode. Additionally, it is important to note that in our patient survey data, as reported in the sixth annual evaluation report, and claims-based quality data reported in **Chapter III: Impact of the Model**, we did not detect any differences in patient experience or quality.[33] Patients with a hip fracture at CJR hospitals reported similar quality of care to patients with a hip fracture at control hospitals during the episode. CJR patients with a hip fracture even showed improvements in certain measures of functional status shortly after the episode period relative to control patients with a hip fracture.[34]

## B.  Did the CJR Model Impact the Total Market Volume of Elective LEJR Discharges for Beneficiaries Residing in CJR MSAs?

Over the past few decades, Americans have been receiving more LEJR surgeries.[35,36] The growth in LEJR surgeries, coupled with incentives present in the CJR Model to perform these procedures, could raise concerns that the model itself boosts LEJR volume beyond what it would have been absent the model. If CJR hospitals provided additional elective LEJRs to patients who otherwise

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[33]  Centers for Medicare & Medicaid Services. (2024). *Comprehensive Care for Joint Replacement Model - Sixth Annual Report*. https://www.cms.gov/priorities/innovation/data-and-reports/2024/cjr-py6-annual-report

[34]  The median time at which surveys were returned was 37 days after the conclusion of the patient's 90-day post-discharge period.

[35]  Wolford, M. L., Palso, K., & Bercovitz, A. (2015). *Hospitalization for total hip replacement among inpatients aged 45 and over: United States, 2000–2010*. NCHS data brief, no. 186. National Center for Health Statistics. https://www.cdc.gov/nchs/data/databriefs/db186.pdf

[36]  Williams, S. N., Wolford, M. L., & Bercovitz, A. (2015). *Hospitalization for total knee replacement among inpatients aged 45 and over: United States, 2000–2010*. NCHS data brief, no. 210. National Center for Health Statistics. https://www.cdc.gov/nchs/data/databriefs/db210.pdf

would have foregone or delayed the procedure, Medicare savings due to the CJR Model would be offset by the payments for these additional LEJR surgeries. In this section, we discuss how elective LEJR surgery rates have changed for the Medicare fee-for-service (FFS) population in CJR MSAs compared with control MSAs.

This analysis utilizes the location of where patients receiving an LEJR live instead of the location of the hospital or surgical center at which they received the surgery. It excludes hip fracture LEJRs since the acute nature of these procedure present hospitals with limited opportunities for pre-surgery patient optimization or discretion in scheduling of the surgery compared to the patients with an elective LEJR. Moreover, we included all elective LEJRs, regardless of the location of their procedure and whether the hospital was in the CJR or control group. Locations included both inpatient and outpatient settings as well as any LEJRs performed in ambulatory surgical centers (ASCs). We included LEJRs performed in ASCs in this analysis, even though they are not episodes under the CJR Model, in order to better gauge whether the CJR Model had an effect on the overall number of beneficiaries receiving elective LEJRs in an MSA. If, for example, the CJR Model did not lead to any changes in elective LEJR volume but did influence the number of hospital outpatient LEJRs by shifting LEJRs from the ASC setting to the hospital outpatient setting, not including LEJRs at ASCs in the sample would lead the analysis to misattribute the shifting of LEJRs as an increase in elective LEJR volume.

### 1.  Summary of Findings

- **For beneficiaries living in CJR MSAs, there was a relative increase in the number of LEJRs during PY 6–PY 7 of 48 LEJRs per 100,000 Medicare FFS beneficiaries.**

### 2.  Results

This analysis estimated the impact of the CJR Model on the probability of receiving at least one elective LEJR for all Medicare FFS beneficiaries living in a mandatory CJR MSA versus a control MSA. This comparison is conducted using two different time periods, 2012 to 2014 (the baseline of this analysis) and 2022–2023 (a combined intervention period containing most of PY 6 and PY 7 of the CJR Model). This method was the same as was used in the analyses presented in the next section where we discuss the impacts that the CJR Model had on patients who were dually eligible for Medicare and Medicaid.

Results for this analysis are reported in terms of the probability of a Medicare FFS beneficiary receiving at least one elective LEJR in a given year, which we referred to and interpreted as LEJR rates per 100,000 FFS beneficiaries per year.

For beneficiaries living in mandatory CJR MSAs, we found that the CJR Model had a small relative increase in the rate of elective LEJRs of 48 LEJRs per 100,000 beneficiaries (90% CI: -5 to 102, p = 0.14) (**Exhibit VII-4**). For context, in 2022–2023, there were 1,404 LEJRs per 100,000 beneficiaries in these MSAs. The increase we identified was not statistically significant at the 10% level, and even the upper bound of the 90% confidence interval was small, at 102 LEJRs per 100,000 beneficiaries.

**Exhibit VII-4: For Patients Residing in CJR MSAs, the CJR Model Had a Small Increase in Elective LEJR Volume**

| Time period | Impact on volume (LEJRs per 100,000 beneficiaries) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|
| CY 2022-2023 | 48 | 0.14 | -5 | 102 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for Medicare FFS beneficiaries enrolled in Medicare between 2012 and 2015 (baseline) or during 2022 and 2023 (intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model on the probability of receiving at least one elective LEJR for all Medicare FFS beneficiaries living in mandatory CJR MSAs or their corresponding control MSAs. Estimates were reported as number of LEJRs per 100,000 Medicare FFS beneficiaries. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; CY= calendar year; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower extremity joint replacement; MSA = metropolitan statistical area; UCI = upper confidence interval.

Given the model's incentives, we may expect hospitals to try to increase their elective volume and provide elective LEJRs to beneficiaries who otherwise would have foregone or delayed the procedures. This shift would be in hopes of reducing the hospital's average payments relative to their target prices and earning additional reconciliation payments from CMS. Though statistically insignificant, the combined results observed in PY 6–PY 7 show an increase in elective LEJR volume. If some of these LEJRs surgeries were not medically necessary and would have not happened if the CJR Model had not occurred, then the increase in volume caused by the model resulted in additional Medicare spending. Our Medicare program savings analysis included a sensitivity test to account for the cost of episodes that may have resulted from the model increasing the number of surgeries (for more information see **Appendix D: Additional Findings**). This sensitivity analysis indicates that even when making the grand assumption that all the elective LEJRs measured in the increased volume are from CJR hospitals inducing unnecessary elective surgeries, the CJR Model still exhibited savings to CMS.

Furthermore, at the start of the extension period in PY 6, the CJR Model utilized a target pricing methodology which accounts for several patient characteristics, which may diminish the financial reward hospitals were expecting from increasing the number of elective LEJRs to lower-cost beneficiaries. It is difficult to pinpoint what aspect of the model design is causing or incentivizing this small relative increase in elective LEJR rates across the full Medicare FFS beneficiary population residing in CJR MSAs.

## C. Did the CJR Model Impact the LEJR Volume for Beneficiaries who Were Dually Eligible for Medicare and Medicaid?

Though small, the increase in overall LEJR volume for the full Medicare FFS beneficiary population residing in CJR MSAs brought attention to what components of the model could be causing this observed increase. As previously stated, the extension period beginning in PY 6 incorporated patient-level risk adjustments to the model, so it is important to evaluate volume changes for patient groups for which those patient-level risk adjustments control. We analyzed one of those groups, looking at whether the CJR Model impacted the LEJR volume of beneficiaries who were dually eligible for Medicare and Medicaid and resided in a CJR MSA.

During both the baseline and intervention periods (PY 6–PY 7), patients who were dually eligible had higher average episode payments and used more institutional PAC services relative to patients who were not dually eligible.[37] A direct response by participant hospitals to these higher average episode payments could be to provide fewer LEJRs to patients who were dually eligible, in hopes of reducing their average episode payments, and thus increase reconciliation payments received through the model. However, a key component of the model's design to consider is that the target prices used to calculate net payment reconciliation amount (NPRA) are risk-adjusted for dual eligibility status of the patient, and it is unclear whether higher average payments make a patient a worse candidate in terms of NPRA. The impact on LEJR volume for patients who were dually eligible is uncertain as these factors contributing to the NPRA could be working in opposite directions. In order to evaluate if the adjustments to the target pricing and other components of the model impacted the rate of elective LEJRs for patients who were dually eligible, we conducted a separate volume analysis.

This analysis utilized the same data and methodology as **Section B** but focused on two groups: a) beneficiaries who were dually eligible for Medicare and Medicaid and b) beneficiaries who were not dually eligible. Additionally, this section used a difference-in-difference-in-differences (DDD) approach, which estimated the impact of the CJR Model on each of the two populations and simultaneously estimated the difference between the estimated impacts for these populations. The DDD approach generated three estimates: (1) CJR impact estimate for beneficiaries who were dually eligible, (2) CJR impact estimate for beneficiaries who were not dually eligible, and (3) an estimate of the "differential impact."

### 1. Summary of Findings

- **Beneficiaries who are dually eligible had 47 more LEJRs per 100,000 beneficiaries per year due to the CJR Model. However, beneficiaries without dual eligibility had a similar increase, 44 more LEJRs per 100,000 beneficiaries per year.**

### 2. Results

We found that beneficiaries who were dually eligible for Medicare and Medicaid had substantially lower rates of LEJRs in the baseline period than beneficiaries who were not dually eligible (**Exhibit VII-5**). The CJR Model did not substantially affect the observed gap in LEJR volume between dually eligible and not dually eligible beneficiaries.

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[37] Unadjusted baseline and PY 6-7 mean values for average episode payments and institutional PAC use can be found in **Appendix D: Additional Findings.**

**Exhibit VII-5:  In Both CJR and Control MSAs, Dually Eligible Beneficiaries Had Substantially Lower Unadjusted LEJR Rates Than Non-Dually Eligible Beneficiaries During the Baseline**

| Population | Reference population | Baseline difference in CJR MSAs (LEJRs per 100k beneficiary-years) | Difference of reference population rate (%) | Baseline difference in control MSAs (LEJRs per 100k beneficiary-years) | Difference of reference population rate (%) |
|---|---|---|---|---|---|
| Beneficiaries who were dually eligible | Beneficiaries who were not dually eligible | -621 | 54.7 | -720 | 56.8 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for Medicare FFS beneficiaries enrolled in Medicare between 2012 and 2015 (baseline) or during 2022 and 2023 (intervention).

*Notes:*  Negative differences indicate that the population had a lower risk-adjusted baseline LEJR rate than the reference population. The reported differences were calculated from both the CJR and control baseline unadjusted means. CJR = Comprehensive Care for Joint Replacement; FFS = fee-for-service; k = thousand; LEJR = lower extremity joint replacement; MSA = metropolitan statistical area.

In our analysis of the impacts of the CJR Model on LEJR volume, we found that the model had statistically significant impacts on beneficiaries who were dually eligible (**Exhibit VII-6**).

**Exhibit VII-6: The CJR Model Had a Statistically Significant Impact on LEJR Volume for Beneficiaries Who Were Dually Eligible**

| Population | Impact (DiD) | p-value (DiD) | 90% LCI (DiD) | 90% UCI (DiD) | Differential Impact (DDD) | p-value (DDD) | 90% LCI (DDD) | 90% UCI (DDD) |
|---|---|---|---|---|---|---|---|---|
| Beneficiaries who were dually eligible | 47 | 0.08 | 2 | 93 | 3 | 0.90 | -39 | 45 |
| Beneficiaries who were not dually eligible | 44 | 0.18 | -10 | 98 | | | | |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for Medicare FFS beneficiaries enrolled in Medicare between 2012 and 2015 (baseline) or during 2022 and 2023 (intervention).

*Notes:*  The estimates in this exhibit were the result of a DDD model on the probability of receiving at least one elective LEJR for all dually eligible and not dually eligible Medicare FFS beneficiaries living in mandatory CJR MSAs or their corresponding control MSAs. Estimates were reported as number of LEJRs per 100,000 Medicare FFS beneficiaries. The estimates were calculated using the unadjusted means for the population during the intervention period. The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%  or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DDD = difference-in-difference-in-differences; DiD = difference-in-differences; FFS = fee-for-service; LCI = lower confidence interval; LEJR = lower extremity joint replacement; MSA = metropolitan statistical area; UCI = upper confidence interval.

Beneficiaries who were dually eligible had an estimated relative increase in their LEJR rate of 47 LEJRs per 100,000 beneficiary-years, a 9.2% relative increase to their unadjusted baseline rate (90% CI: 2 to 93, p = 0.08). Compared to beneficiaries who were not dually eligible, the differential impact for beneficiaries who were dually eligible was an increase of three LEJRs per 100,000 beneficiary-years (90% CI: -39 to 45, p = 0.90), which was not statistically significant. Given that differential impacts were not statistically significant or large, and that impacts on volume were similar for beneficiaries who are dually eligible compared with the full Medicare FFS population, there is no evidence of a specific selection or avoidance of beneficiaries who were dually eligible for Medicare and Medicaid.

# VIII.  Additional Considerations

This report presents the impact of the Comprehensive Care for Joint Replacement (CJR) Model on episode-of-care payments, utilization of post-acute care services, and quality of care for lower extremity joint replacements (LEJRs) with accumulated findings over 7 years. During this time, there were changes to the model, Medicare coverage of LEJRs, and the broader healthcare landscape. This section highlights these changes, how they may have influenced the observed results, and considerations for interpreting the findings in this report.

| Acronyms | |
|---|---|
| **ACO** | Accountable Care Organization |
| **ASC** | ambulatory surgery center |
| **BPCI** | Bundled Payments for Care Improvement |
| **CJR** | Comprehensive Care for Joint Replacement |
| **DiD** | difference-in-differences |
| **LEJR** | lower extremity joint replacement |
| **MA** | Medicare Advantage |
| **MSA** | metropolitan statistical area |
| **SNF** | skilled nursing facility |
| **SSP** | Shared Savings Program |
| **THA** | total hip arthroplasty |
| **TKA** | total knee arthroplasty |
| **VBC** | Value-based care |

## A.  Addition of Outpatient Episodes

CMS included hospital outpatient total knee arthroplasty (TKA) and total hip arthroplasty (THA) as LEJR episodes under the CJR Model starting in Performance Year (PY) 6 (Q4 2021–2022). CMS chose to make episode-level target prices site neutral, meaning that target prices were not adjusted for the surgery setting and instead used an average of inpatient and outpatient episodes in their calculation. Outpatient episodes often had lower spending than inpatient episodes so site neutral target prices would have been larger than the average outpatient episode price. Because of this, outpatient surgeries may have resulted in greater financial gains for hospitals. Because hospitals often could have chosen the inpatient or outpatient setting for patients receiving an LEJR and because the design of the model and target prices may have incentivized the outpatient setting, controlling or accounting for the surgery setting presented a challenge for our difference-in-differences (DiD) analyses. Doing so could have led to biased impact estimates and could violate required statistical assumptions, and as such, we did not risk-adjust for the surgical setting nor estimate separate regressions by setting. As a result, our DiD impact estimates captured the combined effects of any influence on outcomes of the model that may affect the choice of LEJR setting along with any changes in outcomes the model caused directly through care transformation within the inpatient or outpatient setting. Readers should consider our DiD impact estimates as the overall effects of the CJR Model, including effects related to changes in the surgical setting.

## B.  Changes in Included Hospitals

As part of the CJR Model extension period, CMS mandated that all previously participating hospitals that were designated with rural or low-volume status were no longer able to participate in the model. Note, while some hospitals were designated with rural status, all CJR hospitals throughout the entirety of the CJR Model were located in metropolitan statistical areas (MSAs); that is, none of the hospitals designated with rural status are in areas defined as rural by the U.S. Census Bureau. These hospitals had opted to remain in the model after the 2018 mandatory/voluntary split but would not be able to participate in the model extension period. To

implement this policy change for the model extension period, CMS updated the list of hospitals with rural status to include hospitals certified by CMS as rural as of October 4, 2020.[38] The reclassification of some previously non-rural CJR hospitals in mandatory MSAs to rural status led to those hospitals being excluded from the model beginning in PY 6. The removal of these previously mandatory hospitals could have affected the results in this report in three ways. First, the selection caused by hospitals that were reclassified as rural leaving the model could have led to biased impact estimates. Hospitals had to apply for rural reclassification status, and if characteristics we could not control for explain the decision to apply for reclassification or these hospitals' performance under the model, then the exclusion of these hospitals could lead to biased estimates. Second, removing hospitals that reclassified as rural may have affected the generalizability of the findings because the CJR Model effects may differ for hospitals that are able to qualify for the rural reclassification. Third, in most CJR MSAs, not all hospitals within the MSA are now participating in CJR. This could change market factors, such as relationships with skilled nursing facilities (SNFs). These potential market factor changes may have especially important ramifications in our analyses of the effect of CJR on LEJR volume, as described in **Chapter VII. Analysis of Potential Unintended Consequences of the CJR Model**, as that analysis defined "treatment" based on the address of the patient, not on whether a participating CJR hospital was used for an LEJR. Having non-participating hospitals in treated MSAs could attenuate DiD results (make them closer to zero), as you would not expect the CJR Model to influence non-participating hospitals, even if located in a mandatory MSA. This matters as it is possible, and even likely, some of the beneficiaries that reside in mandatory MSAs that receive LEJRs are receiving them from non-participating hospitals, and we are labeling those beneficiaries as being "treated" by CJR.

## C.  Growth in Medicare Advantage (MA) Enrollment

MA enrollment has steadily grown in the past 20 years. At the start of the CJR Model in 2016, around 32.2% of Medicare patients were enrolled in MA plans. That number grew to 48.3% for 2023, which coincided with PY 7.[39] With the growth in MA that occurred throughout the CJR Model, CJR and control MSAs have varying levels of MA penetration across time that could potentially have influenced our estimates. One example in which this could occur is if the differential rates of MA growth led to the fee-for-service (FFS) population in CJR being relatively more or less complex, compared to the control group; for example, if MA patients tend to be healthier on average, the remaining FFS patients in an MSA tend to be relatively more complex the higher the MA penetration rate. However, we did not see any notable differences in changes in

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[38]  Previously, rural status was determined as of February 1, 2018. Between February 1, 2018, and October 4, 2020, additional hospitals applied for and were granted rural status by CMS. This designation resulted in their exclusion from CJR starting in PY 6. See the CJR Three-Year Extension final rule, Section D.2, for more details: https://www.federalregister.gov/documents/2021/05/03/2021-09097/medicare-program-comprehensive-care-for-joint-replacement-model-three-year-extension-and-changes-to.

[39]  We obtained Medicare Advantage statistics from *Centers for Medicare & Medicaid Services. Medicare Enrollment Dashboard.* Accessed January 21, 2025. https://data.cms.gov/tools/medicare-enrollment-dashboard

patient characteristics over time between the CJR and control groups in our analysis described in
**Chapter II. Overview of the CJR Population**.

## D.   Participation in Other Value-based Payment Models

Many CJR and control hospitals participate or have participated in other value-based payment
models and Medicare Accountable Care Organizations (ACOs), which could affect their CJR
Model performance. These models include the Shared Savings Program (SSP), the Bundled
Payments for Care Improvement (BPCI) initiative, and its successor, BPCI Advanced. Although
CJR model rules prohibit overlapping participation in BPCI Advanced for the same LEJR
episodes, 15.4% of LEJR episodes in the control group during PYs 6–7 were attributed to hospitals
or physician groups participating in BPCI Advanced. While we adjusted for BPCI Advanced
participation in the control group, we could not account for similar episodes at CJR hospitals that
might have joined BPCI Advanced if not restricted by CJR rules. This limitation may affect our
estimate of the CJR Model's overall impact, as these unobservable episodes could differ
systematically from other episodes.

Hospitals that participated in both a Medicare ACO and the CJR Model indicated in interviews that
they view the two programs as aligned, that the two programs involve common care redesign
strategies, and that participating in both increased awareness of value-based care (VBC) among
hospital employees. For more details about these interviews, see the Sixth Annual Report. [40]
Between 2013 and 2023 (CJR evaluation baseline through PY 7), 43.0% of CJR hospitals and
54.3% of control hospitals participated in an SSP ACO for at least one year. Hospitals could
change ACO participation over time and, based on exploratory analysis conducted for this
evaluation, those that concurrently participated in CJR and an SSP ACO had higher average per-
episode NPRA compared to CJR hospitals that never participated in an SSP ACO. See
**Chapter VI: ACO Overlap in the CJR Model** for more details on CJR overlaps with Medicare
ACOs.

In the CJR Model Evaluation's Fifth Annual Report, we noted that approximately half of control
hospitals were in the same health system as at least one mandatory CJR hospital. This continued to
be an important factor when considering model impacts in PY 7, as hospital consolidation across
the country has continued, with more hospital mergers in 2023 than 2022. [41] If CJR hospitals in
these health systems shared care practices with control hospitals, it would mean the CJR model
would be indirectly influencing behavior, and thus outcomes, in the control group. This implies the
control group could have become contaminated and it no longer would represent what outcomes
would have looked like in the absence of the model. This would violate necessary assumptions for
the DiD methodology, that the control group is not being influenced by the model, and could lead
to underestimates of the causal impact of the CJR Model

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[40]   CMS CJR Performance Year 6 Evaluation In-Depth Report
[41]   We obtained hospital merger statistics from a January 18, 2024 report from Kaufman Hall: *Hospital and Health
       System M&A in Review: Financial Pressures Emerge as Key Driver in 2023*.
       2023 Hospital and Health System M&A in Review | Kaufman Hall

## E.  Addition of Medicare Coverage for Ambulatory Surgical Centers (ASCs)

Medicare began to pay for knee and hip LEJRs performed in ASCs in 2020 and 2021, respectively. However, LEJRs performed at ASCs are not included as episodes under the CJR Model. As such, we did not include ASC LEJRs in any of our difference-in-differences analyses. The share of ASC LEJRs has grown slowly but steadily and comprised approximately 8-12% of TKAs and 7-9% of THAs across CJR and control MSAs in PY 6–PY 7. CJR MSAs had lower shares of ASC TKA and THA than control MSAs, but the difference was not statistically significant after risk adjustment. Because ASC LEJRs were not covered by Medicare before 2020, which includes our baseline period, this policy change is not naturally accounted for in our DiD design. If the surgeons in CJR MSAs performed fewer LEJRs in the ASC setting in response to CJR incentives, our DiD impact estimates would not capture this behavior. This in turn could result in either over-estimated or under-estimated impacts, depending on what kind of episodes would have been performed in an ASC in the absence of the model. For example, if lower-cost patients were more likely to receive LEJRs in ASCs and were therefore excluded from our evaluation sample, but the CJR Model caused some of those patients to instead receive surgery at a CJR hospital (and thus be included), this could bias results. These lower-cost cases would appear in the CJR group but not the control group, potentially overstating CJR's impact on reducing spending. Moving forward, we will continue to monitor the share of LEJRs performed in the ASC setting and modify our analytic approach if necessary.

# Appendix A:　List of Acronyms and Glossary of Terms

**Exhibit A-1:　List of Acronyms**

| Acronym | Meaning |
|---------|---------|
| ACH | Acute Care Hospital |
| ACO | Accountable Care Organization |
| AHA | American Hospital Association |
| APM | Alternative Payment Model |
| ASC | Ambulatory Surgical Center |
| BPCI | Bundled Payments for Care Improvement |
| BPCI-A | Bundled Payments for Care Improvement Advanced |
| CBE | Consensus-Based Entity |
| CBO | Community Based Organization |
| CFR | Code of Federal Regulations |
| CHF | Congestive Heart Failure |
| CI | Confidence Interval |
| CJR | Comprehensive Care for Joint Replacement |
| CMMI | Center for Medicare & Medicaid Innovation |
| CMS | Centers for Medicare & Medicaid Services |
| COVID-19 | Coronavirus Disease 2019 |
| CPT | Current Procedural Terminology |
| CY | Calendar Year |
| DDD | Difference-in-Difference-in-Differences |
| DiD | Difference-in-Differences |
| DME | Durable Medical Equipment |
| DSH | Disproportionate Share Hospital |
| ED | Emergency Department |
| EMR | Electronic Medical Record |
| ESRD | End-Stage Renal Disease |
| FFS | Fee-for-Service |
| FY | Fiscal Year |
| GPDC | Global and Professional Direct Contracting |
| HCC | Hierarchical Condition Category |
| HH | Home Health |
| HHA | Home Health Agency |
| HPES | High Post-Episode Spending |
| ICS | Internal Cost Savings |
| IP | Inpatient |
| IPO | Inpatient Only |

| Acronym | Meaning |
|---------|---------|
| IPPS | Inpatient Prospective Payment System |
| IRF | Inpatient Rehabilitation Facility |
| LCI | Lower Confidence Interval |
| LEJR | Lower Extremity Joint Replacement |
| LIS | Low-Income Subsidy |
| LOS | Length of Stay |
| LTCH | Long-Term Care Hospital |
| M | Million |
| MA | Medicare Advantage |
| MCC | Major Complication or Comorbidity |
| MDM | Master Data Management |
| MDS | Minimum Data Set |
| MSA | Metropolitan Statistical Area |
| MS-DRG | Medicare Severity-Diagnosis Related Group |
| SSP | Shared Savings Program |
| N | Number |
| NPPGP | Non-Physician Practitioner Group Practices |
| NPRA | Net Payment Reconciliation Amount |
| OLS | Ordinary Least Squares |
| OP | Outpatient |
| OPPS | Outpatient Prospective Payment System |
| OT | Occupational Therapy |
| PAC | Post-Acute Care |
| PCP | Primary Care Provider |
| PDGM | Patient Driven Groupings Model |
| PDP | Post-Discharge Period |
| PDPM | Patient Driven Payment Model |
| PEP | Post-Episode Period |
| PGP | Physician Group Practice |
| PHE | Public Health Emergency |
| POS | Provider of Services |
| PP | Percentage Point |
| PRO | Patient-Reported Outcomes |
| PT | Physical Therapy |
| PT/OT | Physical Therapy or Occupational Therapy |
| PY | Performance Year |
| Q | Quarter (in the calendar year) |

| Acronym | Meaning |
|---------|---------|
| RIF | Research Identifiable File |
| SNF | Skilled Nursing Facility |
| SNH | Safety-Net Hospital |
| THA | Total Hip Arthroplasty |
| TKA | Total Knee Arthroplasty |
| UCI | Upper Confidence Interval |
| VBC | Value-Based Care |
| VBP | Value-Based Payments |

## Exhibit A-2: Glossary of Terms

| Term | Definition |
|------|-----------|
| Acute care hospital (ACH) | A health care facility that provides inpatient medical care and other related services for acute medical conditions or injuries. |
| Ambulatory surgical center (ASC) | A health care facility that provides surgical care to patients not requiring hospitalization or services exceeding 24 hours. |
| Anchor hospitalization or procedure | The inpatient hospitalization or outpatient LEJR procedure that triggers the start of the episode of care. |
| Baseline period | The baseline period used in the evaluation; the period of time that precedes the start of the CJR Model as a basis for comparison in the difference-in-differences statistical technique. The baseline period for our evaluation includes episodes that were initiated from 2012 to 2014 and that ended between April 1, 2012, and March 31, 2015. |
| Beneficiary incentive | A programmatic flexibility available to hospitals participating in the CJR Model. This allows participating hospitals to offer patients certain incentives not tied to the standard provision of health care, if it supports a clinical goal. |
| Beneficiary notification requirement | Written notification that each participant hospital must provide to any Medicare beneficiary who meets the criteria for inclusion in the CJR Model. |
| Bundled payment | A single payment for the combined cost of eligible services and supplies – like treatments, tests, and procedures – provided during a defined episode of care. This payment can cover multiple providers involved in the episode of care. |
| CJR collaborator | Medicare-enrolled providers and suppliers engaged in caring for CJR beneficiaries that enter into sharing agreements with a participant hospital. Collaborators may be a SNF, HHA, LTCH, IRF, physician, non-physician practitioner, provider or supplier of outpatient therapy services, PGP, non-physician provider group practice, ACO, hospital, or critical access hospital. |
| CJR sharing arrangement | A financial arrangement between a participant hospital and a CJR collaborator for the sole purpose of making gainsharing payments or alignment payments under the CJR Model. |
| Composite quality score (CQS) | A summary score reflecting hospital performance and improvement on two LEJR-related quality measures (THA/TKA Complications measure and the HCAHPS Survey measure), as well as successful submission of THA/TKA patient-reported outcomes and limited risk variable data. |

| Term | Definition |
|---|---|
| Effective discount percentage | The effective discount percentage, provided at the beginning of a performance period, serves as Medicare's portion of the savings. A 3% effective discount percentage is used to set the prospective quality-adjusted target price. The effective discount percentage used at reconciliation varies based on the hospital's quality performance in the year. The effective discount percentages are: 0% for "excellent" quality, 1.5% for "good" quality, and 3% for "acceptable" quality. The effective discount percentage for hospitals with "below acceptable" quality is also 3%, but hospitals with "below acceptable" quality are ineligible to receive reconciliation payments. |
| Episode benchmark price | The episode benchmark price represents the expected episode payments if treatment patterns and patient mix do not change from previous historical spending for LEJR episodes. For Performance Year 6 and 7, the episode benchmark price is based solely on regional amounts and includes both outpatient TKA and THA. Additionally, benchmark prices are adjusted for MS-DRG, age indicators, hierarchical condition category counts, and dual eligibility for Medicaid in Performance Year 6 and 7. The product of the episode benchmark price and the effective discount percentage equals the quality-adjusted target price. |
| Episode of care | The set of services and supplies to treat a medical condition, for a defined length of time. A CJR episode of care is triggered by the admission of an eligible Medicare fee-for-service beneficiary to a hospital paid under IPPS for an inpatient hospitalization or an outpatient LEJR procedure that results in a discharge paid under MS-DRG 469 (major joint replacement or reattachment of lower extremity with MCC), 470 (major joint replacement or reattachment of lower extremity without MCC), MS-DRG 521 (hip replacement with principal diagnosis of hip fracture with MCC), or MS-DRG 522 (hip replacement with principal diagnosis of hip fracture without MCC), and ends 90 days after discharge from the anchor hospitalization or the outpatient procedure. Beginning in Performance Year 6, Total Knee Arthroplasty (CPT 27447) or Total Hip Arthroplasty (CPT 27130) procedures performed in the Hospital Outpatient Department (HOPD) setting and paid under the Outpatient Prospective Payment System (OPPS) also initiate a CJR episode. |
| Extension period | Performance Years 6–8 of the CJR Model. The performance period of the CJR Model was extended by 3 years to evaluate design updates implemented by CMS in the 2021 Final Rule. The model extension applied to CJR participants in mandatory MSAs excluding hospitals with Section 401 rural status or low-volume status. CJR hospitals located in voluntary MSAs who previously opted to continue their participation in the CJR Model were required to end their participation at the start of the extension period. |
| Gainsharing payment | A payment from a participant hospital to a CJR collaborator made pursuant to a CJR sharing arrangement. A gainsharing payment may be composed of reconciliation payments, internal cost savings, or both. |
| High episode spending cap | The high episode spending cap prevents participant hospitals from being held responsible for catastrophic episode spending amounts that they could not reasonably have been expected to prevent by capping the costs for those episodes. Episodes qualify for the spending cap when an episode cost exceeds 2 standard deviations above the regional mean episode. |
| Hospital referral region | Regional health care markets based on historical data of where most beneficiaries within a zip code receive services for selected tertiary care, not including orthopedic services. |
| Inpatient-only (IPO) list | A list of procedures that are covered by Medicare only when provided in the inpatient setting. |
| Low volume | A hospital identified by CMS as having fewer than 20 LEJR episodes in total across the 3 historical years of data used to calculate the Performance Year 1 CJR episode target prices. |

| Term | Definition |
|------|-----------|
| Mandatory MSA | Mandatory participation areas for the first two performance years included hospitals paid under the Medicare Inpatient Prospective Payment System (IPPS) in 67 metropolitan statistical areas (MSAs), counties associated with a core urban area with a population of at least 50,000. As of February 1, 2018, 34 of the 67 areas remained mandatory MSAs and starting on October 1, 2021, hospitals in the 34 MSAs not designated as low volume or rural were designated as mandatory participants in CJR for Performance Years 6 through 8. |
| Metropolitan statistical area (MSA) | A geographical region that is associated with a core urban area and has a population of at least 50,000. |
| National adjustment factor | The national mean of the target price for all episode types divided by the national mean of the risk-adjusted target price. Starting from Performance Year 6, the national adjustment factor was replaced with a retrospective market trend factor applied during reconciliation. |
| Net payment reconciliation amount (NPRA) | The total reconciliation or repayment target price amount minus the total performance period episode spending amount at the hospital level, adjusted by stop gain or stop loss limits, if applicable. |
| Outpatient (OP) department | A care setting for procedures not requiring admission or overnight stay covered by Medicare through the OPPS. The 2-midnight rule provides guidance regarding the classification of inpatient or outpatient procedures. |
| Post-acute care (PAC) | Rehabilitation and palliative care services received by the patient from IRFs, SNFs, HHAs, LTCHs, or OP PT/OT following a hospitalization. |
| Post-discharge home visit waiver | A waiver available to hospitals participating in the CJR Model which waives the direct supervision requirement for home visits. CJR beneficiaries may receive up to nine home visits per episode by licensed clinical staff paid under the Medicare Physician Fee Schedule. |
| Post-discharge period (PDP) | The 90-day period after discharge, which starts on the day of the anchor hospitalization discharge for in-patient episodes and the day of the procedure for out-patient episodes. |
| Quality-adjusted target price | The target price in the CJR Model after risk-adjustment and the quality discount factor are applied. In the model extension, the quality-adjusted target price is based on 1 year of historical data. Due to this change, the Performance Year 6 target price reflected the hospital's actual composite quality score at reconciliation in 2021. There are separate quality-adjusted target prices to account for MS-DRG and hip fracture status. Additionally, target prices are adjusted for age indicators, hierarchical category condition counts, and dual eligibility for Medicaid. |
| Quality discount factors | A discount applied during calculation of regional target prices for participant hospitals based on the composite quality score. In Performance Years 6 through 8, the Medicare built-in discount is 0% for participant hospitals with "excellent" quality performance defined as composite quality scores that are greater than 15.0; 1.5% for participant hospitals with "good" quality performance defined as composite quality scores that are greater than or equal to 6.9 and less than or equal to 15.0; and 3% for participant hospitals with "below acceptable/acceptable" quality performance defined as composite quality scores that are less than 6.9. |
| Reconciliation payment | A retrospective payment between Medicare and a CJR participant hospital at the end of a performance year. If total fee-for-service payments for its episodes during a performance year are less than the aggregate quality-adjusted target price, Medicare makes a payment to a CJR participant hospital. If total fee-for-service payments for a CJR participant hospital's episodes are more than its aggregate quality-adjusted target price, the hospital repays the difference to Medicare. |

| Term | Definition |
|------|-----------|
| Related items and services | Episode-related items and services paid under Medicare Part A or Part B that are included in the bundle after exclusions are applied. These episode-related items and services include physicians' services, inpatient hospital services (including readmissions with certain exceptions discussed in the Final Rule), inpatient psychiatric facility services, LTCH services, IRF services, SNF services, HHA services, hospital outpatient services, outpatient therapy services, clinical laboratory services, DME, Part B drugs, and hospice. |
| Retrospective market trend factor | The regional/MS–DRG mean cost for episodes occurring during the performance year divided by the regional/MS–DRG mean cost for episodes occurring during the target price base year. |
| Risk adjustment | A statistical process to adjust claims-based outcomes to consider differences at the patient, episode, hospital, state, and MSA level that are related to the measures of interest. Without adequate risk adjustment, providers treating a sicker or more service-intensive patient mix would have worse outcomes than otherwise comparable providers serving healthier patients. |
| Rural (as defined by the CJR Model) | An IPPS hospital that is in a rural area as defined under § 412.64 of CMS Final Rule 42 CJR Part 510, is in a rural census tract defined under § 412.103(a)(1), or has reclassified as a rural hospital under § 412.103. |
| Safety-net hospital (SNH) | Hospitals with greater than 35.4% of their patient population dually eligible for Medicare and Medicaid or 36.5% of their patient population eligible for Medicare Part D Low Income Subsidy. |
| Stop-loss/Stop-gain limits | Adjustments included in the NPRA calculation vary by performance year. The stop-loss limit is the maximum amount a hospital will have to repay to CMS, and the stop-gain limit is the maximum amount that a hospital will receive from CMS as a reconciliation payment. They are based on a percentage of the quality-adjusted target price. The stop-loss and stop-gain limits are 20% in Performance Years 6 and 7. |
| Telehealth waiver | A waiver available to hospitals participating in the CJR Model. Under this waiver, CMS allows Medicare coverage of telehealth services furnished to eligible beneficiaries regardless of their geographic region. Further, the originating site requirement is waived for eligible beneficiaries receiving telehealth services from their homes or places of residence. |
| Three-day hospital stay waiver | A waiver available to hospitals participating in the CJR Model. Under this waiver, CMS waives the three-day hospital stay requirement for Part A skilled nursing facility coverage. |
| Unmet non-medical need | An individual's unmet need related to adverse social conditions that contribute to poor health outcomes (lack of access to affordable and stable housing, lack of access to healthy food, lack of access to transportation). |
| Value-Based care (VBC) | Designing care so that it focuses on quality, provider performance, and patient experience. |
| Voluntary MSA | Beginning in 2018, the 67 original CJR MSAs were ranked by average historical wage-adjusted episode payment. CMS gave the bottom 33 MSAs a one-time opportunity to opt in to CJR Model through Performance Year 5. |

*Source:*   CJR evaluation team analysis of the CMS Final Rule Medicare Program: Comprehensive Care for Joint Replacement Model Three-Year Extension and Changes to Episode Definition and Pricing, 85 Fed. Reg. 10516 (November 24, 2020) (codified at 42 CFR 510).

# Appendix B: Data and Methods

In this appendix, we summarize the data and methods used to evaluate the Comprehensive Care for Joint Replacement (CJR) Model and generate the results presented in this Seventh Annual Report.

## A. Secondary Data Sources

**Exhibit B-1: Secondary Data Sources**

| Data source | Date range | Dataset contents | Use |
|---|---|---|---|
| **Bundled Payments for Care Improvement Advanced (BPCI-A) programmatic participant data** | Intervention | Identifies health care providers (hospitals, physicians, and physician practice groups) that are participating in the BPCI-A model, the time period of participation, and the episodes for which they are participating. | Used to identify LEJR discharges in the control group that are assigned to BPCI-A participants for risk adjustment. |
| **Bundled Payments for Care Improvement (BPCI) programmatic participant data** | Baseline and intervention | Identifies health care providers (hospitals, PAC providers, physicians, and physician practice groups) that are participating in the BPCI initiative, the time period of participation, and the models and episodes for which they are participating. | Used to identify LEJR discharges that are assigned to BPCI participants for exclusion. Used to identify hospitals as past BPCI LEJR participants for risk adjustment. |
| **Comprehensive Care for Joint Replacement (CJR) programmatic data** | Intervention | List of CJR participant hospitals, as well as their PY 1, PY 2, PY 3, PY 4, PY 5, PY 6, and PY 7 quality-adjusted target prices, reconciliation (NPRA), and hospital quality data. | Used to identify CJR participating hospitals, hospitals that continued mandatory participation in PY 3, their start and end dates in the CJR Model, their quality performance, and their reconciliation payments or repayment responsibility. Used total reconciliation payments and repayments to CMS to calculate savings to Medicare and investigate the distribution of NPRA. |
| **FY Acute IPPS Final Rule data files** | FY 2016, FY 2018, FY 2021 | On an annual basis, CMS sets acute care hospital IPPS payment rates. Data files include FY hospital-level information on provider identification number, bed count, medical residents per 1,000 beds, average daily census, disproportionate share hospital patient percentage, uncompensated care payment per claim, Medicare days as a percent of total inpatient days, and section 401 (rural) status. | Used to risk adjust for acute care IPPS hospital characteristics. Used to identify section 401 hospitals (rural designation) located in control group hospitals to exclude from the PY 6–PY 7 sample. |

| Data source | Date range | Dataset contents | Use |
|---|---|---|---|
| **CMS Master Data Management (MDM)** | Baseline and Intervention | Provider- and patient- level information on participation in CMS Innovation Center payment demonstration programs. Includes beneficiary ID, program ID, and start and end dates of participation. | Used to identify patients involved in Pioneer, Next Generation, and SSP ACO programs and control for their participation in our analyses. Used to apply the ACO exclusion for episodes starting on or after July 1, 2017 (SSP track 3, Comprehensive End-Stage Renal Disease Care Model with downside risk, and Next Generation). For PY 6 through PY 8, SSP Enhanced Track episodes were excluded. |
| **Medicare FFS beneficiary enrollment data** | Baseline and Intervention | Enrollment data (from Common Medicare Enrollment and Medicare Beneficiary Summary File) provide beneficiary Medicare Parts A and B eligibility information. | Enrollment data were used to confirm beneficiary eligibility and provide patient characteristics for analyses (for example, risk adjustment models). Enrollment data were used to measure the change in case-mix of CJR and control group patients between the baseline and the intervention periods. |
| **Medicare FFS claims** | Baseline and Intervention | Medicare Parts A and B claims data (from monthly Medicare claims [TAP] files) provide claims for different services received during the anchor hospitalization and post-discharge period (for example, dates and types of service). A minimum of 3-month claims run out was used for episodes included in this report. | Claims were used to: 1) create the CJR episodes, describe service use, and create risk adjustment (for example, patient prior utilization, HCC score, COVID-19 diagnosis) and outcome variables (for example, unplanned readmissions, emergency department visits, and number of days or visits in each PAC setting); 2) identify TKA and THA procedures in the hospital outpatient departments and ambulatory surgical centers in CJR and control markets for descriptive analyses and create outpatient TKA and THA episodes; and 3) sample participants for primary data collection (patient survey, telephone interviews). |
| **SSP ACO Provider Research Identifiable File (RIF)** | Baseline, 2021, 2022, and 2023 | The Shared Savings Provider RIF file years 2013, 2014, 2021, 2022, and 2023 is used to identify hospitals at the CCN level participating in the SSP. | Used to compile Medicare ACO participation data among CJR and control hospitals. |

| Data source | Date range | Dataset contents | Use |
|---|---|---|---|
| **MDS 3.0 data** | Baseline and Intervention | The MDS is a comprehensive assessment instrument administered by nursing staff to all Medicare beneficiaries when they are admitted to a Medicare-certified SNF, at discharge, as well as on days 5, 14, 30, 60, 90, and quarterly, thereafter. The MDS collects information on patients' demographics, history and diagnoses, skin conditions, medications, care management, restraint use, preferences for routine and activities, and functional, sensory, cognitive, neuro or emotional, bladder, bowel, swallowing or nutritional, and pain status. A minimum 6 month run out of MDS data was used for episodes included in this report. | MDS data were used to identify patients who were in a SNF or long-term nursing facility during the 6 months preceding the episode which was used for risk-adjustment and to measure the change in case-mix of CJR patients and patients in the control group between the baseline and the intervention periods. |
| **Medicare standardized payments** | Baseline and Intervention | Medicare standardized payments for 100% of Parts A and B claims received via the Integrated Data Repository. Produced by a CMS contractor. | Used to create Medicare standardized paid amounts (Parts A and B) and allowed standardized payment amounts, including patient out-of-pocket amounts. Used to estimate the impacts of the CJR Model on total episode and service-level payments. |
| **Next Generation ACO Provider Research Identifiable File (RIF)** | 2021 | Information on Next Generation ACO (NGACO) provider-level participation and related data. The Next Generation ACO Provider RIF files year 2021 is used to identify hospitals at the CCN level participating in the Next Generation Program. | Used to compile Medicare ACO participation data among CJR and control hospitals. |
| **Pioneer ACO Model Provider Research Identifiable File (RIF)** | Baseline | Information on Pioneer ACO provider-level participation and related data. The Pioneer ACO Provider RIF files years 2012, 2013, and 2014 is used to identify hospitals at the CCN level participating in the Pioneer program. | Used to compile Medicare ACO participation data among CJR and control hospitals. |
| **Provider of Services (POS) file** | December 2016 | Information on Medicare-approved facilities, including provider identification number, ownership status, size, medical school affiliation, and staffing. | Used to identify and characterize acute care hospitals actively engaged in Medicare for risk adjustment and descriptive analyses. |

| Data source | Date range | Dataset contents | Use |
|---|---|---|---|
| **REACH ACO Provider Identifiable File (RIF)** | 2021—2023 | Information on REACH and Global and Professional Direct Contracting (GPDC) ACO provider-level participation and related data. The GPDC and REACH ACO Provider file years 2021, 2022, and 2023 are used to identify hospitals at the CCN level participating in the REACH ACO model. | Used to compile Medicare ACO participation data among CJR and control hospitals. |

*Notes:*    ACO = Accountable Care Organization; BPCI = Bundled Payments for Care Improvement; BPCI-A = Bundled Payments for Care Improvement Advanced; CCN = CMS certification number; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; COVID-19 = coronavirus disease 2019; FFS = fee-for-service; FY = fiscal year; GPDC = Global and Professional Direct Contracting; HCC = hierarchical condition category; ID = identification; IPPS = Inpatient Prospective Payment System; LEJR = lower extremity joint replacement; MDM = Master Data Management; MDS = Medicare Minimum Data Set 3.0; NPRA = net payment reconciliation amount; PAC = post-acute care; POS = provider of services; PY = performance year; RIF = Research Identifiable File; SNF = skilled nursing facility; SSP = Shared Savings Program; THA = total hip arthroplasty; TKA = total knee arthroplasty.

## B. Study Population

This section defines the CJR and control group populations, explains the weights used in the mandatory analyses to account for differences in sampling probabilities, and outlines the additional eligibility criteria for hospitals and episodes.

### 1. Defining the CJR and Control Group Populations

At the start of the CJR Model in 2016, CMS selected MSAs eligible for CJR participation based on a stratified sampling methodology. CMS stratified MSAs into eight strata based on historical wage-adjusted episode payments and population size. Within each stratum, MSAs were randomly selected to participate in the CJR Model (n = 67 MSAs). This design allowed for a control group of hospitals in MSAs that were eligible but not selected by CMS to participate in the CJR Model (n = 104 MSAs). These MSAs represented what would have happened in CJR-type markets if the model was never implemented (that is, the counterfactual). To be included in the CJR Model and in our analysis, hospitals had to be acute care hospitals paid under the IPPS that performed LEJRs for Medicare patients.

In 2018, the 67 original CJR MSAs were ranked by average historical wage-adjusted episode payment, and CMS required the top 34 MSAs with the highest payments to continue participation in the model (mandatory MSAs) while giving hospitals in the bottom 33 MSAs a one-time opportunity to opt in (voluntary MSAs). This change reduced mandatory participation by about half by allowing all CJR hospitals in the 33 low-payment MSAs and rural or low-volume CJR hospitals in the 34 high-payment MSAs a one-time opportunity to remain in the model. As discussed in **Chapter I: CJR Model Background**, starting in PY 6, CMS required all CJR participating hospitals in voluntary MSAs to halt their participation in the model. Also starting in PY 6, low-volume or rural CJR hospitals participating in mandatory MSAs could no longer participate in the model.

This report covers PY 6 and PY 7 of the CJR Model, from October 1, 2021, to December 31, 2023. Our analyses focused on episodes from hospitals that were mandated to participate as of PY 6–PY 7. As such, we excluded rural and low-volume hospitals in the mandatory MSAs that previously could opt in to continue participation in CJR because they were no longer allowed to remain in the model in PY 6. Low-volume hospitals were defined as hospitals that had less than 20 episodes over a 3-year historical period (2012 to 2014), and we identified rural hospitals using the FY 2019 IPPS data (Section 401 hospitals). Starting in PY 6, a considerable number of CJR hospitals for which participation had been mandatory since the beginning of the model were no longer eligible to be in the model. Of the 395 mandatory CJR hospitals in PYs 3–5, 72 no longer participated in the model in PY 6 due to an updated rural designation status.

**Exhibit B-2** provides the names of the CJR and control group MSAs included in the original CJR Model and in our analysis of PY 6–PY 7. MSAs that were included in our analysis of PYs 6–7 are indicated by an asterisk.

**Exhibit B-2: CJR and Control Group MSAs Included in the Original Model and PY 6–PY 7**

| CJR | | Control | |
|---|---|---|---|
| **CBSA ID** | **MSA name, state** | **CBSA ID** | **MSA name, state** |
| 10420 | Akron, OH* | 10180 | Abilene, TX |
| 10740 | Albuquerque, NM | 10580 | Albany-Schenectady-Troy, NY |
| 11700 | Asheville, NC* | 10900 | Allentown-Bethlehem-Easton, PA-NJ* |
| 12020 | Athens-Clarke County, GA | 11100 | Amarillo, TX* |
| 12420 | Austin-Round Rock, TX* | 11260 | Anchorage, AK |
| 13140 | Beaumont-Port Arthur, TX* | 12060 | Atlanta-Sandy Springs-Roswell, GA |
| 13900 | Bismarck, ND | 12700 | Barnstable Town, MA* |
| 14500 | Boulder, CO | 13460 | Bend-Redmond, OR |
| 15380 | Buffalo-Cheektowaga-Niagara Falls, NY | 13820 | Birmingham-Hoover, AL* |
| 16020 | Cape Girardeau, MO-IL | 14260 | Boise City, ID |
| 16180 | Carson City, NV | 14460 | Boston-Cambridge-Newton, MA-NH |
| 16740 | Charlotte-Concord-Gastonia, NC-SC | 14540 | Bowling Green, KY* |
| 17140 | Cincinnati, OH-KY-IN* | 15940 | Canton-Massillon, OH |
| 17860 | Columbia, MO | 15980 | Cape Coral-Fort Myers, FL* |
| 18580 | Corpus Christi, TX* | 16060 | Carbondale-Marion, IL* |
| 19500 | Decatur, IL | 16300 | Cedar Rapids, IA |
| 19740 | Denver-Aurora-Lakewood, CO | 16620 | Charleston, WV |
| 20020 | Dothan, AL | 16700 | Charleston-North Charleston, SC |
| 20500 | Durham-Chapel Hill, NC | 16860 | Chattanooga, TN-GA* |
| 22420 | Flint, MI | 16980 | Chicago-Naperville-Elgin, IL-IN-WI* |
| 22500 | Florence, SC | 17020 | Chico, CA |
| 23540 | Gainesville, FL* | 17780 | College Station-Bryan, TX |
| 23580 | Gainesville, GA | 17900 | Columbia, SC* |
| 24780 | Greenville, NC* | 17980 | Columbus, GA-AL |
| 25420 | Harrisburg-Carlisle, PA* | 18140 | Columbus, OH |
| 26300 | Hot Springs, AR* | 19100 | Dallas-Fort Worth-Arlington, TX* |
| 26900 | Indianapolis-Carmel-Anderson, IN | 19380 | Dayton, OH* |
| 28140 | Kansas City, MO-KS | 19660 | Deltona-Daytona Beach-Ormond Beach, FL* |
| 28660 | Killeen-Temple, TX* | 19820 | Detroit-Warren-Dearborn, MI* |
| 30700 | Lincoln, NE | 20260 | Duluth, MN-WI |
| 31080 | Los Angeles-Long Beach-Anaheim, CA* | 20740 | Eau Claire, WI |
| 31180 | Lubbock, TX* | 22020 | Fargo, ND-MN |
| 31540 | Madison, WI | 22520 | Florence-Muscle Shoals, AL* |
| 32820 | Memphis, TN-MS-AR* | 22900 | Fort Smith, AR-OK |
| 33100 | Miami-Fort Lauderdale-West Palm Beach, FL* | 23060 | Fort Wayne, IN |
| 33340 | Milwaukee-Waukesha-West Allis, WI | 23420 | Fresno, CA |
| 33700 | Modesto, CA | 24340 | Grand Rapids-Wyoming, MI |

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| CJR | | Control | |
|---|---|---|---|
| **CBSA ID** | **MSA name, state** | **CBSA ID** | **MSA name, state** |
| 33740 | Monroe, LA* | 24580 | Green Bay, WI |
| 33860 | Montgomery, AL* | 24860 | Greenville-Anderson-Mauldin, SC* |
| 34940 | Naples-Immokalee-Marco Island, FL | 25060 | Gulfport-Biloxi-Pascagoula, MS* |
| 34980 | Nashville-Davidson--Murfreesboro--Franklin, TN | 25540 | Hartford-West Hartford-East Hartford, CT |
| 35300 | New Haven-Milford, CT* | 25620 | Hattiesburg, MS* |
| 35380 | New Orleans-Metairie, LA* | 25940 | Hilton Head Island-Bluffton-Beaufort, SC* |
| 35620 | New York-Newark-Jersey City, NY-NJ-PA* | 26140 | Homosassa Springs, FL* |
| 35980 | Norwich-New London, CT | 26420 | Houston-The Woodlands-Sugar Land, TX* |
| 36260 | Ogden-Clearfield, UT | 26580 | Huntington-Ashland, WV-KY-OH |
| 36420 | Oklahoma City, OK* | 26620 | Huntsville, AL* |
| 36740 | Orlando-Kissimmee-Sanford, FL* | 26980 | Iowa City, IA |
| 37860 | Pensacola-Ferry Pass-Brent, FL | 27140 | Jackson, MS* |
| 38300 | Pittsburgh, PA* | 27860 | Jonesboro, AR* |
| 38940 | Port St. Lucie, FL* | 27900 | Joplin, MO |
| 38900 | Portland-Vancouver-Hillsboro, OR-WA | 29180 | Lafayette, LA* |
| 39340 | Provo-Orem, UT* | 29200 | Lafayette-West Lafayette, IN |
| 39740 | Reading, PA* | 29340 | Lake Charles, LA* |
| 40980 | Saginaw, MI | 29420 | Lake Havasu City-Kingman, AZ |
| 41860 | San Francisco-Oakland-Hayward, CA | 29460 | Lakeland-Winter Haven, FL* |
| 42660 | Seattle-Tacoma-Bellevue, WA | 29620 | Lansing-East Lansing, MI |
| 42680 | Sebastian-Vero Beach, FL | 30460 | Lexington-Fayette, KY* |
| 43780 | South Bend-Mishawaka, IN-MI | 30620 | Lima, OH* |
| 41180 | St. Louis, MO-IL | 30780 | Little Rock-North Little Rock-Conway, AR |
| 44420 | Staunton-Waynesboro, VA | 31140 | Louisville/Jefferson County, KY-IN* |
| 45300 | Tampa-St. Petersburg-Clearwater, FL* | 31420 | Macon, GA* |
| 45780 | Toledo, OH* | 31700 | Manchester-Nashua, NH |
| 45820 | Topeka, KS | 33460 | Minneapolis-St. Paul-Bloomington, MN-WI |
| 46220 | Tuscaloosa, AL | 34820 | Myrtle Beach-Conway-North Myrtle Beach, SC-NC |
| 46340 | Tyler, TX* | 34900 | Napa, CA |
| 48620 | Wichita, KS | 35840 | North Port-Sarasota-Bradenton, FL* |
| | | 36100 | Ocala, FL |
| | | 36540 | Omaha-Council Bluffs, NE-IA |
| | | 37900 | Peoria, IL |
| | | 37980 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD* |
| | | 38060 | Phoenix-Mesa-Scottsdale, AZ |
| | | 38860 | Portland-South Portland, ME |
| | | 39300 | Providence-Warwick, RI-MA |
| | | 39460 | Punta Gorda, FL* |

| CJR | | Control | |
|---|---|---|---|
| **CBSA ID** | **MSA name, state** | **CBSA ID** | **MSA name, state** |
| | | 39580 | Raleigh, NC |
| | | 40140 | Riverside-San Bernardino-Ontario, CA* |
| | | 40220 | Roanoke, VA |
| | | 40340 | Rochester, MN |
| | | 40380 | Rochester, NY |
| | | 40900 | Sacramento--Roseville--Arden-Arcade, CA |
| | | 41500 | Salinas, CA |
| | | 41620 | Salt Lake City, UT* |
| | | 41740 | San Diego-Carlsbad, CA |
| | | 41940 | San Jose-Sunnyvale-Santa Clara, CA |
| | | 41980 | San Juan-Carolina-Caguas, PR |
| | | 42200 | Santa Maria-Santa Barbara, CA |
| | | 42220 | Santa Rosa, CA |
| | | 42340 | Savannah, GA |
| | | 43340 | Shreveport-Bossier City, LA* |
| | | 43620 | Sioux Falls, SD |
| | | 44060 | Spokane-Spokane Valley, WA |
| | | 44100 | Springfield, IL |
| | | 44180 | Springfield, MO |
| | | 41100 | St. George, UT |
| | | 46060 | Tucson, AZ |
| | | 46140 | Tulsa, OK |
| | | 46520 | Urban Honolulu, HI |
| | | 47940 | Waterloo-Cedar Falls, IA* |
| | | 48300 | Wenatchee, WA |
| | | 48900 | Wilmington, NC |
| | | 49340 | Worcester, MA-CT* |
| | | 49620 | York-Hanover, PA* |
| | | 49660 | Youngstown-Warren-Boardman, OH-PA* |

*Source:* https://innovation.cms.gov/initiatives/CJR. Information for control group MSAs provided by the Centers for Medicare & Medicaid Services.

*Notes:* An asterisk indicates that the MSA had participating CJR hospitals in PY 6–PY 7 or was included in our control group for PY 6–PY 7. MSAs without an asterisk were not included in the analyses of PY 6–PY 7.

CBSA = core-based statistical area; CJR = Comprehensive Care for Joint Replacement; MSA = metropolitan statistical area; PY = performance year.

## 2. Analytic MSA Sampling Weights and Construction of Control Group

In all analyses, unless otherwise noted, we used analytic MSA-level sampling weights that reflect both the stratified sampling of MSAs used in the design of the CJR Model and the voluntary–mandatory split of the model in 2018. The probability of an MSA being selected to participate in the original CJR Model varied across the strata, with CMS proportionally under-sampling MSAs in the lower average episode payment strata (strata 1, 2, 5, and 6) and over-sampling MSAs in higher average episode payment strata (strata 3, 4, 7, and 8). **Exhibit B-3** shows the count of CJR and control group MSAs by stratum and the proportion of MSAs in each stratum that make up the CJR and control groups.

**Exhibit B-3:    CMS' Original Stratified Random Sample of CJR MSAs**

| MSA population | MSA sampling stratum | MSA average episode payment | # MSAs eligible for sampling | CJR sample | | Control group sample | |
|---|---|---|---|---|---|---|---|
| | | | | # CJR MSAs | Percent of MSAs selected for CJR (%) | # Control group MSAs | Percent of MSAs in the control group (%) |
| Less than median population | 1 | Lowest quartile | 25 | 8 | 32.0 | 17 | 68.0 |
| | 2 | 2nd lowest quartile | 18 | 6 | 33.3 | 12 | 66.7 |
| | 3 | 3rd lowest quartile | 19 | 8 | 42.1 | 11 | 57.9 |
| | 4 | Highest quartile | 22 | 11 | 50.0 | 11 | 50.0 |
| More than median population | 5 | Lowest quartile | 15 | 5 | 33.3 | 10 | 66.7 |
| | 6 | 2nd lowest quartile | 28 | 10 | 35.7 | 18 | 64.3 |
| | 7 | 3rd lowest quartile | 22 | 9 | 40.9 | 13 | 59.1 |
| | 8 | Highest quartile | 22 | 10 | 45.5 | 12 | 54.5 |
| | | Total | 171 | 67 | | 104 | |

*Source:*   CJR evaluation team analysis of the CMS Final Rule Medicare Program Comprehensive Care for Joint Replacement Payment Model for Acute Care Hospitals Furnishing Lower Extremity Joint Replacement Services, 80 Fed. Reg. 73273 (November 24, 2015) (codified at 42 CFR 510).

*Notes:*   CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; MSA = metropolitan statistical area.

CJR was implemented as a randomized control trial, so the control group began as the MSAs that were eligible but not selected to be mandatory CJR participants. We then created MSA-specific analytic sampling weights to account for the exact details of CMS' stratified random sampling design as follows:

Step 1.   We began with the 104 non-CJR MSAs.

Step 2.   We applied MSA-level weights to the 104 non-CJR MSAs based on the probability that the MSA was selected into the 34 mandatory CJR MSAs through the two-step selection process.

To construct the weights in Step 2, we first calculated the probabilities of the first-stage selection for each MSA, that is, the probability that the MSA was randomly selected to be in the original set of 67 CJR MSAs. These probabilities equaled the proportion of MSAs randomly selected for CJR from each MSA sampling stratum.

Next, we calculated the probabilities of the second-stage selection, that is, the probability that the MSA was selected among the 34 mandatory CJR MSAs given that it was selected in the first stage. Those second-stage selection probabilities were more complex to calculate because the MSAs for the 34 mandatory CJR MSAs were not selected randomly, so we could not rely on simple proportions.[42] We used an average treatment effect on the treated (ATT) analysis to evaluate the impact of CJR on mandatory hospitals; thus, we used the calculated probabilities to construct MSA-level weights such that the weighted control group was representative of the CJR group. For this reason, all CJR MSAs received a weight of 1. Specifically,

*Weight for mandatory CJR hospitals = 1*

*Weight for control group hospitals =*

$$= \frac{(probability\ in\ treatment)}{(probability\ in\ control)} = \frac{(probability\ in\ 34\ mandatory\ CJR\ MSAs)}{(probability\ in\ 104\ non\ CJR\ MSAs)}$$

*Notes:* These were MSA stratum-level weights so all control group hospitals in the same MSA had the same weight.

**Exhibit B-4** shows the analytic weights calculated for control group MSAs and **Exhibit B-5** shows the full list of MSA-specific weights.

**Exhibit B-4:    Analytic Weights for Control Group MSAs**

| MSA sampling stratum | MSA | Weight |
|---|---|---|
| 3 | MSA-specific weights | Ranges from 0.00 to 0.73 |
| 4 | All MSAs | 1.00 |
| 7 | MSA-specific weights | Ranges from 0.02 to 0.69 |
| 8 | All MSAs | 0.83 |

*Source:*  CJR evaluation team analysis of the CMS Final Rule Medicare Program; Cancellation of Advancing Care Coordination Through Episode Payment and Cardiac Rehabilitation Incentive Payment Models; Changes to Comprehensive Care for Joint Replacement Payment Model: Extreme and Uncontrollable Circumstances Policy for the Comprehensive Care for Joint Replacement Payment Model, 82 Fed. Reg. 57066 (December 1, 2017) (codified at 42 CFR 510 and 42 CFR 512).

*Notes:*  CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; MSA = metropolitan statistical area.

**Exhibit B-5:    Analytic Sampling Weights for Control Group MSAs**

| MSA sampling stratum | MSA | Weight |
|---|---|---|
| 4 | All MSAs | 1.00 |
| 8 | All MSAs | 0.83 |
| 7 | Birmingham-Hoover, AL | 0.69 |
| 7 | Cape Coral-Fort Myers, FL | 0.69 |
| 7 | Chattanooga, TN-GA | 0.68 |

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[42]  The MSAs were selected by ranking the original 67 CJR MSAs by historical average episode payment and retaining the top half of the sample (that is, retaining the 34 MSAs with the highest historical average episode payment).

| MSA sampling stratum | MSA | Weight |
|---|---|---|
| 7 | Columbia, SC | 0.11 |
| 7 | Greenville-Anderson-Mauldin, SC | 0.69 |
| 3 | Gulfport-Biloxi-Pascagoula, MS | 0.73 |
| 3 | Hattiesburg, MS | 0.73 |
| 3 | Huntsville, AL | 0.71 |
| 3 | Jonesboro, AR | 0.73 |
| 7 | Lexington-Fayette, KY | 0.69 |
| 3 | Lima, OH | 0.73 |
| 7 | Louisville/Jefferson County, KY-IN | 0.51 |
| 3 | Macon, GA | 0.73 |
| 3 | Manchester-Nashua, NH | 0.00 |
| 7 | North Port-Sarasota-Bradenton, FL | 0.69 |
| 7 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 0.56 |
| 3 | Punta Gorda, FL | 0.73 |
| 7 | Riverside-San Bernardino-Ontario, CA | 0.02 |
| 7 | Salt Lake City, UT | 0.05 |
| 3 | Waterloo-Cedar Falls, IA | 0.73 |
| 7 | Worcester, MA-CT | 0.69 |
| 7 | York-Hanover, PA | 0.69 |

*Source:*   CJR evaluation team analysis of the Medicare Program; Cancellation of Advancing Care Coordination Through Episode Payment and Cardiac Rehabilitation Incentive Payment Models; Changes to Comprehensive Care for Joint Replacement Payment Model: Extreme and Uncontrollable Circumstances Policy for the Comprehensive Care for Joint Replacement Payment Model; A Final Rule by CMS, 82 FR 57066 (December 1, 2017) (codified at 42 CFR 510 and 42 CFR 512).

*Notes:*   CFR = Code of Federal Regulations; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; MSA = metropolitan statistical area.

### 3.   *LEJR Episode Definition*

Initially, for both the CJR and control group populations, the beginning of an IP episode was triggered by an admission to a CJR participating or control group hospital (called an anchor hospitalization) with a resulting discharge in Medicare Severity-Diagnosis Related Group (MS-DRG) 469 or 470 (LEJR with major complications or comorbidities [MCC] and LEJR without MCC, respectively). Starting in October 2020, CMS added two new MS-DRGs for LEJR due to hip fracture (521 with MCC and 522 without MCC) as episode triggers. Previously, hip fracture episodes were discharged under MS-DRGs 469 or 470 and were identified as having a hip fracture based on International Classification of Diseases diagnosis codes. The end of the episode is 90 days after the anchor hospitalization end date.

For OP LEJRs, the beginning of the episode is triggered by an LEJR performed in the OP department of a CJR participating or control group hospital, as identified in Part B institutional claims by Current Procedural Terminology code 27447 for total knee arthroplasty or 27130 for

total hip arthroplasty assigned to C-APC 5115 with status indicator "J1." The end of the episode is 90 days after the OP procedure.

Identically for both IP and OP LEJR recipients, Medicare beneficiaries who met and maintained the following eligibility throughout the period were included in the analysis:

- Enrolled in Medicare Parts A and B;

- Medicare was the primary payer; and

- Not eligible for Medicare based on end-stage renal disease (ESRD)

As specified in the Final Rule, episodes were canceled in the CJR Model and excluded from the analysis if:

- The patient no longer met the eligibility criteria described above;

- The patient was readmitted to a participating hospital during the episode and discharged under MS-DRG 469, 470, 521, or 522 (in which case the first episode is canceled and a new CJR episode begins);

- The patient died at any time during the episode period;

- The episodes started on or after July 1, 2017, and were prospectively assigned to a Next Generation ACO, an SSP ACO in track 3, or a Comprehensive ESRD Care Model ACO with downside risk;[43] or

- The episodes were attributed to the BPCI initiative[44]

To estimate the all-cause mortality rate measure, we retained episodes that were canceled due to death of patient but otherwise met all other eligibility criteria. We also excluded episodes that lacked certain patient information used to risk-adjust outcomes (for example, age, sex, and 6 months of Medicare FFS enrollment history prior to the LEJR hospital admission).

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[43]   This additional exclusion criterion was added with the January 2017 Final Rule, *Advancing Care Coordination Through Episode Payment Models (EPMs); Cardiac Rehabilitation Incentive Payment Model; and Changes to the Comprehensive Care for Joint Replacement Model (CJR)*. Available at:
https://www.federalregister.gov/documents/2017/01/03/2016-30746/medicare-program-advancing-care-coordination-through-episode-payment-models-epms-cardiac

[44]   Episodes initiated at CJR participant hospitals could be attributed to a physician group practice participating in the BPCI initiative or to skilled nursing facilities (SNFs), inpatient rehabilitation facilities (IRFs), long-term care hospitals (LTCHs), or home health agencies (HHAs) participating in the BPCI Initiative Model 3.

## C.  Secondary Data Claims-Based Outcomes

### 1.  *Measures of Impact on Payments, Utilization, and Quality*

In this section, we present the episode-level outcome measures that we constructed using Medicare FFS claims to assess the impact of the CJR Model on Medicare payments, utilization, and quality (**Exhibit B-6**).

**Exhibit B-6:**   **Claims-Based Outcome Definitions**[45]

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Medicare payments** | Total Medicare standardized allowed amounts per episode[46] | The sum of Medicare payment and patient out-of-pocket amounts for related items and services covered by Medicare Part A and Part B[47] performed during the LEJR hospitalization (anchor hospitalization) through the 90-day post-discharge period that are included in the episode. | Anchor hospitalization through 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

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[45]   The eligible sample column notes the inclusion criteria for episodes as defined by the Final Rule and additional measure-specific inclusion criteria required for the evaluation.

[46]   Standardized payments remove wage adjustments and other Medicare payment adjustments (for example, GME, IME, and DSH). Allowed amounts include beneficiary cost sharing.

[47]   Episode-related items and services paid under Medicare Part A or Part B, after exclusions are applied, including physician services, inpatient hospital services (including readmissions with certain exceptions discussed in the Final Rule), inpatient psychiatric facility services, long-term care hospital services, IRF services, SNF services, HHA services, hospital outpatient services, outpatient therapy services, clinical laboratory services, DME, Part B drugs, and hospice.

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Medicare payments (continued)** | Medicare standardized allowed amount for the anchor hospitalization per episode | The sum of Medicare payment and patient out-of-pocket amounts for the LEJR anchor hospitalization (Medicare Severity-Diagnosis Related Group 469, 470, 521, or 522 for inpatient episodes covered under Medicare Part A; CPT 27447 for outpatient TKA episodes and CPT 27130 for outpatient THA covered under Medicare Part B). | Anchor hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Other Medicare Part A standardized allowed amounts per episode, by service | The sum of Medicare payment and patient out-of-pocket amounts for all payments under Medicare Part A, excluding payments for readmissions, IRF, and SNF services covered under Medicare Part A. Includes all costs incurred during the 90 days following discharge. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Medicare standardized allowed amounts for HHA services per episode | The sum of Medicare payment and patient out-of-pocket amounts for HHA services covered under Medicare Part A or Part B HHA. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Medicare payments (continued)** | Other Medicare Part B standardized allowed amounts per episode | The sum of Medicare payment and patient out-of-pocket amounts for related items and services covered under Medicare Part B (except HHA services and payments for the LEJR if performed in the OP setting) including physician evaluation and management services, outpatient therapy services (speech, occupation, and physical therapy), imaging and lab services, procedures, DME, all other non-institutional services, and other institutional services. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Medicare Part A SNF Standardized Allowed Amount | The sum of Medicare payment and patient out-of-pocket amounts for Part A health care services provided for SNF during the 90-day PDP. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Medicare Part A IRF Standardized Allowed Amount | The sum of Medicare payment and patient out-of-pocket amounts for Part A health care services provided for IRF during the 90-day PDP. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Medicare payments (continued)** | Medicare Part A Readmissions Standardized Allowed Amount | The sum of Medicare payment and patient out-of-pocket amounts for Part A health care services provided for readmissions during the 90-day PDP. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Medicare standardized allowed amounts for services provided in the 30 days post-episode per episode | The sum of Medicare payment and patient out-of-pocket amounts for all health care services covered under Medicare Part A or B performed during the 30-day post-episode period | 30-day post-episode period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before January 30, 2024; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| **Utilization** | First discharge to IRF | The percentage of all episodes with patients initially discharged to an IRF. The first PAC setting is an IRF (a freestanding facility or a distinct unit within an acute hospital) if admission to the IRF occurred within the first 5 days of hospital discharge and no other PAC use occurred prior to IRF admission. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 5 days of the transfer discharge. | 1st to 5th day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Utilization (continued)** | First discharge to SNF | The percentage of all episodes with patients initially discharged to a SNF. The first PAC setting is a SNF if admission to the SNF occurred within the first 5 days of hospital discharge and no other PAC use occurred prior to SNF admission. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 5 days of the transfer discharge. | 1$^{st}$ to 5$^{th}$ day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | First discharge to HHA | The percentage of all episodes with patients initially discharged to an HHA. The first PAC setting is an HHA if admission to the HHA occurred within 14 days of hospital discharge and no other PAC use occurred prior to HHA admission. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 14 days of the transfer discharge. | 1$^{st}$ to 14$^{th}$ day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | First discharge to OP PT/OT | The percentage of all episodes with patients initially discharged to an outpatient physical therapy or occupational therapy setting. The first PAC setting is an OP PT/OT if there was not an admission to either SNF or IRF within 5 days after discharge, not an admission to a HHA within 14 days of hospital discharge, but there was a use of OP PT/OT within days 2 to 14 after discharge. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 14 days of the transfer discharge. | 1$^{st}$ to 14$^{th}$ day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Utilization (continued)** | First discharge to other | The percentage of all episodes with patients initially discharged to a setting other than SNF, IRF, HHA, or OP PT/OT. The first PAC setting is other if there was not an admission to either SNF or IRF within 5 days after discharge, not an admission to a HHA within 14 days of hospital discharge, not an admission to a OP PT/OT within days 2 to 14 after discharge of the discharge, but there was an admission to hospice, an IPPS, an LTCH, or another inpatient setting within 5 days of hospital discharge. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 14 days of the transfer discharge. | 1st to 14th day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | First discharge to home without HHA or OP PT/OT | The percent of all episodes with patients initially discharged to home without HHA or OP PT/OT services. The first PAC setting is home without HHA or OP PT/OT if the patient is not admitted to a SNF or IRF within 5 days of hospital discharge, is not admitted to a HHA within 14 days of hospital discharge, does not utilize OP PT/OT services on days 2 to 14 after discharge, and does not use an admitted to a different location within 5 days after discharge. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 14 days of the transfer discharge. | 1st to 14th day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Utilization (continued)** | First discharge to other | The percentage of all episodes with patients initially discharged to a setting other than SNF, IRF, HHA, or OP PT/OT. The first PAC setting is other if there was not an admission to either SNF or IRF within 5 days after discharge, not an admission to a HHA within 14 days of hospital discharge, not an admission to a OP PT/OT within days 2 to 14 after discharge of the discharge, but there was an admission to hospice, an IPPS, an LTCH, or an other inpatient setting within 5 days of hospital discharge. If the patient is directly transferred to another ACH after the anchor hospitalization, then the first PAC setting was defined within 14 days of the transfer discharge. | 1st to 14th day after discharge from the anchor or transfer hospitalization | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Any HHA use | The percent of all episodes with patients using any HHA services during the 90-day post-discharge period, as indicated by non-zero Medicare payment and patient out-of-pocket amounts for HHA services covered under Medicare Part A or Part B. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have non-missing Medicare standardized allowed payment information for the episode; 6) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Utilization (continued)** | Number of IRF days | The average number of IRF days of care during the 90-day post-discharge period. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have at least one IRF day during this period; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
| | Number of SNF days | The average number of SNF days of care during the 90-day post-discharge period. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have at least one SNF day during this period; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Utilization (continued)** | Number of HHA visits | The average number of HHA visits during the 90-day post-discharge period. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have at least one HHA visit during this period; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
|  | Number of outpatient PT or OT visits | The average number of outpatient PT or OT visits during the 90-day post-discharge period. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) have at least one outpatient PT or OT visit during this period; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| Quality | Unplanned readmission rate | The proportion of episodes with one or more unplanned readmissions for any eligible condition.[48] Following these specifications, we excluded planned admissions, based on Agency for Healthcare Research and Quality Clinical Classification System Procedure and Diagnoses codes. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) are discharged from the anchor hospitalization in accordance with medical advice; 6) have non-missing Medicare standardized allowed payment information for the episode ; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |
|  | ED visit rate | The proportion of episodes with one or more ED visits during the 90-day post-discharge period for which the patient required medical treatment but was not admitted to the hospital. Eligible ED visits are outpatient claims with a code indicating the patient used the ED but was not admitted to the hospital. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) are discharged from the anchor hospitalization in accordance with medical advice; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

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[48]  Updated specification documents were released by CMS in March 2019 for the unplanned readmission measure, and the measure was revised accordingly. Available at: https://www.qualitynet.org/inpatient/measures/readmission/methodology

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Quality (continued)** | All-cause mortality rate | Death from any cause during the anchor hospitalization or 90-day post-discharge period. | Anchor hospitalization and 90-day post-discharge period | Under the CJR Model, death during the anchor hospitalization or 90-day PDP cancels the episode. Therefore, this analysis includes CJR and control group episodes as well as patients at CJR participant and control group hospitals that would have been identified as episodes if they had not died during the episode of care. Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have not received hospice care in the 6 months prior to admission; 5) have a measurement period that ends on or before December 31, 2023; 6) are discharged from the anchor hospitalization in accordance with medical advice; 7) have non-missing Medicare standardized allowed payment information for the episode. |

| Domain | Outcome name | Definition | Measurement period(s) | Eligible sample |
|---|---|---|---|---|
| **Quality (continued)** | Incidence of any complications | The proportion of episodes with incidence (during the anchor hospitalization or a readmission) of: acute myocardial infarction, pneumonia, or sepsis or septicemia within the 7-day PDP; or surgical site bleeding or pulmonary embolism within the 30-day PDP; or mechanical complications, periprosthetic joint infection, or wound infection within the 90-day PDP. This measure was based on specifications for the NQF-endorsed THA or TKA complications measure (NQF measure 1550) for elective LEJRs.[49] Death in the 30 days after discharge is part of the technical definition but is not included in our analysis because patients who died during the anchor hospitalization or in the 90-day PDP are excluded from the CJR Model. | 90-day post-discharge period | Patients who: 1) have a complete FFS enrollment history 6 months prior to the anchor hospitalization; 2) have consistent, reliable sex and age data (age <115); 3) maintain Parts A and B enrollment throughout the measurement period; 4) have a measurement period that ends on or before December 31, 2023; 5) are discharged from the anchor hospitalization in accordance with medical advice; 6) have non-missing Medicare standardized allowed payment information for the episode; 7) have not died from any cause during the anchor hospitalization or 90-day post-discharge period. |

*Notes*: ACH = acute care hospital; CJR = Comprehensive Care for Joint Replacement; CMS = Centers for Medicare & Medicaid Services; CPT = current procedural terminology; DME = durable medical equipment; ED = emergency department; FFS = fee-for-service; HHA = home health agency; IRF = inpatient rehabilitation facility; LEJR = lower extremity joint replacement; LTCH = long-term care hospital; NQF = National Quality Forum; OP = outpatient; OT = occupational therapy; PAC = post-acute care; PDP = post-discharge period; PT = physical therapy; SNF = skilled nursing facility; THA = total hip arthroplasty; TKA = total knee arthroplasty.

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[49] Updated specification documents were released by CMS in March 2019 for the THA or TKA complications measure, and the measure was revised accordingly. Available at: https://www.qualitynet.org/inpatient/measures/complication/methodology

### 2.  *Measures of Unintended Consequences*

In our evaluation of unintended consequences of the CJR Model, one of the topics we studied was changes in patient mix.[50] **Exhibit B-7** lists the patient characteristics from claims and enrollment data that we monitored. Although the impact analysis on payment, utilization, and quality controlled for changes in many of these patient characteristics, we also monitored changes in these characteristics separately to directly examine changes in patient mix.

**Exhibit B-7:   Measures of Patient Mix**

| Type of unintended consequence | Measure name or description |
|---|---|
| **Changes in patient mix** | Age<br>• Less than 65 years<br>• 65-74 years<br>• 75-84 years<br>• 85 years or greater |
| | Sex |
| | Medicaid eligibility |
| | Disability, no ESRD |
| | HCC<br>• Score<br>• Count<br>• Indicator for having a count of 0, 1, 2, 3, or 4 or more |
| | Congestive heart failure |
| | Dementia |
| | Obesity |
| | Hypertension |
| | Diabetes |
| **Changes in patient mix (continued)** | Prior utilization (in the 6 months prior to the anchor hospitalization)<br>• IP ACH stay<br>• IRF stay<br>• SNF stay<br>• HH use<br>Any prior care[a] |

*Source:*  Patient mix measures were constructed from Medicare fee-for-service claims and beneficiary enrollment data.

*Notes:*  ACH = acute care hospital; ESRD = end-stage renal disease; HCC = Hierarchical Condition Category; HH = home health; IRF = inpatient rehabilitation facility; IP = inpatient; SNF = skilled nursing facility.

[a]  Any prior care included IP hospital, psychiatric hospital, emergency department, SNF, IRF, home health, long-term care hospital, and hospice during the 6 months prior to anchor hospitalization.

We also looked at the impact of the CJR Model on payments in the 30 days following the episode in our evaluation of unintended consequences. This claims-based measure is defined in detail in **Exhibit B-6**.

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[50]  As presented in **Chapter VII: Analysis of Potential Unintended Consequences of the CJR Model**, we also completed analyses on the model's impact on payments in the 30 days following the episode and analyses on the model's impact on the total market volume of elective LEJR discharges.

## D. Analytic Methodology

To control for both observed and unobserved differences and to isolate the impact of the CJR Model on outcomes, we employed a difference-in-differences (DiD) regression approach using the control group created by the model's randomization of CJR MSAs and supplemented by risk adjustment.

### 1. Difference-in-Differences Estimator

The DiD approach quantified the impact of the CJR Model by comparing changes in outcomes between the baseline and the intervention period of interest (PY 6–PY 7) for the CJR population and the control group population. One of the main advantages of this approach is that it can isolate the effect of unobserved characteristics of treatment and control groups that are time invariant.[51]

#### a. Baseline Period

The baseline period for our evaluation encompassed episodes that started between January 1, 2012, and December 31, 2014, and ended between April 1, 2012, and March 31, 2015.

#### b. Intervention Period

The intervention period for this annual report followed the model timeline for PY 6–PY 7 and was specified as episodes that ended between October 1, 2021, and December 31, 2023.[52]

#### c. Exclusion of Performance Years 1–5

In this annual report, we were focused on studying the impact of the CJR Model during PY 6–PY 7. Thus, the methodology did not need to account for artifacts of the CJR Model prior to PY 6 if they were no longer relevant in PY 6.

#### d. Primary Regression Specification

The DiD model used an outcome measure, $Y$, and estimated the differential change in $Y$ for patients receiving care from CJR participant hospitals between the baseline and the intervention period relative to that same change for patients receiving care from hospitals in the control group.

As an illustrative example of the DiD approach, we defined:

- $Y_{i,k,t}$ as the outcome for the $i^{th}$ episode with an LEJR at hospital $k$ in period $t$ ($t = 1$ during the CJR PY 6 or PY 7 intervention quarters and 0 otherwise)

- $CJR_{i,k}$ as an indicator that takes the value of 1 if the $i^{th}$ episode was initiated by a CJR participant hospital $k$ and takes the value of 0 otherwise.

- $X_{i,k,t}$ as hospital, geographic, and patient characteristics in period $t$.

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[51]   Although the DiD model controls for unobserved heterogeneity that is fixed over time, it does not control for unobserved heterogeneity that varies over time.

[52]   Final Rule issued by CMS in the Federal Register on April 29, 2021, extending the CJR Model: https://www.federalregister.gov/documents/2020/02/24/2020-03434/medicare-program-comprehensive-care-for-joint-replacement-model-three-year-extension-and-changes-to.

- E[Y|t, CJR, X] as the expected value of outcome measure Y conditional on values of $t$, *CJR*, and *X*.

The DiD estimator can then be represented by:

$$DiD = [E(Y \mid t=1, CJR = 1, X) - (E(Y \mid t=0, CJR = 1, X)] - [E(Y \mid t=1, CJR = 0, X) - (E(Y \mid t=0, CJR = 0, X)] \quad \textbf{(1)}$$

To illustrate the calculation of the DiD, consider the linear model listed below:

$$Y_{i,k,t} = b_0 + b_1 \cdot t + b_2 \cdot CJR_{i,k} + b_3 \cdot CJR_{i,k} \cdot t + X_{i,k,t}{}' \cdot B + u_{i,k,t} \quad \textbf{(2)}$$

- The value of coefficient $b_1$ captured aggregate factors that could cause changes in outcome *Y* in the intervention period relative to the baseline period that are common across CJR and control group episodes.

- Coefficient $b_2$ captured the relative differences in outcomes between CJR and control group episodes.

- Coefficient $b_3$ determined the differential in outcome *Y* experienced by patients receiving services from CJR hospitals during the CJR intervention period relative to control group episodes in the intervention period and represented the DiD estimator.

- The vector of coefficients $B$ measured the differential effects of risk factors ($X$) on the outcome variable.

Finally, to calculate the DiD estimate for outcome measures that were risk-adjusted with nonlinear models, we used the regression model's coefficient estimates to calculate each of the four conditional expectations that make up the DiD estimator in Equation 1. For all DiD models, we assessed statistical significance at the 10% level but did not impose strict cutoffs of p-values when interpreting results. For example, given the context and magnitude of impact estimates, we consider some results with p-values just above 0.1 as important findings and others with p-values below 0.1 as borderline. Given the design of the CJR Model, which involved randomly sampling MSAs to participate, we accounted for clustering at the MSA level in the estimation of our standard errors in all regression models.

Additionally, we conducted various tests of whether the CJR and control populations were on parallel trends in the baseline period and sensitivity analyses related to different geographic and temporal control variables. See **Appendix D: Additional Findings** for a description of the methodologies and results.

### e.   *Secondary Regression Specification*

In addition to the primary regression specification, we estimated a secondary regression for each outcome. These specifications were identical to those described above, but instead of combining PY 6 and PY 7 into a single "intervention" term in the difference-in-differences design, we estimate a separate effect for each performance year. No other elements of the regression changed. Results are in **Appendix D: Additional Findings**.

Specifically, to illustrate the calculation of the PY specific DiD, consider the linear model listed below:

$$Y_{i,k,t} = b_0 + b_1 \cdot PY6 + b_2 \cdot PY7 + b_3 \cdot CJR_{i,k} + b_4 \cdot CJR_{i,k} \cdot PY6 + b_5 \cdot CJR_{i,k} \cdot PY7 + X_{i,k,t}'$$
$$\cdot B + u_{i,k,t}$$

**(3)**

- The value of coefficient $b_1$ captured aggregate factors that could cause changes in outcome $Y$ in PY 6 relative to the baseline period that are common across CJR and control group episodes.

- The value of coefficient $b_2$ captured aggregate factors that could cause changes in outcome $Y$ in PY 7 relative to the baseline period that are common across CJR and control group episodes.

- Coefficient $b_3$ captured the relative differences in outcomes between CJR and control group episodes.

- Coefficient $b_4$ determined the differential in outcome $Y$ experienced by patients receiving services from CJR hospitals during PY 6 relative to control group episodes in PY 6 and represented the DiD estimator for PY 6.

- Coefficient $b_5$ determined the differential in outcome $Y$ experienced by patients receiving services from CJR hospitals during PY 7 relative to control group episodes in PY 7 and represented the DiD estimator for PY 7.

- The vector of coefficients $B$ measured the differential effects of risk factors ($X$) on the outcome variable.

### f. Risk Adjustment to Control for Differences in Patient Demographics and Clinical Risk Factors

In the DiD models, we controlled for potential differences in patient demographics, clinical characteristics observed before hospitalization, and provider characteristics (represented by $X_{i,k,t}$ in Equation 2 above). Some demographic factors included age categories, sex, age and sex interactions, Medicaid eligibility status, and disability status. We risk-adjusted all outcomes for the episode's hip fracture status, procedure type (hip or knee), and presence or absence of an MCC, defined by MS-DRGs.[53] To control for participation in other Medicare initiatives, we used an indicator variable that indicated whether the patient was in the SSP ACO, Pioneer ACO Model, or Next Generation ACO Model during the episode.[54] To control for prior health conditions, we used Hierarchical Condition Category (HCC) indicators for the 12 months preceding the anchor

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[53]   We made two modifications to DRGs for this process: (1) We back-code DRGs that occurred prior to the separation of elective and fracture DRGs to match what they would have been under this change, and (2) we code all OP procedures as MS-DRG 470.

[54]   Patients with episodes during or after July 2017 that were aligned with the SSP track 3, Next Generation ACO, or the Comprehensive ESRD Care model were excluded from the CJR Model.

hospitalization,[55] as well as indicators for obesity, diabetes, hypertension, and tobacco use, generated from the claims data. To further control for case-mix differences, we included measures of the following types of prior care use: acute care IPPS hospital, skilled nursing facility (SNF), inpatient rehabilitation facility (IRF), hospice, other Part A IP, home health agency (HHA), custodial nursing facility, and others. We used the Long-Term Care MDS 3.0 data to create a measure of prior custodial nursing facility use in the 6 months prior to the episode. The collection of this assessment data was temporarily paused during most of the COVID-19 Public Health Emergency; thus, we imputed seemingly missing values of this covariate during that time period. We also included COVID-19-related risk-adjusters. To address patient-level effects of the COVID-19 pandemic, we controlled for a COVID-19 diagnosis in the 30 days prior to anchor hospitalization or during the anchor hospitalization from claims data (confirmed positive, suspected, or probable with symptoms or exposure).

We also controlled for provider characteristics that might have been related to the outcomes of interest, such as hospital bed count, ownership type, previous BPCI initiative LEJR experience, and previous BPCI initiative experience in a clinical episode other than LEJR. In October 2018, the BPCI Advanced initiative began. This Innovation Center model also includes LEJR as a clinical episode and aims to reduce payments while maintaining or improving quality. CJR participant hospitals could not participate in the BPCI Advanced initiative for LEJR clinical episodes; however, hospitals and surgeons in the control group could participate. To account for contamination in our control group by this other Innovation Center model, we included indicator variables that identify control group LEJR episodes performed by surgeons or at hospitals participating in the BPCI Advanced model.

See **Exhibit B-8** for additional details about our risk-adjustment methodology.[56]

**Exhibit B-8:**     **Predictive Risk Factors Used to Risk-Adjust Claims-Based Outcomes for Impact Analyses**

| Domain | Variables |
|---|---|
| **Characteristics of the procedure** | • Anchor Medicare Severity-Diagnosis Related Group<br>• Procedure type (hip or knee) |
| **Patient demographics and enrollment** | • Age (under 65, 65-79, 80+)<br>• Sex<br>• Medicaid status<br>• Disability status at enrollment in Medicare (not end-stage renal disease)<br>• Attribution to Shared Savings Program, Pioneer ACO Model, or Next Generation ACO Models during the Comprehensive Care for Joint Replacement episode<br>• Other demographic characteristics |

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[55] The CMS-HCC model is a prospective risk-adjustment model used by CMS to adjust Medicare Part C capitation payments for beneficiary health spending risk. The model adjusts for demographic and clinical characteristics. The clinical component of the model uses diagnoses from qualifying services grouped into numerous HCC indicators.

[56] For additional information on how we chose these risk-adjustment covariates, please see the CJR Model evaluation's First Annual Report appendices: https://www.cms.gov/files/document/cjr-firstannrptapppdf.pdf

| Domain | Variables |
|---|---|
| **Prior health conditions** | • CMS-HCC version 21 indicators from qualifying services and diagnoses from claims and data for 12 months preceding the anchor hospitalization[a]<br>• Obesity indicator<br>• Diabetes indicator<br>• Hypertension indicator<br>• Tobacco use indicator |
| **Prior use** | • Prior care use (any acute care IP, emergency department visits, IRF, SNF, HHA, hospice, other Part A IP, long-term care hospital, and custodial nursing facility service) variables used in risk adjustment varied by model[b]<br> ▪ Binary indicators for any care use in the 6 months preceding the start of the episode<br> ▪ Binary indicators for any care use in the 1 month preceding the start of the episode<br> ▪ Number of days of care use in the 6 months preceding the start of the episode |
| **Geography** | • State indicators |
| **COVID-19** | • Patient-level COVID-19 diagnosis in the 30 days prior to the anchor hospitalization<br>• Patient-level COVID-19 diagnosis during the anchor hospitalization |
| **Hospital provider characteristics** | • Bed count<br>• For-profit status<br>• BPCI LEJR experience<br>• BPCI experience in a clinical episode other than LEJR<br>• LEJR performed by surgeons or at hospitals participating in the BPCI-A model for LEJR clinical episodes (control group only) |

*Source:* Risk adjustment variables were constructed from Medicare fee-for-service claims and beneficiary enrollment data, December 2016 provider of services, fiscal year 2016 CMS Annual Inpatient Prospective Payment System, CMS Master Data Management, BPCI initiative participant list, and BPCI-A initiative participant list.

*Notes:* ACO = Accountable Care Organization; BPCI = Bundled Payments for Care Improvement; BPCI-A = Bundled Payments for Care Improvement Advanced; CMS = Centers for Medicare & Medicaid Services; COVID-19 = coronavirus disease 2019; ED = emergency department; HCC = hierarchical condition category; HHA = home health agency; IP = inpatient; IRF = inpatient rehabilitation facility; LEJR = lower extremity joint replacement; SNF = skilled nursing facility.

[a] The HCC indicators in the risk adjustment model included: sepsis, different types of cancer, diabetes, obesity, malnutrition, rheumatoid arthritis, coagulation defects, dementia, drug or alcohol dependence, mood disorder, Parkinson's disease, seizure disorders, cardio-respiratory failure, congestive heart failure, angina, heart arrhythmias, stroke, vascular disease, chronic obstructive pulmonary disease, macular degeneration, kidney disease, and renal failure. For hip fracture only analyses, we also include indicators for metastatic cancer and acute leukemia, lung and other severe cancers, intestinal obstruction/perforation, inflammatory bowel disease, severe hematological disorders, disorders of immunity, dementia with complications, drug/alcohol psychosis, schizophrenia, spinal cord disorders/injuries, acute myocardial infarction, cerebral hemorrhage, hemiplegia/hemiparesis, fibrosis of lung and other chronic lung disorders, aspiration and specified bacterial pneumonias, chronic kidney disease severe (stage 4), pressure ulcer of skin with partial thickness skin loss, pressure pre-ulcer skin changes of unspecified stage, major head injury, vertebral fractures without spinal cord injury, and artificial openings for feeding or elimination. (Pope, Gregory C.; Kautter, John; Ellis, Randall P.; Ash, Arlene S.; Ayanian, John Z.; Iezzoni, Lisa I.; Ingber, Melvin J.; Levy, Jesse M.; and Robst, John, "Risk adjustment of Medicare capitation payments using the CMS-HCC model" (2004). Quantitative Health Sciences Publications and Presentations. Paper 723.)

[b] The specification for each prior use variable varied for each outcome. The binary 6-month indicators were used for: SNF payment, IRF payment, HHA payment, Part B payment, unplanned readmissions, ED use, number of SNF days, and first discharge setting. The binary 1-month indicators were used for: complications and mortality. The indicators for number of days in the past 6 months were used for: total episode payment, readmissions payment, 30-day post-episode payment, number of IRF days, number of HHA visits, any HHA visits, and number of outpatient PT or OT visits.

### g. Parallel Trends

One critical assumption for an unbiased difference-in-differences (DiD) estimate is that the average outcomes for both groups would have followed parallel trends in the intervention period had the policy not been implemented. As the Comprehensive Care for Joint Replacement (CJR) policy was implemented, this assumption is untestable, since we are unable to observe a world where the policy did not come into effect. As such, we tested to see if CJR and the control group outcomes followed parallel trends for the outcome of interest during the baseline period, as a proxy for whether they likely would have followed parallel trends in the intervention period.

We evaluated the parallel trends assumption three ways, with each way testing whether the CJR and control group outcomes followed parallel trends during the baseline period. In the first two methods, we estimated episode-level models for each outcome using baseline data and used both a linear trends test and a joint test of equality on discrete time periods to study whether there was statistical evidence that the groups exhibited parallel trends in the baseline period. We considered outcomes to fail these statistical parallel trends tests if we rejected the null hypothesis of seemingly parallel trends at the 10% significance level. In the third method, we descriptively estimated a "Hypothetical DiD," which took into account any potential differential pre-trends between CJR and control. We then compared it with the actual estimated performance year (PY) 6 and PY 7 DiD to gauge how large of an effect potential differential pre-trends would have on the DiD impact estimate. These findings help provide interpretation and context for our standard PY 6–PY 7 DiD estimates.

### 1. Statistical Tests of Parallel Trends

For the joint test of equality on discrete time period, we report the p-value of an F-test that tested whether the differential between the CJR and control groups was jointly equal across discrete 4-quarter time periods. We included dummy variables for each of the 3 baseline years, interaction terms between the CJR group indicator and each of the year dummies, along with all the risk-adjustment variables that we included in the DiD models, described in **Appendix B: Data and Methods**.

The joint F-test model was:

$$Y_{i,k,t} = b_0 + b_1 \cdot Year_{1,i} + b_2 \cdot Year_{2,i} + b_3 \cdot Year_{3,i} + b_4 \cdot Year_{1,i} \cdot CJR_k + b_5 \cdot Year_{2,i} \cdot CJR_k + b_6 \cdot Year_{3,i} \cdot CJR_k + X_{i,k}' \cdot B + u_{i,k,t}$$

where:

- $Y_{i,k,t}$ was the outcome for the $i^{th}$ episode with an LEJR at hospital $k$ in the baseline period in year $t$,

- $Year_{i,t}$ was an indicator that took the value of 1 if the $i^{th}$ episode was initiated during year $t$ of the baseline period and took the value of 0 otherwise,

- $CJR_{i,k}$ was an indicator that took the value of 1 if the $i^{th}$ episode was initiated by a CJR participant hospital $k$ and took the value of 0 otherwise,

- $X_{i,k}$ were hospital, geographic, and patient characteristics in the baseline period,

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and the test was:

$$H_0: b_4 = b_5 = b_6$$
$$H_1: b_4 \neq b_5, or\ b_4 \neq b_6, or\ b_5 \neq b_6$$

For the linear trends test, we report the p-value of a linear slope coefficient of the quarterly difference between the CJR and control group. We included a quarterly indicator; interaction term between the CJR group indicator and the quarterly indicator, along with all the risk-adjustment variables that we included in the DiD models.

The linear test model was:

$$Y_{i,k,t} = b_0 + b_1 \cdot Quarter_{i,t} + b_2 \cdot CJR_k + b_3 \cdot Quarter_{i,t} \cdot CJR_k + X_{i,k}' \cdot B + u_{i,k,t}$$

where:

- $Y_{i,k,t}$ was the outcome for the $i^{th}$ episode with an LEJR at hospital $k$ in the baseline period in quarter $t$,

- $Quarter_{i,t}$ was an indicator that took the value of 1 if the $i^{th}$ episode was initiated during quarter $t$ of the baseline period and took the value of 0 otherwise,

- $CJR_{i,k}$ was an indicator that took the value of 1 if the $i^{th}$ episode was initiated by a CJR participant hospital $k$ and took the value of 0 otherwise,

- $X_{i,k}$ were hospital, geographic, and patient characteristics in the baseline period,

and the test was:

$$H_0: b_3 = 0$$
$$H_1: b_3 \neq 0$$

## 2. *Hypothetical Difference-in-Difference Method*

In addition to using the joint test and linear trend test to determine whether the CJR and control populations were on differential trends in the baseline period, we conducted a third parallel trend analysis to examine the extent possible deviations in parallel trends could possibly influence our PY 6–PY 7 combined impact estimates, as reported in **Chapter III: Impact of the Model**. While the calculations of the hypothetical DiD impact estimates were objective, their interpretation was fundamentally subjective. In this section, we describe our approach, our findings, and ultimately our interpretation, with the acknowledgment that the interpretation may differ for different readers.

The first step in calculating the hypothetical impact estimates involved running a two-stage least squares difference-in-difference regression which controlled for differential baseline trends between CJR and control. This regression was almost identical to that of our standard difference-in-difference equation described in **Section D.1.d**, with the primary difference being that we allow for both CJR and control to have a trend in the baseline period.

The model entails two first-stage equations:

$$Control\ Quarter_{i,k,t}$$
$$= b_0 + b_1 \cdot Modified\ Control\ Quarter_{i,k,t} + b_2 * Modified\ CJR\ Quarter_{i,k,t}$$
$$+ b_3 * CJR_k + b_4 * After_t + b_5 * After_t * CJR_k + X_{i,k}{}' \cdot B + u_{i,k,t}$$

and

$$CJR\ Quarter_{i,k,t}$$
$$= b_0 + b_1 \cdot Modified\ Control\ Quarter_{i,k,t} + b_2 * Modified\ CJR\ Quarter_{i,k,t}$$
$$+ b_3 * CJR_k + b_4 * After_t + b_5 * After_t * CJR_k + X_{i,k}{}' \cdot B + u_{i,k,t}$$

where:

- *Control Quarter$_{i,k,t}$* was the quarter for the $i^{th}$ episode with an LEJR at hospital $k$ in the control group in quarter $t$. Observations at hospital $k$ in the CJR group have a value of 0 for all quarters.

- *CJR Quarter$_{i,k,t}$* was the quarter for the $i^{th}$ episode with an LEJR at hospital $k$ in the CJR group in quarter $t$. Observations at hospital $k$ in the control group have a value of 0 for all quarters.

- *Modified Control Quarter$_{i,k,t}$* was the quarter for the $i^{th}$ episode with an LEJR at hospital $k$ in the control group in the baseline period in quarter $t$. All observations at hospital $k$ in the CJR group and, additionally, all observations in a quarter in the intervention period have a value of 0.

- *Modified CJR Quarter$_{i,k,t}$* was the quarter for the $i^{th}$ episode with an LEJR at hospital $k$ in the CJR group in the baseline period in quarter $t$. All observations at hospital $k$ in the control group and, additionally, all observations in a quarter in the intervention period have a value of 0.

- $CJR_k$, $After_t$, and $After_t * CJR_k + X_{i,k}$ are the standard difference-in-differences covariates, and $X_{i,k}$ are hospital, geographic, and patient characteristics. See **Section D.1.d** for more details.

Each of these first stage equations generate predicted values of the quarter variable for control or CJR observations, respectively. Let these predicted variables be labeled as $\widehat{Control\ Quarter}_{i,k,t}$ and $\widehat{CJR\ Quarter}_{i,k,t}$. Without loss of generality, we will focus on $\widehat{Control\ Quarter}_{i,k,t}$.

Given the estimating equation above, *Control Quarter*$_{i,k,t}$ is predicted for all observations, regardless of whether the observation is for CJR or control, and regardless of whether it is baseline or intervention. Specifically:

- Observations in control in the baseline: *Control Quarter*$_{i,k,t}$ is almost perfectly predicted for all control observations in the baseline period due to the inclusion of *Modified Control Quarter*$_{i,k,t}$ variable.[57]

- Observations in CJR (both baseline and intervention): As *Control Quarter*$_{i,k,t}$ is equal to 0 for all CJR observations, this variable is almost perfectly predicted (to equal 0) for all CJR observations due to the inclusion of the *CJR*$_k$ variable.

- Observations in control in the intervention: All control observations in the intervention period are almost predicted to equal the average value of *Control Quarter*$_{i,k,t}$ in the intervention period due to the inclusion of the *After*$_t$ variable.

The second stage of the model is then estimated by:

$$Outcome_{i,k,t} = b_0 + b_1 \cdot \widehat{Control\ Quarter}_{i,k,t} + b_2 * \widehat{CJR\ Quarter}_{i,k,t} + b_3 * CJR_k + b_4 * After_t + b_5 * After_t * CJR_k + X_{i,k}' \cdot B + u_{i,k,t}$$

where:

- $\widehat{Control\ Quarter}_{i,k,t}$ and $\widehat{CJR\ Quarter}_{i,k,t}$ are the predicted variables from the first-stage model and all other variables are as previously specified,

- The differential linear trend estimate is taken as the difference between $b_2$ and $b_1$, and

- $b_5$ is the hypothetical DiD estimate.

The advantage of the two-stage linear regression method is that the baseline trends for CJR and control are estimated in the same regression as the hypothetical DiD. This leads to the estimated coefficients for all the risk-adjustment included in $X_{i,k}$ to much more closely resemble those estimated in our standard DiD as they are estimated using the exact same sample as compared to a standard parallel trends model that only used baseline data.

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[57]   Note, these observations are not truly perfectly predicted due to extremely slight deviations caused by risk-adjustment. If we were to run these models without risk-adjustment, these observations would be perfectly predicted in the first stage. Throughout this chapter, we use the word "almost" to refer to this type of prediction behavior.

Importantly, the coefficients on the baseline trends for CJR and control ($b_1$ and $b_2$) are only influenced by observations in the baseline period, for either control or CJR, respectively. Again without loss of generality, this is because while the intervention control observations of $\widehat{Control\ Quarter}_{i,k,t}$ are not equal to zero, the fact they are all approximately equal to the average quarter value for control observations in the intervention means that they are almost perfectly collinear with the observations that dictate the value the coefficient on $After_t$ ($b_5$). That is, the temporal effects of control observations in the intervention period are captured by $After_t$, leaving only the trending temporal effects of control observations in the baseline period to influence $b_1$ (the coefficient on $Control\ Quarter_{i,k,t}$). These temporal effects are not perfectly captured by the constant ($b_0$), as that only captures the average effect in the baseline, not an effect that is allowed to trend over the baseline quarters.

We interpreted and presented these results holistically. We paid close attention to both the magnitude and statistical significance of the PY 6–PY 7 DiD estimate, the magnitude and statistical significance of the differential trend coefficient, and the results for the Joint F-Test and Linear Test (shown in **Exhibit D-1**). While using various pieces of information from multiple results to assist in a single interpretation of an effect of the CJR Model was an inherently subjective process, we have applied the process as consistently across samples and outcomes as possible.

We classified outcomes into four groupings with the following guidelines. Note, while we used these as guidelines, we stress the subjective nature of this analysis, and we present all intermediate pieces of information that were used in our interpretation in this section. For interpretation purposes, we did not consider standard p-value cutoffs, for example, <0.10 as "meaningful" as strictly binding. For example, we interpreted a p-value of 0.12 nearly identically to a p-value of 0.09.

1. Very High Trust:

     a. Outcomes that did not fail the parallel trends tests and where the differences between the baseline trends of the CJR and control samples were of small magnitude.

     b. Outcomes that did not fail the parallel trends tests and had sufficiently large standard errors, such that we did not believe we could extrapolate the trends in any meaningful way.

2. High Trust: Outcomes that did potentially fail the parallel trends tests, but for which the differential trend was small in magnitude. We believe we could interpret the DiD estimates with relative certainty for these outcomes.

3. Low Trust: Outcomes that did not statistically fail the parallel trends test but did have sufficiently large differential baseline trends. For these outcomes, we believe additional caveats may be warranted in the interpretation of the DiD estimate.

4. Very Low Trust: Outcomes that did statistically fail parallel trends tests and had sufficiently large differential pre-trends. We believe strong additional caveats were warranted in the interpretation of the DiD estimates for these outcomes.

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### h.  Impact on Patients Dually Eligible for Medicare and Medicaid

Our analysis of the differential impact of the CJR Model on patients who were dually eligible for Medicare and Medicaid was based on the DiD methodology described above. In essence, we estimated the impact of the CJR Model on patients who were dually eligible and the impact on patients who were not dually eligible, and then estimated the difference between those two estimates. In practice, all these estimations took place in a single triple difference (DDD) regression, subject to the constraint that coefficients on risk-adjustment variables were the same for both dually eligible and not dually eligible episodes.

In general, the statistical model to estimate this DDD regression was:

$$Y_{i,k,t} = b_0 + b_1 \cdot t + b_2 \cdot CJR_{i,k} + b_3 \cdot G_{i,t} + b_4 \cdot G_{i,t} \cdot t + b_5 \cdot CJR_{i,k} \cdot t + b_6 \cdot CJR_{i,k} \cdot G_{i,t} \cdot t + X_{i,k,t}' \cdot B + u_{i,k,t}$$

where,

- $Y_{i,k,t}$ was the outcome for the $i^{th}$ episode with an LEJR at hospital $k$ in period $t$ ($t = 1$ during the CJR PY6 intervention quarters and zero otherwise)

- $CJR_{i,k}$ was an indicator that takes the value of 1 if the $i^{th}$ episode was initiated by a CJR participant hospital $k$ and takes the value of 0 otherwise

- $G_{i,t}$ was an indicator that takes the value of 1 if the patient for the $i^{th}$ episode was dually eligible and takes the value of 0 if the patient was not dually eligible

- $X_{i,k,t}$ was a vector containing hospital, geographic, and patient characteristics in period $t$[58]

- The value of coefficient $b_1$ captured aggregate factors that could cause changes in outcome $Y$ in the intervention period relative to the baseline period that are common across CJR and control group episodes.

- Coefficient $b_2$ captured the relative differences in outcomes between CJR and control group episodes.

- Coefficient $b_3$ captured the relative differences in outcomes between patients with dual eligibility and patients without dual eligibility

- Coefficient $b_4$ captured aggregated factors that could cause changes in outcome $Y$ for patients with dual eligibility in the intervention period relative to the baseline period that are common across CJR and control group episodes.

- Coefficient $b_5$ determined the differential in outcome $Y$ experienced by patients receiving services from CJR hospitals during the CJR intervention period relative to control group episodes in the intervention period and represented the DiD estimator.

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[58]  Note, we used a reduced set of health condition indicators when estimating the impact on patients dually eligible for Medicaid due to issues with over and perfect prediction.

- Coefficient $b_6$ determined the differential in outcome $Y$ experienced by patients with dual eligibility receiving services from CJR hospitals during the CJR intervention period relative to control group episodes in the intervention period and represented the DDD estimator.

- The vector of coefficients $B$ measured the effects of risk factors ($X$) on the outcome variable.

### i. *Impact on LEJR Volume*

We evaluated the impact of the CJR Model on elective LEJR volume and the differential impact of the CJR Model on elective LEJR volume for patients who were dually eligible for Medicare and Medicaid relative to patients who were not dually eligible. This analysis used the DiD and DDD frameworks outlined above.

The outcome of interest was whether a patient received at least one elective LEJR in a given year. We used a logistic regression model, which incorporated controls for patient characteristics, HCC flags, prior care use, and state fixed effects.

$$logit(Y_{it}) = b_0 + b_1 C_{it} + b_2 HCC_{it} + b_3 PC_{it} + b_4 CJR_{it} + b_5 After_t + b_6(CJR_{it} \times After_t) + b_7 S_{it} + \varepsilon_{it}$$

- $Y_{it}$ was an indicator variable that takes on the value of 1 if patient $i$ received at least one elective LEJR in year $t$.

- $C_{it}$ was a vector of patient characteristics. Some included variables are indicator variables for dual eligibility for Medicare and Medicaid, age buckets, sex, and certain chronic complications, such as obesity and diabetes.

- $HCC_{it}$ was a vector of indicator variables for a subset of HCC flags.

- $PC_{it}$ was a vector of variables for prior care use—specifically, continuous variables reflecting the number of days receiving health care services in the 6 months prior to the LEJR.

- $S_{it}$ was a vector of binary variables indicating the state in which the patient resided.

- $CJR_{it}$ was an indicator for whether a patient resided in a CJR MSA at time $t$.

- $After_t$ was an indicator for whether the episode occurred during the baseline (=0) or during the last 4 quarters of PY 6, in 2022 (=1).

The impact of the CJR Model was captured by the coefficient $b_6$, which was identified by comparing the patients who resided in CJR MSAs during PY 6 ($After_t = 1$) to patients who resided in CJR MSAs during the baseline period ($After_t = 0$) and then comparing that difference to the same difference calculated on patients who resided in control MSAs. We then transformed the coefficient into an LEJR rate, the number of LEJRs performed per 100,000 FFS beneficiaries per year. Standard errors were clustered at the MSA level.

The DDD model for the differential impact on patients who were dually eligible relative to those who were not was:

$$logit(Y_{it}) = b_0 + b_1 X_{it} + b_2 G_{it} + b_3 CJR_{it} + b_4 After_t + b_5(G_{it} \times CJR_{it}) + b_6(G_{it} \times After_t) \\ + b_7(CJR_{it} \times After_t) + b_8(G_{it} \times CJR_{it} \times After_t) + \varepsilon_{it}$$

$Y_{it}$ was an indicator variable that takes on the value of 1 if patient $i$ received at least one elective LEJR in year $t$, and $X_{it}$ was a vector of control covariates, containing all of the covariates mentioned above. $G_{it}$ was a binary variable that indicated whether patient $i$ in year $t$ had dual eligibility. The coefficient $b_8$ captured the difference in the estimated effect of the CJR Model on the probability of receiving an LEJR between patients with dual eligibility and patients without dual eligibility.

An important limitation to the beneficiary-year analyses was that the sample, by construction, does not capture LEJRs performed on patients who did not reside in a mandatory CJR or control MSA but who received LEJRs in mandatory CJR or control MSAs. A non-negligible portion of LEJRs performed in mandatory CJR or mandatory control MSAs involved patients traveling from other locations, and these LEJRs were not captured in the beneficiary-year analysis. While a smaller population, patients who reside in the CJR or control MSAs who received LEJRs in hospitals that were not in these areas are not included in this analysis.

## 2. Model Types

We used a variety of models including logistic, Poisson, multinomial logit, ordinary least squares (OLS) regressions, and two-part models (**Exhibit B-9**). Models were estimated depending on the type and characteristics of the outcome measure. For example, logistic models were estimated for the discrete quality outcomes (that is, all claims-based quality-of-care measures). A multinomial logit model was applied to the first discharge setting. Due to insufficient sample size, observations with a first discharge setting of "other" were omitted from the multinomial logit analyses of first discharge setting. OLS models were estimated for the continuous total number of days or visits measures as well as total episode payments and Part B payments. We used two-part models for payment outcomes where a considerable number of individuals had zero payments for the particular outcome.

**Exhibit B-9: Outcomes by Model Type**

| Model type | Outcomes |
|---|---|
| OLS | <ul><li>Total episode payments</li><li>Part B payments</li><li>Number of IRF days</li><li>Number of SNF days</li><li>Number of HHA visits</li><li>Number of OP PT or OT Visits</li></ul> |

| Model type | Outcomes |
|---|---|
| **Two-part models (Probit or OLS)** | • Readmission payments<br>• IRF payments<br>• SNF payments<br>• HHA payments<br>• 30-day post-episode payments |
| **Multinomial logistic** | • First post-acute discharge was to IRF<br>• First post-acute discharge was to SNF<br>• First post-acute discharge was to HHA<br>• First post-acute discharge was to OP PT/OT<br>• Discharge to home without HH or OP PT/OT[59] |
| **Logistic** | • Any HHA visits<br>• Unplanned readmission<br>• ED visit<br>• Complications<br>• All-cause mortality |

*Notes:*   ED = emergency department; HH = home health; HHA = home health agency; IRF = inpatient rehabilitation facility; OLS = ordinary least squares; OP = outpatient; OT = occupational therapy; PT = physical therapy; SNF = skilled nursing facility.

We used estimates from the multivariate regression models to construct model-predicted outcomes (sometimes labeled "risk-adjusted mean outcomes") under two scenarios (baseline and PY 6–PY 7 intervention) for both CJR and control group hospitals. To control for changes in service and case mix over time, as well as differences between CJR and non-CJR patients, we used the same reference population of patients to calculate predicted outcomes for CJR and control group episodes. The reference population used for this report was all CJR patients during the baseline and intervention period.

## E. Savings to Medicare due to the CJR Model

We calculated Medicare savings by subtracting reconciliation payments to CJR participant hospitals from the change in nonstandardized paid amounts due to the CJR Model. Medicare savings were calculated on both a total and a per-episode basis.

*Medicare savings = Change in nonstandardized paid amounts – Reconciliation payments*

### 1. Change in Nonstandardized Paid Amounts

To best capture the actual amount of payments sent and received by CMS, we use nonstandardized paid amounts for our analyses on the savings to Medicare. We calculate the change in nonstandardized paid amounts using estimates from a DiD model of per-episode standardized paid amounts. The DiD estimates were multiplied by –1 and converted to nonstandardized paid amounts using a ratio of nonstandardized-to-standardized Medicare paid amounts from CJR intervention episodes (**Exhibit B-10**). This method produced a per-episode estimate of the change in

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[59]   Note, some episodes meet the requirements of being classified as "First post-acute discharge was to Other". However, as these observations make up less than 1% of observations, these observations are dropped from the multinomial logistic regression.

nonstandardized paid amounts. We calculated the total change in nonstandardized paid amounts by multiplying the per-episode estimate by the total number of PYs 6–7 CJR episodes.

**Exhibit B-10: Ratios of Nonstandardized-to-Standardized Medicare Paid Amounts Over Time**

| Time period | Mandatory hospitals |
|---|---|
| Baseline | 1.038 |
| PY 6 | 1.059 |
| PY 7 | 1.046 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The ratio was calculated as the average nonstandardized (actual) paid amounts divided by the average standardized paid amounts for episodes. The anchor payment (Medicare Severity-Diagnosis Related Group payment for inpatient episodes) was subtracted from the total episode payment before calculating the ratio. CJR = Comprehensive Care for Joint Replacement; PY = performance year.

Note that in this report, we estimated Medicare savings only for PYs 6–7. We considered the Medicare savings results for PYs 1–5 reported in the Fifth Annual Report to be authoritative in terms of describing Medicare savings over the first 5 PYs of the model.[60]

## 2. Reconciliation Payments

We defined reconciliation payments as the total payments made to CJR participants by Medicare minus repayments from CJR participants to Medicare. Reconciliation payments could be positive or negative. In the program literature, they are often referred to as net payment reconciliation amounts (NPRA). The CMS CJR payment contractor provided this data. We calculated reconciliation payments per episode by dividing total reconciliation payments by the total number of CJR episodes.

In analyzing the distribution of NPRA to hospitals, we ordered hospitals by their NPRA in PYs 6–7 and grouped the ordered hospitals into deciles, each comprising 10% of the total hospital participants. For each decile, we calculated the total NPRA received by hospitals in the decile and average NPRA across hospitals in the decile. We previously performed a similar analysis for total NPRA in PYs 1–5 in the Fifth Annual Report.[61] We then conducted exploratory analyses aimed at the characteristics of hospitals that received the most reconciliation payments or had the largest repayments.

## 2. Target Prices

We also analyzed target prices. Target prices in the CJR Model are set at an episode level in PYs 6–7, considering the type of procedure, the hospital region, market trends, and patient characteristics. The CMS CJR payment contractor provided this data. We calculated the average target price within

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[60] Centers for Medicare & Medicaid Services. (2023). *Comprehensive Care for Joint Replacement Model - Fifth Annual Report*. https://www.cms.gov/priorities/innovation/data-and-reports/2023/cjr-py5-annual-report

[61] Centers for Medicare & Medicaid Services. (2023). *Comprehensive Care for Joint Replacement Model - Fifth Annual Report*. https://www.cms.gov/priorities/innovation/data-and-reports/2023/cjr-py5-annual-report

each MS-DRG by averaging the target price across all episodes of that MS-DRG.[62] We calculated the average target price overall by averaging across all episodes.

### 3. Considerations

In the estimation of Medicare program savings, we dropped some episodes that resulted in reconciliation payments or repayments to CMS from the estimation sample, primarily due to our requirement that patients have a complete FFS enrollment history for 6 months prior to the anchor hospitalization.[63] We did not extrapolate estimated payment reductions to these "missing" episodes. Thus, our estimates of total Medicare program savings are slightly conservative; if the missing episodes also had payment reductions due to the CJR Model, our estimates of Medicare program savings are underestimates.

In figure notes where we report Medicare program savings estimates, we noted that the ranges for net savings are ranges based on the 90% confidence interval. We specified this because it is not technically correct to think of the net savings estimate as having a confidence interval. This is because if gross reductions in episode spending had been different, net reconciliation payments would also have been different. The reported ranges for net savings estimates incorporate the uncertainty in our estimate of gross episode spending reductions, but do not incorporate a modelled relationship between gross episode spending reductions and NPRA.

## F. Impact of the CJR Model on Safety-Net Hospitals

### 1. Quantitative Analyses

For our analysis of safety-net hospitals (SNHs), we defined a SNH in accordance with the definition used by CMS. This definition is based on the proportion of a hospital's patients who are dually eligible for Medicare and Medicaid and the proportion who are eligible for the Part-D Low Income Subsidy (LIS).

We identified SNHs among both CJR participant hospitals and the hospitals that make up our control group to perform our descriptive analyses. These analyses made use of our main analytic dataset, described in Section C above, the NPRA and Target Pricing data described in Section E above, and the CJR participant quality data, which is available to the public.

### 2. Qualitative Analyses

We conducted telephone interviews during September-November of 2024 with 13 CJR participant hospitals that were identified as being SNHs based on CMS criteria.

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[62] In PY 6–PY 7, outpatient episodes were included in the CJR model. Outpatient episodes are not classified into MS-DRGs, but are instead classified using HCPCS codes. In this analysis we classified outpatient episodes as the appropriate MS-DRG (for instance, an elective outpatient hip replacement would be classified as MS-DRG 470).

[63] See the Fourth Annual Report appendices for information and results of sensitivity analyses related to these episodes: https://www.cms.gov/priorities/innovation/data-and-reports/2022/cjr-py4-ar-app

### a.   Interviewees

We interviewed representatives from CJR participant hospitals, including hospital staff and leadership, orthopedic surgeons, and system-level representatives.

### b.   Protocol

We developed and implemented a semi-structured interview guide that included questions about the hospital's status as a safety-net hospital and how that impacted their experience in the CJR Model. Some interviews were completed in two separate 45-minute sessions with Service Line team members and Executive Staff team members, but most were completed in one 75-minute session. The key protocol questions were:

- What are the characteristics of SNHs and their patients with an LEJR?

- How do hospitals identify and care for patients with unmet non-medical needs?

- What community resources or partnerships do SNHs utilize to address unmet non-medical needs?

- What do care pathways look like for patients with an LEJR with unmet non-medical needs, and what challenges do SNHs face providing high-quality care for these patients?

- What strategies do SNHs use to response to the CJR Model?

- What resource or program supports do SNHs need to succeed in episode-based payment models?

- What advice do SNH interviewees have for other SNHs that are new to episode-based payment models?

### c.   Sample Selection

We used a list of SNH hospitals provided by CMS to identify hospitals for our interview sample. To be considered a SNH in 2023, hospitals had to satisfy one of two criteria: at least 28.18% of the patient mix had to be dually eligible or at least 28.78% had to qualify for the Part D LIS. With this methodology, there were 90 SNHs in the CJR Model, with a range of net payment reconciliation amount (NPRA) in PY 6 (**Exhibit B-11**). Consistent with previous rounds of telephone interviews, hospitals with fewer than 20 episodes in the previous performance year were excluded. Additionally, we excluded the six hospitals that participated in the previous round of SNH interviews. After excluding hospitals there were 45 SNHs remaining in the sample.

**Exhibit B-11:  Distribution of NPRA Payments for CJR Hospitals Meeting CMMI SNH Definition**

| NPRA Percentiles | Number of safety-net hospitals, based on distribution of PY 6 NPRA |
|---|---|
| Top 30% | 12 |
| Middle 40% | 47 |
| Bottom 30% | 31 |
| Total | 90 |

*Source:*   CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 6.

*Notes:*   CJR = Comprehensive Care for Joint Replacement; CMMI = Center for Medicare & Medicaid Innovation; NPRA = net payment reconciliation amount; PY = performance year; SNH = safety-net hospital.

We categorized the SNHs by their NPRA percentile in PY6. In our proposed sample of 45 hospitals, 11 fell in the top 30% of reconciliation payments, 11 fell in the middle 40%, and 23 fell in the bottom 30% (**Exhibit B-11**). To align with our research aims of hearing from hospitals that are financially successful in the CJR Model, we conducted outreach to all hospitals in the top and middle of the distribution, which allowed us to capture important perspectives from SNHs who succeeded in the model.

### d.   Recruitment

The research team conducted outreach to the 22 hospitals in the top and middle NPRA distribution first. Hospitals were invited to participate via email to the CJR point of contact on file (**Exhibit B-12**). Follow-up emails were sent 2 weeks after the initial email to non-responding hospitals. Once outreach to the top and middle NPRA distribution hospitals was completed, recruitment moved on to the bottom 30% of hospitals. An additional 15 hospitals were invited to interviews from the bottom 30%.

**Exhibit B-12.  Response Rate of SNHs by Distribution of NPRA Payments**

| NPRA Percentiles | Invited | Interviewed | Response Rate (%) |
|---|---|---|---|
| Top 30% | 11 | 5 | 45.5 |
| Middle 40% | 11 | 4 | 36.4 |
| Bottom 30% | 15 | 4 | 26.7 |
| Totals | 37 | 13 | 35.1 |

*Source*:   CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 6.

*Notes:*   CJR = Comprehensive Care for Joint Replacement; NPRA = net payment reconciliation amount; PY = performance year; SNH = safety-net hospital.

### e.   Data Collection

Thirteen hospitals agreed to participate in telephone interviews. Many SNH identified staff members that were responsible for both administering the CJR program and caring for patients with an LEJR, so these hospitals completed one interview instead of two.

Interviews generally included two to four interviewees who had roles such as LEJR service-line coordinators, nurse navigators or care coordinators, hospital executives, managers of value-based care, and data analysts. One primary interviewer and one notetaker conducted the interviews. Other interviewers participated in calls when available to broaden understanding of SNH experience during data collection. Notes were taken during telephone interviews, and with the interviewees' consent, the interview was recorded to verify and enhance interview notes. ATLAS.ti software was used to code and analyze notes from the telephone interviews.

### f. Analysis

Notetakers and interviewers who participated in interviews completed a thematic analysis of telephone interview data. We developed analytic codebooks including primary and sub-codes based on the telephone interview protocols. Coders used ATLAS.ti to apply codes and sub-codes to comprehensive interview notes and ran queries to identify themes across interviews. All coders received systematic training, which included parallel coding and discussion of results with trainers until consistency was established. We refined the codebooks throughout the analysis (that is, codes were dropped, consolidated, added, or revised) to better capture patterns as they emerged.

## G. ACO Overlap

**Chapter VI. ACO Overlap in the CJR Model** described patterns of concurrent participation of hospitals in a Medicare ACO and the CJR Model and looked at changes that persisted in outcomes of NPRA, quality scores, HCC, and total episode cost. The analyses in **Chapter VI. ACO Overlap** were restricted to Shared Savings Program (SSP) ACO participation as this ACO made up the vast majority of LEJRs in CJR and control hospitals when considering SSP, Pioneer, NextGen, and REACH ACOs.

### 1. Sample and Time Periods

The sample for this analysis was limited to extension period mandatory CJR (and control) hospitals with at least one LEJR in PY 6 or PY 7. Hospital-level ACO participation was identified by 2012-2023 RIFF files for SSP, Pioneer, and NextGen ACOs and through separate access files for REACH ACOs (**Exhibit B-1**). Hospital-level ACO participation was available at the calendar year level. With our data, we were unable to determine if hospital ACO participation was hospital-led or not. All counts and statistics presented in **Chapter VI. ACO Overlap in the CJR Model** were calculated without the use of the sampling weights.

Patient-level attributes were used to determine certain hospital-level characteristics including average HCC score, average total episode payment, and LEJR volume. The patient sample included all Medicare FFS patients who resided in mandatory CJR or control MSAs in either PY 6 or PY 7. This sample of LEJRs did not apply the CJR Model ACO hospital episode exclusion rules.

### 2. ACO Participation Grouping Variable

The ACO grouping variable we chose in **Chapter VI. ACO Overlap in the CJR Model** incorporated the important inflection point that is the start year of the CJR intervention period. This

allowed us to look at the association between ACO participation and possible CJR Model impacts. It also incorporated the duration of ACO participation by including information about hospitals that left or had interruptions in ACO participation. **Exhibit B-13** describes a simplified description that is used in exhibits ("Simplified classification" column) and the "Detailed classification" column gives more information about the logic used to create the ACO participation grouping variable.

**Exhibit B-13.  Simplified and Detailed Classification Descriptions for the ACO Participation Grouping Variable**

| Simplified classification | Detailed classification |
|---|---|
| **Joined SSP ACO before 2016, stayed in the ACO** | Joined an SSP ACO in 2013, 2014, or 2015 (before the CJR intervention period start year) and stayed in the ACO until the end of PY 7 (2023). |
| **Joined SSP ACO in 2016 or later, stayed in the ACO** | Joined an SSP ACO anytime between 2016 and 2023 (during the CJR intervention period start year) and stayed in the ACO until the end of PY 7 (2023). |
| **Left an SSP ACO between 2014 and 2023** | Joined an SSP ACO anytime between 2013 and 2023 and either i) left the ACO between 2014 and 2023, or ii) had at least one year of interruption in ACO participation between 2014 and 2023. |
| **Never participated in an SSP ACO** | Never participated in an SSP ACO from 2013 to 2023. |

*Notes:*   ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; SSP = Shared Savings Program; PY = performance year.

# Appendix C:   Descriptive Statistics of the CJR Population

In this appendix, we present the descriptive tables focusing on the CJR and control populations in this report.

## Descriptive Tables

**Exhibit C-1:**   **Demographics, Health Conditions, and Prior Health Care Use for CJR and Control Populations in Both PY 6–PY 7 and in the Baseline**

| Domain | Measure | CJR | | Control | |
| --- | --- | --- | --- | --- | --- |
| | | Baseline (%) | PY 6–PY 7 (%) | Baseline (%) | PY 6–PY 7 (%) |
| **Demographics** | **Patients who were dually eligible** | 13.7 | 7.5 | 10.7 | 5.5 |
| | **Female** | 66.1 | 63.3 | 65.6 | 63.2 |
| | **Disability, no ESRD** | 15.2 | 10.6 | 15.8 | 10.3 |
| **Health Conditions** | **Dementia** | 7.6 | 5.3 | 7.1 | 4.9 |
| | **Diabetes** | 29.5 | 27.1 | 27.3 | 24.8 |
| | **Hypertension** | 75.2 | 76.4 | 75.4 | 76.3 |
| | **Obesity** | 15.3 | 33.9 | 16.4 | 34.7 |
| **Prior Care** | **Any Prior Use** | 30.0 | 24.2 | 29.3 | 23.4 |
| | **Any HH** | 13.2 | 9.7 | 12.2 | 8.7 |
| | **Any ACH stay** | 13.0 | 7.4 | 12.8 | 7.2 |
| | **Any IRF** | 1.4 | 0.7 | 1.4 | 1.0 |
| | **Any SNF** | 5.1 | 2.5 | 4.4 | 2.2 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   Prior Care is defined as utilization 6 months prior to the anchor begin date. ACH = acute care hospital; CJR = Comprehensive Care for Joint Replacement Model; ESRD = end-stage renal disease; HH = home health; IRF = inpatient rehabilitation facility; PY = performance year, SNF = skilled nursing facility.

**Exhibit C-2:** **Demographics, Health Conditions, and Prior Health Care Use for CJR and Control Patients without a Fracture at Baseline and PY 6–PY 7**

| Characteristic | | Proportions | | | | Relative Difference (CJR vs. Control) | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | CJR | | Control | | Estimate (pp) | p-value | 90% LCI | 90% UCI |
| | | Baseline | PY 6–PY 7 | Baseline | PY 6–PY 7 | | | | |
| Age | <65 years | 8.5% | 3.5% | 8.8% | 3.4% | 0.33 | 0.650 | -0.88 | 1.55 |
| | 65–74 years | 49.3% | 52.7% | 51.9% | 54.6% | 0.67 | 0.590 | -1.38 | 2.72 |
| | 75–84 years | 34.8% | 37.9% | 32.9% | 36.5% | -0.47 | 0.561 | -1.80 | 0.86 |
| | 85+ years | 7.4% | 5.9% | 6.5% | 5.5% | -0.54 | 0.144 | -1.14 | 0.07 |
| Sex | Female | 64.7% | 62.4% | 64.4% | 62.2% | -0.10 | 0.809 | -0.81 | 0.61 |
| Eligibility | Eligible for Medicaid | 12.3% | 6.3% | 9.8% | 4.7% | -0.99 | 0.281 | -2.51 | 0.52 |
| | Disability, no ESRD | 16.1% | 10.6% | 16.4% | 10.2% | 0.69 | 0.447 | -0.81 | 2.20 |
| HCC | Score | 1.25 | 1.34 | 1.17 | 1.30 | -0.04 | 0.194 | -0.08 | 0.01 |
| | Count | 2.27 | 2.56 | 2.10 | 2.47 | -0.08 | 0.258 | -0.20 | 0.04 |
| | Count: 0 | 19.1% | 16.9% | 21.6% | 17.7% | 1.66 | 0.048 | 0.28 | 3.04 |
| | Count: 1 | 24.3% | 21.9% | 25.8% | 22.7% | 0.66 | 0.264 | -0.31 | 1.62 |
| | Count: 2 | 20.5% | 19.4% | 20.0% | 19.3% | -0.45 | 0.091 | -0.89 | -0.01 |
| | Count: 3 | 14.2% | 14.8% | 13.2% | 14.5% | -0.74 | 0.034 | -1.31 | -0.16 |
| | Count: 4+ | 22.0% | 27.1% | 19.5% | 25.7% | -1.13 | 0.332 | -3.04 | 0.78 |
| Comorbid Conditions | Obesity | 17.3% | 36.8% | 18.0% | 37.5% | 0.00 | 1.000 | -3.97 | 3.97 |
| | Diabetes | 29.3% | 26.6% | 27.1% | 24.6% | -0.07 | 0.921 | -1.30 | 1.15 |
| | Hypertension | 75.1% | 76.2% | 75.2% | 76.1% | 0.28 | 0.767 | -1.29 | 1.86 |
| | Dementia | 3.2% | 2.5% | 3.1% | 2.3% | 0.15 | 0.349 | -0.11 | 0.41 |
| Prior Use | Any HH | 10.5% | 8.1% | 9.8% | 7.1% | 0.27 | 0.739 | -1.05 | 1.58 |
| | Any Prior Use | 26.2% | 21.2% | 25.9% | 20.6% | 0.27 | 0.693 | -0.87 | 1.41 |
| | Any ACH stay | 11.0% | 5.7% | 11.1% | 5.5% | 0.37 | 0.249 | -0.16 | 0.90 |
| | Any IRF | 1.1% | 0.5% | 1.1% | 0.6% | -0.15 | 0.363 | -0.43 | 0.12 |
| | Any SNF | 3.6% | 1.4% | 3.2% | 1.1% | -0.19 | 0.451 | -0.62 | 0.23 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* Fracture is defined based on ICD codes for hip fracture provided by the CMMI on the CJR Model website: https://innovation.cms.gov/Files/worksheets/cjr-icd10hipfracturecodes.xlsx. The estimates in this exhibit are the results of unadjusted DiD models on patient characteristics. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Any prior care included IP hospital, psychiatric hospital, emergency department, SNF, IRF, home health, long-term care hospital, and hospice during the 6 months prior to anchor hospitalization. ACH = acute care hospital; CJR = Comprehensive Care for Joint Replacement Model; CMMI = Center for Medicare & Medicaid Innovation; ESRD = end-stage renal disease; HCC = hierarchical condition category; HH = home health; ICD = international classification of diseases; IP = inpatient; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; pp = percentage point; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

**Exhibit C-3:  Demographics, Health Conditions, and Prior Health Care Use for CJR and Control Patients with a Fracture at Baseline and PY 6–PY 7**

| Characteristic | | Proportions | | | | Relative Difference (CJR vs. Control) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | CJR | | Control | | | | | |
| | | Baseline | PY 6–PY 7 | Baseline | PY 6–PY 7 | Estimate (pp) | p-value | 90% LCI | 90% UCI |
| **Age** | **<65 years** | 3.0% | 2.2% | 3.4% | 2.2% | 0.36 | 0.233 | -0.14 | 0.86 |
| | **65–74 years** | 15.6% | 18.1% | 16.4% | 19.2% | -0.19 | 0.827 | -1.64 | 1.25 |
| | **75–84 years** | 31.4% | 35.3% | 33.3% | 36.2% | 1.04 | 0.287 | -0.57 | 2.65 |
| | **85+ years** | 50.1% | 44.4% | 46.8% | 42.4% | -1.21 | 0.402 | -3.59 | 1.17 |
| **Sex** | **Female** | 73.9% | 70.6% | 73.5% | 71.4% | -1.26 | 0.054 | -2.33 | -0.19 |
| **Eligibility** | **Eligible for Medicaid** | 19.8% | 16.5% | 16.1% | 11.0% | 1.72 | 0.195 | -0.46 | 3.89 |
| | **Disability, no ESRD** | 9.8% | 10.3% | 10.8% | 10.4% | 0.93 | 0.140 | -0.11 | 1.96 |
| **HCC** | **Score** | 2.42 | 2.60 | 2.38 | 2.51 | 0.05 | 0.180 | -0.01 | 0.10 |
| | **Count** | 4.60 | 5.00 | 4.54 | 4.85 | 0.08 | 0.190 | -0.02 | 0.19 |
| | **Count: 0** | 0.3% | 0.3% | 0.2% | 0.2% | 0.04 | 0.639 | -0.10 | 0.17 |
| | **Count: 1** | 9.6% | 8.9% | 9.9% | 10.5% | -1.21 | 0.008 | -1.96 | -0.45 |
| | **Count: 2** | 15.5% | 13.6% | 15.9% | 13.4% | 0.67 | 0.371 | -0.57 | 1.91 |
| | **Count: 3** | 16.7% | 14.6% | 16.9% | 15.6% | -0.80 | 0.139 | -1.69 | 0.09 |
| | **Count: 4+** | 58.0% | 62.5% | 57.1% | 60.3% | 1.30 | 0.132 | -0.12 | 2.72 |
| **Comorbid Conditions** | **Obesity** | 4.2% | 11.0% | 5.2% | 10.9% | 1.15 | 0.267 | -0.56 | 2.87 |
| | **Diabetes** | 29.3% | 29.7% | 26.9% | 25.9% | 1.44 | 0.197 | -0.39 | 3.27 |
| | **Hypertension** | 75.2% | 76.9% | 75.3% | 76.8% | 0.22 | 0.814 | -1.29 | 1.72 |
| | **Dementia** | 29.7% | 26.2% | 31.4% | 25.7% | 2.12 | 0.012 | 0.73 | 3.51 |
| **Prior Use** | **Any HH** | 25.9% | 21.5% | 26.1% | 21.3% | 0.40 | 0.801 | -2.22 | 3.02 |
| | **Any Prior Use** | 48.0% | 45.9% | 49.1% | 45.0% | 2.08 | 0.131 | -0.19 | 4.35 |
| | **Any ACH stay** | 22.2% | 19.2% | 22.4% | 19.4% | 0.04 | 0.965 | -1.51 | 1.59 |
| | **Any IRF** | 2.7% | 2.5% | 3.4% | 3.2% | 0.07 | 0.856 | -0.57 | 0.71 |
| | **Any SNF** | 12.4% | 10.9% | 11.8% | 10.2% | 0.12 | 0.877 | -1.18 | 1.43 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   Fracture is defined based on ICD codes for hip fracture provided by the CMMI on the CJR Model website: https://innovation.cms.gov/Files/worksheets/cjr-icd10hipfracturecodes.xlsx. The estimates in this exhibit are the results of unadjusted DiD models on patient characteristics. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Any prior care included IP hospital, psychiatric hospital, emergency department, SNF, IRF, home health, long-term care hospital, and hospice during the 6 months prior to anchor hospitalization. ACH = acute care hospital; CJR = Comprehensive Care for Joint Replacement Model; CMMI = Center for Medicare & Medicaid Innovation; DiD = difference-in-differences; ESRD = end-stage renal disease; ICD = international classification of diseases; HCC = hierarchical condition category; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; pp = percentage point; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

# Appendix D: Additional Findings

In this appendix, we present detailed results for the difference-in-differences (DiD) impacts on our claims-based outcomes, Medicare program savings, analysis of safety-net hospitals, and our analysis of the overlap between CJR and ACOs. Brief descriptions of the methodology are provided when applicable. For a full description of our data and methods please see **Appendix B: Data and Methods**.

## A. Model Impact

The results presented in this section correspond to the findings presented in **Chapter III: Impact of the Model** and **Chapter VII: Analysis of Potential Unintended Consequences of the Comprehensive Care for Joint Replacement (CJR) Model**.

| Acronyms | |
|---|---|
| CJR | Comprehensive Care for Joint Replacement |
| DiD | difference-in-differences |
| HH | home health |
| IRF | inpatient rehabilitation facility |
| LEJR | lower extremity joint replacement |
| PY | performance year |

### 1. Parallel Trends

We evaluated the parallel trends assumption three ways. In the first two methods, we used a linear trends test and a joint test of equality on discrete time periods to study whether there was statistical evidence that the CJR and control groups exhibited parallel trends in the baseline period. In the third method, we descriptively estimated a "Hypothetical difference-in-differences (DiD)," which considered any potential differential pre-trends between CJR and control episodes and then compared the hypothetical DiD with the actual estimated performance year (PY) 6 and PY 7 DiD impacts. See **Appendix B: Data and Methods** for a full description of the methodology used to evaluate parallel trends.

#### a. Statistical Tests of Parallel Trends

Results of the joint test and trends test are presented in **Exhibit D-1**. For the all lower extremity joint replacement (LEJR) sample, home health (HH) payments ($p < 0.01$ for the joint test and $p < 0.01$ for the linear test), other Part B payments ($p < 0.10$ for the joint test and $p < 0.10$ for the linear test), 30-day post-episode period (PEP) payments ($p < 0.05$ for the joint test and $p < 0.05$ for the linear test), first post-acute care (PAC) home with HH ($p < 0.01$ for the joint test and $p < 0.05$ for the linear test), and any HH use ($p < 0.10$ for the joint test and $p < 0.05$ for the linear test) failed the statistical parallel trends tests.[64]

In the elective LEJR sample, HH payments ($p < 0.01$ for the joint test and $p < 0.01$ for the linear test), other Part B payments ($p < 0.10$ for the joint test and $p < 0.05$ for the linear test), 30-day PEP payments ($p < 0.01$ for the joint test and $p < 0.01$ for the linear test), and first PAC home with HH ($p < 0.01$ for the joint test and $p < 0.05$ for the linear test) failed the statistical parallel trends tests.

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[64] See **Appendix B: Data and Methods** for complete definitions of all outcomes, including the first discharge destination outcomes.

In the fracture LEJR sample, first PAC skilled nursing facility (SNF) ($p < 0.10$ for the joint test and $p < 0.05$ for the linear test) and first PAC institutional rehabilitation facility (IRF) ($p < 0.10$ for the joint test and $p < 0.10$ for the linear test) failed the statistical parallel trends tests.

**Exhibit D-1:** **Linear and Joint Tests of Parallel Trends for Payment, Utilization, and Quality Metrics, Baseline, All LEJR Episodes, Fracture Episodes, and Elective Episodes**

| Domain | Measure | All LEJR | | Elective | | Fracture | |
|---|---|---|---|---|---|---|---|
| | | Joint Test | Linear Test | Joint Test | Linear Test | Joint Test | Linear Test |
| **Payments** | **Total Episode Payments** | p = 0.801 | p = 0.903 | p = 0.678 | p = 0.726 | p = 0.857 | p = 0.325 |
| | **SNF Payments** | p = 0.749 | p = 0.728 | p = 0.684 | p = 0.880 | p = 0.419 | p = 0.278 |
| | **IRF Payments** | p = 0.056 | p = 0.454 | p = 0.037 | p = 0.572 | p = 0.103 | p = 0.084 |
| | **HH Payments** | p = 0.003 | p = 0.001 | p = 0.008 | p = 0.003 | p = 0.394 | p = 0.459 |
| | **Readmission Payments** | p = 0.314 | p = 0.276 | p = 0.224 | p = 0.152 | p = 0.886 | p = 0.692 |
| | **Anchor Payments** | p = 0.009 | p = 0.140 | p = 0.008 | p = 0.108 | p = 0.920 | p = 0.636 |
| | **Other A Payments** | p = 0.794 | p = 0.902 | p = 0.769 | p = 0.974 | p = 0.948 | p = 0.778 |
| | **Other B Payments** | p = 0.093 | p = 0.053 | p = 0.065 | p = 0.034 | p = 0.958 | p = 0.735 |
| | **30-day PEP payments** | p = 0.012 | p = 0.019 | p = 0.004 | p = 0.004 | p = 0.603 | p = 0.814 |
| **Utilization** | **First PAC SNF** | p = 0.165 | p = 0.182 | p = 0.142 | p = 0.271 | p = 0.063 | p = 0.047 |
| | **First PAC IRF** | p = 0.050 | p = 0.452 | p = 0.034 | p = 0.627 | p = 0.051 | p = 0.056 |
| | **First PAC HH** | p = 0.007 | p = 0.014 | p = 0.008 | p = 0.011 | p = 0.597 | p = 0.322 |
| | **First PAC PT/OT** | p = 0.476 | p = 0.278 | p = 0.470 | p = 0.277 | p = 0.887 | p = 0.810 |
| | **First PAC Home without HH** | p = 0.609 | p = 0.823 | p = 0.501 | p = 0.891 | p = 0.420 | p = 0.715 |
| | **SNF Days** | p = 0.129 | p = 0.061 | p = 0.164 | p = 0.106 | p = 0.391 | p = 0.130 |
| | **IRF Days** | p = 0.334 | p = 0.303 | p = 0.399 | p = 0.382 | p = 0.850 | p = 0.572 |
| | **HH Visits** | p = 0.274 | p = 0.159 | p = 0.248 | p = 0.140 | p = 0.795 | p = 0.623 |
| | **Outpatient PT/OT Visits** | p = 0.214 | p = 0.094 | p = 0.207 | p = 0.075 | p = 0.232 | p = 0.958 |
| | **Any HH use** | p = 0.077 | p = 0.026 | p = 0.115 | p = 0.040 | p = 0.790 | p = 0.668 |
| **Quality** | **Unplanned Readmission Rate** | p = 0.314 | p = 0.276 | p = 0.224 | p = 0.152 | p = 0.886 | p = 0.692 |
| | **ED Use Rate** | p = 0.600 | p = 0.757 | p = 0.530 | p = 0.970 | p = 0.695 | p = 0.364 |
| | **Complication Rate** | p = 0.753 | p = 0.227 | p = 0.915 | p = 0.597 | p = 0.173 | p = 0.263 |
| | **Mortality Rate** | p = 0.108 | p = 0.678 | p = 0.658 | p = 0.851 | p = 0.165 | p = 0.662 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline).

*Notes*: The p-values in this exhibit were the result of risk-adjusted regression models analyzing if the respective CJR and control groups followed parallel trends during the baseline period. For the joint test, we report the p-value of an F-test that tests if the differential between the CJR and control group were jointly equal across annual time periods. For the linear test, we report the p-value of a linear slope coefficient of the quarterly difference between the CJR and control group. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. We considered outcomes to fail parallel trends if we rejected the null hypothesis of seemingly parallel trends for both tests at the 10% significance level.

CJR = Comprehensive Care for Joint Replacement; ED = emergency department; HH = home health; IRF = inpatient rehabilitation facility; LEJR = Lower Extremity Joint Replacement; OT = occupational therapy; p = p-value; PAC = post-acute care; PEP = post-episode payment; PT = physical therapy; PY = performance year; SNF = skilled nursing facility.

### b.   *Hypothetical Difference-in-Differences Method*

We interpreted and presented these results holistically. We paid close attention to both the magnitude and statistical significance of the PY 6–PY 7 DiD estimate, the magnitude and statistical significance of the differential trend coefficient, and the results for the Joint F-Test and Linear Test (shown in **Exhibit D-1**). While using various pieces of information from multiple results to assist in a single interpretation of an effect of the CJR Model was an inherently subjective process, we have applied the process as consistently across samples and outcomes as possible.

We classified outcomes into four groupings with the following guidelines. Note, while we used these as guidelines, we stress the subjective nature of this analysis, and we present all intermediate pieces of information that were used in our interpretation in this section. For interpretation purposes, we did not consider standard p-value cutoffs, for example, <0.10 as "meaningful" as strictly binding. For example, we interpreted a p-value of 0.12 nearly identically to a p-value of 0.09.

1. Very High Trust:

    a. Outcomes that did not fail the parallel trends tests and where the differences between the baseline trends of the CJR and control samples were of small magnitude.

    b. Outcomes that did not fail the parallel trends tests and had sufficiently large standard errors, such that we did not believe we could extrapolate the trends in any meaningful way.

2. High Trust: Outcomes that did potentially fail the parallel trends tests, but for which the differential trend was small in magnitude. We believe we could interpret the DiD estimates with relative certainty for these outcomes.

3. Low Trust: Outcomes that did not statistically fail the parallel trends test but did have sufficiently large differential baseline trends. For these outcomes, we believe additional caveats may be warranted in the interpretation of the DiD estimate.

4. Very Low Trust: Outcomes that did statistically fail parallel trends tests and had sufficiently large differential pre-trends. We believe strong additional caveats were warranted in the interpretation of the DiD estimates for these outcomes.

**Exhibits D-2 though D-4** show the results of the hypothetical DiD analysis, as well as our interpretation of the degree of trust we had in the DiD point estimate.

**Exhibit D-2: Level of Trust in DiD Estimates, PY 6–PY 7, All LEJR Episodes**

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| Payment | Total Episode Payments | -$9 | 0.731 | -$52 | $34 | -$658 | 0.303 | -$1,711 | $394 | -$975 | 0.118 | Very High | |
| | SNF Payments | -$17 | 0.277 | -$42 | $9 | $257 | 0.697 | -$829 | $1,343 | -$137 | 0.658 | Very High | |
| | IRF Payments | $14 | 0.590 | -$29 | $57 | -$983 | 0.205 | -$2,258 | $292 | -$533 | 0.107 | Very High | |
| | HH Payments | $17 | <0.001 | $10 | $24 | -$462 | 0.004 | -$724 | -$199 | $176 | 0.364 | Very Low | - or 0 |
| | Readmission Payments | -$6 | 0.160 | -$13 | $1 | $108 | 0.516 | -$165 | $380 | -$134 | 0.167 | High | |
| | Anchor Payments | -$3 | 0.240 | -$8 | $1 | $106 | 0.372 | -$89 | $302 | -$4 | 0.903 | Very High | |
| | Other Part A Payments | $0 | 0.980 | -$5 | $5 | $51 | 0.645 | -$130 | $232 | $48 | 0.230 | Very High | |
| | Other Part B | -$14 | 0.035 | -$24 | -$3 | $291 | 0.058 | $38 | $545 | -$216 | 0.120 | Very Low | + or 0 |
| | 30 Day PEP | -$8 | 0.026 | -$14 | -$2 | $358 | 0.010 | $129 | $587 | $60 | 0.050 | Very Low | + |
| Utilization | First PAC SNF | -0.29 | 0.043 | -0.52 | -0.05 | 6.91 | 0.279 | -3.60 | 17.42 | -1.34 | 0.530 | Very Low | + or 0 |
| | First PAC IRF | 0.07 | 0.709 | -0.25 | 0.40 | -5.09 | 0.372 | -14.45 | 4.28 | -3.70 | 0.097 | Very High | |
| | First PAC HH | 0.33 | 0.008 | 0.12 | 0.54 | -1.00 | 0.827 | -8.57 | 6.56 | 11.79 | 0.020 | Very Low | 0 |
| | First PAC OP PT/OT | -0.12 | 0.191 | -0.28 | 0.03 | 1.10 | 0.741 | -4.37 | 6.57 | -4.31 | 0.120 | High | |
| | First PAC None | 0.00 | 0.950 | -0.12 | 0.13 | -1.92 | 0.311 | -5.04 | 1.20 | -2.44 | 0.220 | Very High | |
| | Any HH Use | 0.32 | 0.023 | 0.09 | 0.54 | -3.87 | 0.314 | -10.18 | 2.45 | 8.35 | 0.180 | Very Low | 0 |
| | SNF Days | 0.08 | 0.083 | 0.00 | 0.16 | -2.56 | 0.200 | -5.84 | 0.73 | 0.53 | 0.530 | Very Low | - or 0 |
| | IRF Days | -0.01 | 0.201 | -0.03 | 0.00 | 0.54 | 0.189 | -0.14 | 1.23 | 0.01 | 0.980 | Very High | |
| | HH Visits | 0.05 | 0.066 | 0.01 | 0.10 | -2.38 | 0.004 | -3.75 | -1.01 | -0.53 | 0.390 | Low | - |
| | Outpatient PT/OT Visits | -0.02 | 0.207 | -0.05 | 0.01 | 0.92 | 0.145 | -0.12 | 1.97 | 0.15 | 0.760 | Very High | |

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| Quality | ED Use | 0.01 | 0.701 | -0.05 | 0.08 | -0.31 | 0.824 | -2.64 | 2.01 | -0.39 | 0.230 | Very High | |
| | Readmission | -0.03 | 0.361 | -0.09 | 0.03 | 0.85 | 0.516 | -1.31 | 3.01 | 0.20 | 0.630 | Very High | |
| | Complication | 0.02 | 0.203 | -0.01 | 0.06 | -1.04 | 0.185 | -2.33 | 0.25 | -0.20 | 0.270 | Very High | |
| | Mortality | 0.01 | 0.695 | -0.02 | 0.04 | -0.28 | 0.646 | -1.29 | 0.73 | -0.06 | 0.580 | Very High | |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:   The "Coefficient" column shows the estimated differential trend between CJR and control in the baseline period, the "P-value" shows the associated p-value, and the "90% CI LL" and "90% CI UL" columns show the 90% lower and upper confidence limits for the estimate, respectively. The "DiD Impact" estimates were reproduced from exhibits in **Appendix D, Section D.2**. The "Hypothetical DiD" column is calculated using two-staged least squares DiD. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. The "Level of Trust in DiD Estimate" column was subjective and based on the other information in the table. The "Likely sign of true effect" column is the most likely sign of the true effect based on the other information in the table (where "0" indicates a null effect, "+" indicates a positive effect, and "-" indicates a negative effect). CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; ED = emergency department; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; PEP = post-episode period; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

**Exhibit D-3:   Level of Trust in DiD Estimates, PY 6–PY 7, Elective LEJR Episodes**

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| **Payment** | **Total Episode Payments** | -$24 | 0.454 | -$77 | $29 | -$291 | 0.699 | -$1,529 | $947 | -$1,172 | 0.099 | Very High | |
| | **SNF Payments** | -$14 | 0.268 | -$36 | $7 | -$49 | 0.936 | -$1,047 | $949 | -$333 | 0.220 | Very High | |
| | **IRF Payments** | $3 | 0.890 | -$36 | $42 | -$509 | 0.454 | -$1,627 | $610 | -$413 | 0.092 | Very High | |
| | **HH Payments** | $18 | 0.001 | $10 | $27 | -$486 | 0.012 | -$805 | -$166 | $185 | 0.380 | Very Low | - or 0 |
| | **Readmission Payments** | -$9 | 0.103 | -$18 | $0 | $214 | 0.246 | -$90 | $517 | -$128 | 0.160 | Very Low | 0 |
| | **Anchor Payments** | -$4 | 0.236 | -$9 | $1 | $95 | 0.468 | -$120 | $310 | -$21 | 0.540 | Very High | |
| | **Other Part A Payments** | $0 | 0.912 | -$4 | $5 | $20 | 0.850 | -$152 | $192 | $31 | 0.170 | Very High | |
| | **Other Part B** | -$18 | 0.022 | -$31 | -$5 | $423 | 0.029 | $105 | $742 | -$251 | 0.090 | Very Low | + or 0 |
| | **30 Day PEP** | -$9 | 0.005 | -$15 | -$4 | $352 | 0.003 | $159 | $544 | $1 | 0.970 | Very Low | + |
| **Utilization** | **First PAC SNF** | -0.29 | 0.052 | -0.53 | -0.04 | 6.21 | 0.355 | -4.84 | 17.27 | -2.33 | 0.350 | Very Low | 0 |
| | **First PAC IRF** | 0.01 | 0.973 | -0.32 | 0.33 | -2.53 | 0.651 | -11.73 | 6.67 | -3.08 | 0.093 | Very High | |
| | **First PAC HH** | 0.41 | 0.007 | 0.16 | 0.66 | -3.00 | 0.557 | -11.38 | 5.39 | 13.21 | 0.020 | Very Low | + or 0 |
| | **First PAC OP PT/OT** | -0.14 | 0.206 | -0.32 | 0.04 | 1.60 | 0.668 | -4.55 | 7.75 | -4.94 | 0.130 | High | |
| | **First PAC None** | 0.01 | 0.905 | -0.13 | 0.15 | -2.29 | 0.275 | -5.73 | 1.16 | -2.87 | 0.190 | Very High | |
| | **Any HH Use** | 0.35 | 0.028 | 0.09 | 0.61 | -3.79 | 0.398 | -11.17 | 3.58 | 9.76 | 0.170 | Very Low | 0 |
| | **SNF Days** | 0.06 | 0.147 | -0.01 | 0.14 | -2.76 | 0.060 | -5.17 | -0.34 | -0.41 | 0.590 | High | |
| | **IRF Days** | -0.02 | 0.281 | -0.04 | 0.01 | 0.68 | 0.256 | -0.30 | 1.66 | 0.06 | 0.790 | Very High | |
| | **HH Visits** | 0.05 | 0.061 | 0.01 | 0.10 | -2.53 | 0.003 | -3.91 | -1.15 | -0.63 | 0.340 | Very Low | - |
| | **Outpatient PT/OT Visits** | -0.02 | 0.183 | -0.05 | 0.01 | 0.94 | 0.141 | -0.11 | 1.98 | 0.12 | 0.810 | Very High | |

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| Quality | ED Use | 0.00 | 0.916 | -0.06 | 0.07 | 0.22 | 0.881 | -2.23 | 2.68 | 0.36 | 0.410 | Very High | |
| | Readmission | -0.04 | 0.345 | -0.10 | 0.03 | 1.11 | 0.421 | -1.16 | 3.38 | -0.27 | 0.330 | Very High | |
| | Complication | 0.01 | 0.521 | -0.02 | 0.05 | -0.62 | 0.456 | -1.99 | 0.75 | -0.18 | 0.260 | Very High | |
| | Mortality | 0.00 | 0.871 | -0.02 | 0.02 | -0.11 | 0.773 | -0.74 | 0.52 | -0.05 | 0.290 | Very High | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: The "Coefficient" column shows the estimated differential trend between CJR and control in the baseline period, the "P-value" shows the associated p-value, and the "90% CI LL" and "90% CI UL" columns show the 90% lower and upper confidence limits for the estimate, respectively. The "DiD Impact" estimates were reproduced from exhibits in **Appendix D, Section D.2**. The "Hypothetical DiD" column is calculated using two-staged least squares DiD. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. The "Level of Trust in DiD Estimate" column was subjective and based on the other information in the table. The "Likely sign of true effect" column is the most likely sign of the true effect based on the other information in the table (where "0" indicates a null effect, "+" indicates a positive effect, and "-" indicates a negative effect). CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; ED = emergency department; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; PEP = post-episode period; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

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**Exhibit D-4: Level of Trust in DiD Estimates, PY 6–PY 7, Fracture LEJR Episodes**

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| Payment | Total Episode Payments | $44 | 0.294 | -$25 | $113 | -$1,810 | 0.308 | -$4,734 | $1,114 | -$153 | 0.850 | Low | - or 0 |
| | SNF Payments | -$62 | 0.233 | -$147 | $23 | $3,702 | 0.028 | $925 | $6,479 | $1,431 | 0.051 | Low | + |
| | IRF Payments | $72 | 0.116 | -$3 | $148 | -$4,188 | 0.003 | -$6,525 | -$1,850 | -$1,205 | 0.110 | Low | - |
| | HH Payments | $8 | 0.297 | -$5 | $21 | -$324 | 0.234 | -$772 | $124 | -$22 | 0.760 | Very High | |
| | Readmission Payments | $12 | 0.476 | -$16 | $40 | -$568 | 0.385 | -$1,646 | $509 | -$135 | 0.370 | Very High | |
| | Anchor Payments | -$3 | 0.664 | -$16 | $9 | $160 | 0.574 | -$308 | $628 | $52 | 0.380 | Very High | |
| | Other Part A Payments | $2 | 0.886 | -$16 | $19 | $43 | 0.908 | -$571 | $658 | $97 | 0.470 | Very High | |
| | Other Part B | $6 | 0.462 | -$8 | $20 | -$258 | 0.454 | -$826 | $310 | -$25 | 0.850 | Very High | |
| | 30 Day PEP | -$1 | 0.924 | -$27 | $24 | $462 | 0.421 | -$482 | $1,406 | $411 | 0.009 | Very High | |
| Utilization | First PAC SNF | -0.39 | 0.046 | -0.72 | -0.07 | 16.47 | 0.010 | 5.89 | 27.04 | 1.82 | 0.480 | Very Low | + |
| | First PAC IRF | 0.44 | 0.057 | 0.06 | 0.82 | -21.42 | 0.004 | -33.60 | -9.25 | -5.46 | 0.130 | Very Low | - |
| | First PAC HH | -0.06 | 0.374 | -0.18 | 0.05 | 5.64 | 0.052 | 0.86 | 10.43 | 3.51 | 0.011 | Very High | |
| | First PAC OP PT/OT | 0.01 | 0.791 | -0.05 | 0.07 | -0.42 | 0.749 | -2.57 | 1.73 | 0.03 | 0.910 | Very High | |
| | First PAC None | 0.01 | 0.886 | -0.08 | 0.09 | -0.27 | 0.885 | -3.32 | 2.78 | 0.10 | 0.810 | Very High | |
| | Any HH Use | 0.11 | 0.535 | -0.18 | 0.40 | -5.49 | 0.365 | -15.45 | 4.48 | -1.35 | 0.210 | Very High | |
| | SNF Days | 0.14 | 0.156 | -0.02 | 0.30 | -3.24 | 0.391 | -9.45 | 2.97 | 1.84 | 0.110 | Very Low | 0 |
| | IRF Days | -0.02 | 0.506 | -0.07 | 0.03 | 0.59 | 0.563 | -1.08 | 2.25 | -0.13 | 0.680 | Very High | |
| | HH Visits | 0.03 | 0.602 | -0.06 | 0.12 | -0.92 | 0.639 | -4.15 | 2.31 | 0.14 | 0.780 | Very High | |
| | Outpatient PT/OT Visits | 0.00 | 0.920 | -0.06 | 0.07 | 0.33 | 0.817 | -2.00 | 2.66 | 0.46 | 0.270 | Very High | |

| Domain | Outcome | Differential Trend | | | | Hypothetical PY 6–PY 7 DiD | | | | Standard PY 6–PY 7 DiD | | Level of Trust | Likely Sign of True Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | 90% LCI | 90% UCI | Impact | p-value | 90% LCI | 90% UCI | Impact | p-value | | |
| Quality | ED Use | 0.08 | 0.429 | -0.08 | 0.24 | -3.61 | 0.353 | -9.99 | 2.78 | -0.63 | 0.450 | Very High | |
| | Readmission | 0.00 | 0.975 | -0.17 | 0.16 | -1.09 | 0.779 | -7.45 | 5.28 | -1.11 | 0.240 | Very High | |
| | Complication | 0.09 | 0.272 | -0.04 | 0.22 | -3.33 | 0.286 | -8.47 | 1.80 | -0.26 | 0.600 | Very High | |
| | Mortality | 0.02 | 0.827 | -0.12 | 0.16 | -0.77 | 0.798 | -5.73 | 4.19 | -0.07 | 0.910 | Very High | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: The "Coefficient" column shows the estimated differential trend between CJR and control in the baseline period, the "P-value" shows the associated p-value, and the "90% CI LL" and "90% CI UL" columns show the 90% lower and upper confidence limits for the estimate, respectively. The "DiD Impact" estimates were reproduced from exhibits in **Appendix D, Section D.2**. The "Hypothetical DiD" column is calculated using two-staged least squares DiD. Estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. The "Level of Trust in DiD Estimate" column was subjective and based on the other information in the table. The "Likely sign of true effect" column is the most likely sign of the true effect based on the other information in the table (where "0" indicates a null effect, "+" indicates a positive effect, and "-" indicates a negative effect). CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; ED = emergency department; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; OP = outpatient; OT = occupational therapy; PAC = post-acute care; PEP = post-episode period; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

## 2. Impact Estimates

**Exhibit D-5:    Payment Outcomes, PY 6–PY 7, All LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| Total Episode Payment | 114,525 | 98,744 | $28,678 | $25,568 | 141,473 | 105,150 | $27,829 | $25,694 | -$975 | -3.4 | 0.118 | -$2,002 | $52 |
| SNF Payment | 114,525 | 98,744 | $5,947 | $2,954 | 141,473 | 105,150 | $5,891 | $3,035 | -$137 | -2.3 | 0.658 | -$644 | $371 |
| IRF Payment | 114,525 | 98,744 | $2,193 | $1,310 | 141,473 | 105,150 | $1,986 | $1,636 | -$533 | -24.3 | 0.107 | -$1,077 | $11 |
| HH Payment[a] | 114,525 | 98,744 | $2,371 | $2,029 | 141,473 | 105,150 | $2,156 | $1,638 | $176 | 7.4 | 0.364 | -$143 | $496 |
| Readmission Payment | 114,525 | 98,744 | $1,172 | $1,021 | 141,473 | 105,150 | $1,066 | $1,049 | -$134 | -11.4 | 0.167 | -$294 | $25 |
| Other Part B Payment[a] | 114,525 | 98,744 | $4,970 | $4,658 | 141,473 | 105,150 | $4,779 | $4,684 | -$216 | -4.4 | 0.116 | -$443 | $10 |
| Other Part A Payment | 114,525 | 98,744 | $124 | $119 | 141,473 | 105,150 | $175 | $122 | $48 | 38.6 | 0.230 | -$18 | $114 |
| Anchor Payment | 114,525 | 98,744 | $12,127 | $12,964 | 141,473 | 105,150 | $12,113 | $12,954 | -$4 | 0.0 | 0.903 | -$55 | $48 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012 and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:    The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]    Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b]    Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-6:     Payment Outcomes, PY 6–PY 7, Elective LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| Total Episode Payment | 96,266 | 87,408 | $25,770 | $21,820 | 122,534 | 93,853 | $24,687 | $21,908 | -$1,172 | -4.5 | 0.099 | -$2,342 | -$3 |
| SNF Payment | 96,266 | 87,408 | $4,159 | $1,295 | 122,534 | 93,853 | $3,962 | $1,431 | -$333 | -8.0 | 0.219 | -$778 | $113 |
| IRF Payment | 96,266 | 87,408 | $1,644 | $641 | 122,534 | 93,853 | $1,465 | $874 | -$413 | -25.1 | 0.092 | -$815 | -$10 |
| HH Payment [a] | 96,266 | 87,408 | $2,366 | $1,953 | 122,534 | 93,853 | $2,133 | $1,535 | $185 | 7.8 | 0.385 | -$165 | $535 |
| Readmission Payment [a] | 96,266 | 87,408 | $942 | $761 | 122,534 | 93,853 | $840 | $787 | -$128 | -13.6 | 0.163 | -$280 | $23 |
| Other Part B Payment [a] | 96,266 | 87,408 | $4,774 | $4,328 | 122,534 | 93,853 | $4,546 | $4,351 | -$251 | -5.3 | 0.089 | -$494 | -$8 |
| Other Part A Payment | 96,266 | 87,408 | $58 | $39 | 122,534 | 93,853 | $83 | $33 | $31 | 53.5 | 0.169 | -$6 | $68 |
| Anchor Payment | 96,266 | 87,408 | $11,958 | $12,640 | 122,534 | 93,853 | $11,923 | $12,626 | -$21 | -0.2 | 0.542 | -$79 | $37 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:   The estimates in this exhibit were the result of a DiD model. DiD estimates that are significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]   Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b]   Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-7:    Payment Outcomes, PY 6–PY 7, Fracture LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| Total Episode Payment[a] | 18,259 | 11,273 | $47,203 | $49,473 | 18,939 | 11,194 | $47,232 | $49,654 | -$153 | -0.3 | 0.846 | -$1,465 | $1,159 |
| SNF Payment[a] | 18,259 | 11,273 | $16,666 | $15,361 | 18,939 | 11,194 | $17,515 | $14,779 | $1,431 | 8.6 | 0.050 | $228 | $2,634 |
| IRF Payment[a] | 18,026 | 11,167 | $5,453 | $6,354 | 18,909 | 11,185 | $4,936 | $7,042 | -$1,205 | -22.1 | 0.110 | -$2,446 | $35 |
| HH Payment | 18,259 | 11,273 | $2,441 | $2,518 | 18,939 | 11,194 | $2,333 | $2,432 | -$22 | -0.9 | 0.762 | -$141 | $97 |
| Readmission Payment | 18,259 | 11,273 | $2,582 | $2,732 | 18,939 | 11,194 | $2,481 | $2,765 | -$135 | -5.2 | 0.374 | -$383 | $114 |
| Other Part B Payment | 18,259 | 11,273 | $6,269 | $6,791 | 18,939 | 11,194 | $6,213 | $6,761 | -$25 | -0.4 | 0.851 | -$246 | $196 |
| Other Part A Payment | 18,259 | 11,273 | $565 | $599 | 18,939 | 11,194 | $717 | $654 | $97 | 17.1 | 0.470 | -$126 | $319 |
| Anchor Payment | 18,259 | 11,273 | $13,262 | $15,083 | 18,939 | 11,194 | $13,299 | $15,069 | $52 | 0.4 | 0.383 | -$47 | $151 |

*Source:*    CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:    The estimates in this exhibit were the result of a DiD model. DiD estimates that are significant at the 1%, 5%, or 10%.Significance levels were indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]    Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b]    Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-8:    Payment Outcomes, PY 6 and PY 7 Separated, All LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **Total Episode Payment** | $28,677 | $27,825 | -$995 | 0.093 | -$1,969 | -$20 | -$940 | 0.157 | -$2,037 | $156 |
| **SNF Payment** | $5,947 | $5,892 | -$152 | 0.609 | -$641 | $337 | -$114 | 0.728 | -$651 | $423 |
| **IRF Payment** | $2,192 | $1,984 | -$575 | 0.064 | -$1,085 | -$65 | -$479 | 0.184 | -$1,071 | $114 |
| **HH Payment** [a] | $2,371 | $2,157 | $189 | 0.329 | -$130 | $509 | $160 | 0.414 | -$163 | $484 |
| **Readmission Payment** | $1,172 | $1,066 | -$161 | 0.065 | -$304 | -$18 | -$102 | 0.363 | -$287 | $83 |
| **Other Part B Payment** [a] | $4,969 | $4,778 | -$222 | 0.096 | -$441 | -$3 | -$207 | 0.155 | -$446 | $33 |
| **Other Part A Payment** | $124 | $175 | $42 | 0.260 | -$20 | $104 | $55 | 0.212 | -$18 | $128 |
| **Anchor Payment** | $12,126 | $12,111 | $13 | 0.668 | -$39 | $66 | -$17 | 0.594 | -$70 | $36 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:  The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]  Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6–PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6–PY 7 results.

**Exhibit D-9:    Payment Outcomes, PY 6 and PY 7 Separated, Elective LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **Total Episode Payment** | $25,769 | $24,684 | -$1,139 | 0.088 | -$2,236 | -$42 | -$1,203 | 0.117 | -$2,465 | $59 |
| **SNF Payment** | $4,159 | $3,964 | -$339 | 0.193 | -$767 | $89 | -$321 | 0.262 | -$792 | $149 |
| **IRF Payment** | $1,644 | $1,464 | -$414 | 0.070 | -$790 | -$38 | -$407 | 0.127 | -$846 | $32 |
| **HH Payment** [a] | $2,366 | $2,134 | $206 | 0.332 | -$144 | $557 | $160 | 0.456 | -$192 | $512 |
| **Readmission Payment** [a] | $941 | $840 | -$145 | 0.083 | -$282 | -$7 | -$109 | 0.301 | -$283 | $64 |
| **Other Part B Payment** [a] | $4,773 | $4,545 | -$250 | 0.083 | -$487 | -$13 | -$249 | 0.108 | -$505 | $6 |
| **Other Part A Payment** | $58 | $83 | $23 | 0.306 | -$14 | $61 | $40 | 0.092 | $1 | $78 |
| **Anchor Payment** | $11,957 | $11,921 | -$7 | 0.835 | -$64 | $50 | -$33 | 0.396 | -$96 | $31 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:   The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = Difference-in-Differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]   Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6–PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6–PY 7 results.

**Exhibit D-10:  Payment Outcomes, PY 6 and PY 7 Separated, Fracture LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **Total Episode Payment** [a] | $47,199 | $47,221 | -$545 | 0.462 | -$1,771 | $682 | $397 | 0.671 | -$1,155 | $1,948 |
| **SNF Payment** [a] | $16,666 | $17,513 | $1,539 | 0.017 | $478 | $2,599 | $1,326 | 0.137 | -$140 | $2,792 |
| **IRF Payment** [a] | $5,451 | $4,931 | -$1,532 | 0.037 | -$2,742 | -$322 | -$789 | 0.340 | -$2,151 | $572 |
| **HH Payment** | $2,441 | $2,333 | -$64 | 0.398 | -$187 | $60 | $25 | 0.751 | -$105 | $155 |
| **Readmission Payment** | $2,582 | $2,480 | -$226 | 0.144 | -$480 | $28 | -$22 | 0.917 | -$375 | $330 |
| **Other Part B Payment** | $6,268 | $6,211 | -$85 | 0.479 | -$285 | $114 | $64 | 0.699 | -$210 | $338 |
| **Other Part A Payment** | $565 | $717 | $106 | 0.361 | -$86 | $299 | $86 | 0.613 | -$197 | $370 |
| **Anchor Payment** | $13,261 | $13,297 | $104 | 0.111 | -$3 | $211 | $9 | 0.893 | -$98 | $115 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2022 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

**Exhibit D-11: Utilization Outcomes, PY 6–PY 7, All LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| **First PAC SNF**[a] | 113,951 | 98,488 | 42.0% | 14.9% | 140,987 | 104,834 | 41.0% | 15.3% | -1.34 pp | -3.2 | 0.529 | -4.83 pp | 2.15 pp |
| **First PAC IRF** | 113,951 | 98,488 | 13.6% | 5.4% | 140,987 | 104,834 | 12.4% | 7.9% | -3.70 pp | -27.1 | 0.096 | -7.37 pp | -0.04 pp |
| **First PAC HH**[a] | 113,951 | 98,488 | 36.0% | 55.1% | 140,987 | 104,834 | 33.5% | 40.7% | 11.79 pp | 32.7 | 0.021 | 3.40 pp | 20.18 pp |
| **First PAC Outpatient PT/OT** | 113,951 | 98,488 | 5.7% | 18.1% | 140,987 | 104,834 | 9.1% | 25.8% | -4.31 pp | -76.1 | 0.123 | -8.91 pp | 0.28 pp |
| **First PAC Home Without HH** | 113,951 | 98,488 | 2.7% | 6.6% | 140,987 | 104,834 | 4.0% | 10.3% | -2.44 pp | -91.0 | 0.216 | -5.67 pp | 0.80 pp |
| **SNF Days**[a] | 51,542 | 15,233 | 27.2 | 23.8 | 58,508 | 14,048 | 27.8 | 23.9 | 0.5 | 1.9 | 0.527 | -0.9 | 1.9 |
| **IRF Days** | 16,415 | 5,641 | 11.6 | 12.1 | 17,844 | 7,430 | 11.4 | 11.9 | 0.0 | 0.1 | 0.982 | -0.5 | 0.5 |
| **HH Visits**[a] | 80,813 | 68,443 | 16.7 | 13.6 | 99,158 | 61,077 | 16.3 | 13.7 | -0.5 | -3.1 | 0.387 | -1.5 | 0.5 |
| **Outpatient PT/OT Visits** | 69,289 | 83,782 | 13.0 | 14.6 | 90,157 | 90,584 | 13.3 | 14.8 | 0.2 | 1.2 | 0.763 | -0.7 | 1.0 |
| **Any HH Use**[a] | 114,525 | 98,744 | 73.5% | 71.4% | 141,473 | 105,150 | 68.6% | 58.1% | 8.35 pp | 11.4 | 0.184 | -1.99 pp | 18.69 pp |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; OT = occupational therapy; PAC = post-acute care; pp = percentage points; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b] Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-12: Utilization Outcomes, PY 6–PY 7, Elective LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| **First PAC SNF**[a] | 95,879 | 87,223 | 38.5% | 8.4% | 122,289 | 93,647 | 36.6% | 8.9% | -2.33 pp | -6.0 | 0.347 | -6.39 pp | 1.74 pp |
| **First PAC IRF** | 95,879 | 87,223 | 11.5% | 2.4% | 122,289 | 93,647 | 10.5% | 4.5% | -3.08 pp | -26.8 | 0.093 | -6.09 pp | -0.06 pp |
| **First PAC HH**[a] | 95,879 | 87,223 | 40.8% | 61.4% | 122,289 | 93,647 | 38.0% | 45.4% | 13.21 pp | 32.4 | 0.018 | 4.04 pp | 22.39 pp |
| **First PAC Outpatient PT/OT** | 95,879 | 87,223 | 6.4% | 20.7% | 122,289 | 93,647 | 10.4% | 29.6% | -4.94 pp | -77.1 | 0.126 | -10.25 pp | 0.37 pp |
| **First PAC Home Without HH** | 95,879 | 87,223 | 2.8% | 7.2% | 122,289 | 93,647 | 4.4% | 11.6% | -2.87 pp | -101.0 | 0.190 | -6.47 pp | 0.73 pp |
| **SNF Days** | 38,172 | 8,225 | 20.3 | 18.7 | 45,034 | 7,615 | 20.6 | 19.4 | -0.4 | -2.0 | 0.588 | -1.7 | 0.8 |
| **IRF Days** | 11,325 | 2,735 | 10.2 | 11.4 | 12,356 | 3,888 | 10.1 | 11.2 | 0.1 | 0.6 | 0.795 | -0.3 | 0.5 |
| **HH Visits**[a] | 68,802 | 60,671 | 16.1 | 12.6 | 87,138 | 53,350 | 15.7 | 12.8 | -0.6 | -3.9 | 0.342 | -1.7 | 0.5 |
| **Outpatient PT/OT Visits** | 64,933 | 79,824 | 13.1 | 14.7 | 85,782 | 86,757 | 13.5 | 14.9 | 0.1 | 0.9 | 0.810 | -0.7 | 1.0 |
| **Any HH Use**[a] | 96,266 | 87,408 | 74.1% | 71.8% | 122,534 | 93,853 | 68.9% | 56.8% | 9.76 pp | 13.2 | 0.172 | -2.01 pp | 21.53 pp |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; OT = occupational therapy; PAC = post-acute care; pp = percentage points; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b] Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-13:  Utilization Outcomes, PY 6–PY 7, Fracture LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| **First PAC SNF**[a] | 18,072 | 11,202 | 64.9% | 57.2% | 18,698 | 11,085 | 66.0% | 56.5% | 1.82 pp | 2.8 | 0.482 | -2.44 pp | 6.09 pp |
| **First PAC IRF**[a] | 18,072 | 11,202 | 27.5% | 24.1% | 18,698 | 11,085 | 25.9% | 28.0% | -5.46 pp | -19.9 | 0.127 | -11.35 pp | 0.43 pp |
| **First PAC HH** | 18,072 | 11,202 | 5.3% | 14.7% | 18,698 | 11,085 | 5.8% | 11.7% | 3.51 pp | 65.7 | 0.011 | 1.24 pp | 5.78 pp |
| **First PAC Outpatient PT/OT** | 18,072 | 11,202 | 0.9% | 1.6% | 18,698 | 11,085 | 0.9% | 1.5% | 0.03 pp | 2.9 | 0.911 | -0.35 pp | 0.41 pp |
| **First PAC Home Without HH** | 18,072 | 11,202 | 1.4% | 2.4% | 18,698 | 11,085 | 1.4% | 2.3% | 0.10 pp | 7.5 | 0.806 | -0.58 pp | 0.78 pp |
| **SNF Days**[a] | 13,370 | 6,999 | 43.1 | 37.1 | 13,474 | 6,424 | 44.8 | 36.9 | 1.8 | 4.3 | 0.113 | -0.1 | 3.8 |
| **IRF Days** | 5,090 | 2,902 | 14.1 | 13.8 | 5,488 | 3,528 | 13.8 | 13.6 | -0.1 | -0.9 | 0.679 | -0.7 | 0.4 |
| **HH Visits** | 12,011 | 7,724 | 21.0 | 19.8 | 12,020 | 7,663 | 20.4 | 19.1 | 0.1 | 0.7 | 0.781 | -0.7 | 1.0 |
| **Outpatient PT/OT Visits** | 4,356 | 3,897 | 10.5 | 12.5 | 4,375 | 3,734 | 10.7 | 12.2 | 0.5 | 4.4 | 0.274 | -0.2 | 1.2 |
| **Any HH Use** | 18,259 | 11,273 | 69.5% | 69.9% | 18,939 | 11,194 | 67.6% | 69.3% | -1.35 pp | -1.9 | 0.211 | -3.11 pp | 0.42 pp |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; OT = occupational therapy; PAC = post-acute care; pp = percentage points; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a]   Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b]   Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-14:  Utilization Outcomes, PY 6 and PY 7 Separated, All LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| First PAC SNF [a] | 42.0% | 41.0% | -1.25 pp | 0.557 | -4.75 pp | 2.25 pp | -1.44 pp | 0.498 | -4.93 pp | 2.05 pp |
| First PAC IRF | 13.6% | 12.4% | -3.89 pp | 0.069 | -7.40 pp | -0.37 pp | -3.48 pp | 0.140 | -7.35 pp | 0.40 pp |
| First PAC HH [a] | 36.0% | 33.5% | 12.59 pp | 0.013 | 4.24 pp | 20.94 pp | 10.79 pp | 0.037 | 2.28 pp | 19.29 pp |
| First PAC Outpatient PT/OT | 5.7% | 9.1% | -4.26 pp | 0.123 | -8.80 pp | 0.28 pp | -4.33 pp | 0.137 | -9.12 pp | 0.46 pp |
| First PAC Home Without HH | 2.7% | 4.0% | -3.19 pp | 0.086 | -6.25 pp | -0.14 pp | -1.54 pp | 0.474 | -5.09 pp | 2.00 pp |
| SNF Days [a] | 27.2 | 27.8 | 0.4 | 0.636 | -0.9 | 1.7 | 0.7 | 0.430 | -0.8 | 2.3 |
| IRF Days | 11.6 | 11.4 | 0.2 | 0.495 | -0.3 | 0.7 | -0.2 | 0.461 | -0.7 | 0.3 |
| HH Visits [a] | 16.7 | 16.3 | -0.5 | 0.390 | -1.6 | 0.5 | -0.5 | 0.375 | -1.5 | 0.4 |
| Outpatient PT/OT Visits | 13.0 | 13.3 | 0.1 | 0.906 | -0.8 | 0.9 | 0.3 | 0.608 | -0.6 | 1.1 |
| Any HH Use [a] | 73.5% | 68.6% | 8.72 pp | 0.159 | -1.46 pp | 18.90 pp | 7.90 pp | 0.221 | -2.72 pp | 18.52 pp |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6 and PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6 and PY 7 results.

**Exhibit D-15: Utilization Outcomes, PY 6 and PY 7 Separated, Elective LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **First PAC SNF** [a] | 38.5% | 36.6% | -2.36 pp | 0.331 | -6.35 pp | 1.63 pp | -2.27 pp | 0.370 | -6.42 pp | 1.89 pp |
| **First PAC IRF** | 11.5% | 10.5% | -3.14 pp | 0.079 | -6.08 pp | -0.20 pp | -3.01 pp | 0.114 | -6.14 pp | 0.13 pp |
| **First PAC HH** [a] | 40.8% | 38.0% | 14.14 pp | 0.011 | 5.00 pp | 23.27 pp | 12.06 pp | 0.033 | 2.77 pp | 21.36 pp |
| **First PAC Outpatient PT/OT** | 6.4% | 10.4% | -4.89 pp | 0.125 | -10.14 pp | 0.36 pp | -4.94 pp | 0.141 | -10.47 pp | 0.58 pp |
| **First PAC Home Without HH** | 2.8% | 4.4% | -3.74 pp | 0.070 | -7.13 pp | -0.35 pp | -1.85 pp | 0.443 | -5.81 pp | 2.12 pp |
| **SNF Days** | 20.3 | 20.6 | -0.5 | 0.559 | -1.7 | 0.8 | -0.4 | 0.659 | -1.7 | 1.0 |
| **IRF Days** | 10.2 | 10.1 | 0.4 | 0.114 | -0.0 | 0.9 | -0.3 | 0.246 | -0.7 | 0.1 |
| **HH Visits** [a] | 16.1 | 15.7 | -0.6 | 0.378 | -1.8 | 0.5 | -0.6 | 0.294 | -1.7 | 0.4 |
| **Outpatient PT/OT Visits** | 13.1 | 13.5 | 0.0 | 0.953 | -0.8 | 0.9 | 0.2 | 0.656 | -0.6 | 1.1 |
| **Any HH Use** [a] | 74.1% | 68.9% | 10.27 pp | 0.146 | -1.36 pp | 21.89 pp | 9.16 pp | 0.210 | -2.87 pp | 21.19 pp |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; PAC = post-acute care; OT = occupational therapy; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6 and PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6 and PY 7 results.

**Exhibit D-16: Utilization Outcomes, PY 6 and PY 7 Separated, Fracture LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **First PAC SNF** [a] | 64.9% | 66.1% | 2.97 pp | 0.210 | -0.93 pp | 6.88 pp | 0.39 pp | 0.900 | -4.78 pp | 5.57 pp |
| **First PAC IRF** [a] | 27.5% | 25.9% | -6.50 pp | 0.058 | -12.13 pp | -0.86 pp | -4.15 pp | 0.289 | -10.59 pp | 2.29 pp |
| **First PAC HH** | 5.3% | 5.8% | 3.50 pp | 0.018 | 1.07 pp | 5.92 pp | 3.51 pp | 0.017 | 1.08 pp | 5.93 pp |
| **First PAC Outpatient PT/OT** | 0.9% | 0.8% | -0.10 pp | 0.694 | -0.52 pp | 0.32 pp | 0.18 pp | 0.567 | -0.34 pp | 0.71 pp |
| **First PAC Home Without HH** | 1.4% | 1.4% | 0.13 pp | 0.772 | -0.61 pp | 0.87 pp | 0.07 pp | 0.884 | -0.70 pp | 0.83 pp |
| **SNF Days** [a] | 43.1 | 44.8 | 1.7 | 0.080 | 0.1 | 3.3 | 2.0 | 0.173 | -0.4 | 4.5 |
| **IRF Days** | 14.1 | 13.8 | -0.1 | 0.791 | -0.7 | 0.5 | -0.2 | 0.609 | -0.8 | 0.4 |
| **HH Visits** | 21.0 | 20.4 | -0.1 | 0.785 | -1.0 | 0.7 | 0.5 | 0.350 | -0.4 | 1.3 |
| **Outpatient PT/OT Visits** | 10.5 | 10.7 | 0.3 | 0.543 | -0.5 | 1.2 | 0.6 | 0.102 | -0.0 | 1.3 |
| **Any HH Use** | 69.5% | 67.6% | -1.62 pp | 0.088 | -3.19 pp | -0.06 pp | -1.06 pp | 0.469 | -3.46 pp | 1.34 pp |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; OT = occupational therapy; SNF = skilled nursing facility; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6 and PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6 and PY 7 results.

**Exhibit D-17: Quality Outcomes, PY 6–PY 7, All LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD; pp) | DiD as a Percent[a] (%) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | | |
| Unplanned Readmission Rate | 114,500 | 98,721 | 9.9 | 6.9 | 141,450 | 105,135 | 9.5 | 7.0 | -0.39 | -4.0 | 0.234 | -0.94 | 0.15 |
| ED Use Rate | 114,500 | 98,721 | 12.8 | 13.1 | 141,450 | 105,135 | 12.3 | 12.4 | 0.20 | 1.6 | 0.632 | -0.49 | 0.88 |
| Complication Rate | 114,500 | 98,707 | 3.9 | 2.3 | 141,450 | 105,132 | 3.7 | 2.3 | -0.20 | -5.1 | 0.272 | -0.50 | 0.10 |
| Mortality Rate | 117,415 | 100,375 | 2.4 | 2.2 | 144,680 | 106,791 | 2.5 | 2.3 | -0.06 | -2.6 | 0.582 | -0.24 | 0.12 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; pp = percentage point; PY = performance year; UCI = upper confidence interval.

a   Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-18: Quality Outcomes, PY 6–PY 7, Elective LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD; pp) | DiD as a Percent[a] (%) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | | |
| Unplanned Readmission Rate | 96,244 | 87,396 | 8.1 | 5.5 | 122,516 | 93,842 | 7.8 | 5.5 | -0.27 | -3.3 | 0.332 | -0.72 | 0.18 |
| ED Use Rate | 96,244 | 87,389 | 12.0 | 12.3 | 122,516 | 93,841 | 11.5 | 11.4 | 0.36 | 3.0 | 0.405 | -0.35 | 1.06 |
| Complication Rate | 96,244 | 87,389 | 3.0 | 1.7 | 122,516 | 93,841 | 2.8 | 1.7 | -0.18 | -6.1 | 0.265 | -0.45 | 0.09 |
| Mortality Rate | 96,783 | 87,630 | 0.5 | 0.4 | 123,165 | 94,133 | 0.5 | 0.5 | -0.05 | -9.4 | 0.286 | -0.12 | 0.03 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; pp = percentage point; PY = performance year; UCI = upper confidence interval.

[a] Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-19:  Quality Outcomes, PY 6–PY 7, Fracture LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD; pp) | DiD as a Percent[a] (%) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | | |
| Unplanned Readmission Rate | 18,256 | 11,262 | 21.1 | 16.1 | 18,934 | 11,190 | 20.5 | 16.5 | -1.11 | -5.2 | 0.241 | -2.66 | 0.45 |
| ED Use Rate | 18,256 | 11,262 | 17.9 | 18.8 | 18,934 | 11,190 | 17.5 | 19.0 | -0.63 | -3.6 | 0.447 | -2.01 | 0.74 |
| Complication Rate | 18,256 | 11,255 | 9.9 | 6.4 | 18,934 | 11,188 | 9.7 | 6.5 | -0.26 | -2.6 | 0.602 | -1.09 | 0.57 |
| Mortality Rate | 20,632 | 12,624 | 12.8 | 12.2 | 21,515 | 12,510 | 13.2 | 12.7 | -0.07 | -0.6 | 0.905 | -1.06 | 0.91 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:  The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; N = number; pp = percentage point; PY = performance year; UCI = upper confidence interval.

[a]  Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-20:  Quality Outcomes, PY 6 and PY 7 Separated, All LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average (%) | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
| **Unplanned Readmission Rate** | 9.9 | 9.5 | -0.48 | 0.114 | -0.97 | 0.02 | -0.30 | 0.458 | -0.96 | 0.36 |
| **ED Use Rate** | 12.8 | 12.3 | 0.31 | 0.447 | -0.36 | 0.99 | 0.07 | 0.886 | -0.74 | 0.89 |
| **Complication Rate** | 3.9 | 3.7 | -0.19 | 0.256 | -0.48 | 0.09 | -0.20 | 0.348 | -0.56 | 0.15 |
| **Mortality Rate** | 2.4 | 2.5 | -0.04 | 0.756 | -0.24 | 0.16 | -0.09 | 0.501 | -0.33 | 0.14 |

*Source:*　CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:　The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

**Exhibit D-21:  Quality Outcomes, PY 6 and PY 7 Separated, Elective LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average (%) | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
| **Unplanned Readmission Rate** | 8.1 | 7.8 | -0.27 | 0.282 | -0.68 | 0.14 | -0.26 | 0.442 | -0.82 | 0.30 |
| **ED Use Rate** | 12.0 | 11.5 | 0.50 | 0.269 | -0.24 | 1.23 | 0.20 | 0.684 | -0.59 | 0.98 |
| **Complication Rate** | 3.0 | 2.8 | -0.21 | 0.166 | -0.46 | 0.04 | -0.15 | 0.456 | -0.48 | 0.18 |
| **Mortality Rate** | 0.5 | 0.5 | -0.02 | 0.682 | -0.12 | 0.07 | -0.08 | 0.155 | -0.17 | 0.01 |

*Source:*　CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:　The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

**Exhibit D-22: Quality Outcomes, PY 6 and PY 7 Separated, Fracture LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average (%) | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
| Unplanned Readmission Rate | 21.1 | 20.5 | -1.63 | 0.100 | -3.27 | 0.00 | -0.45 | 0.666 | -2.18 | 1.27 |
| ED Use Rate | 17.9 | 17.5 | -0.60 | 0.501 | -2.06 | 0.86 | -0.66 | 0.526 | -2.38 | 1.05 |
| Complication Rate | 9.9 | 9.7 | 0.03 | 0.953 | -0.91 | 0.98 | -0.61 | 0.314 | -1.61 | 0.39 |
| Mortality Rate | 12.8 | 13.2 | -0.03 | 0.966 | -1.10 | 1.05 | -0.13 | 0.864 | -1.43 | 1.16 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; ED = emergency department; LCI = lower confidence interval; LEJR = Lower Extremity Joint Replacement; pp = percentage point; PY = performance year; UCI = upper confidence interval.

**Exhibit D-23: Total Episode Payment Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Population | CJR | | | Control | | | PY 6–PY 7 Impact (DiD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | |
| Total Episode Payment | Patients who were dually eligible | 5,557 | $30,529 | $26,254 | 4,576 | $28,648 | $25,480 | -$1,596 | 0.075 | -$3,070 | -$122 |
| | Patients who were not dually eligible* | 81,851 | $25,321 | $21,281 | 89,277 | $24,515 | $21,164 | -$1,086 | 0.124 | -$2,248 | $77 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; LCI = lower confidence interval; N = number; PY = performance year; UCI = upper confidence interval.

* The sample for this estimate failed tests for parallel trends in the baseline period.

**Exhibit D-24: Difference in Impact for Total Episode Payment Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Population | PY 6–PY 7 Impact (DiD) | Difference in Impact (DDD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|
| Total Episode Payment | Patients who were dually eligible | -$1,596 | -$510 | 0.215 | -$1,189 | $169 |
| | Patients who were not dually eligible | -$1,086 | | | | |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; LCI = lower confidence interval; PY = performance year; UCI = upper confidence interval.

**Exhibit D-25: Quality Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Population | CJR | | | Control | | | Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | |
| Mortality Rate | Patients who were dually eligible | 5,573 | 0.8 | 0.6 | 4,599 | 0.8 | 0.7 | -0.09 | 0.625 | -0.38 | 0.21 |
| | Patients who were not dually eligible | 82,057 | 0.5 | 0.3 | 89,534 | 0.5 | 0.3 | -0.05 | 0.266 | -0.12 | 0.02 |
| ED Use | Patients who were dually eligible | 5,554 | 19.1 | 17.5 | 4,574 | 22.2 | 18.4 | 1.96 | 0.146 | -0.26 | 4.17 |
| | Patients who were not dually eligible | 81,835 | 11.2 | 11.6 | 89,267 | 11.3 | 11.5 | 0.21 | 0.596 | -0.44 | 0.86 |
| Readmission Rate | Patients who were dually eligible | 5,554 | 11.1 | 8.2 | 4,575 | 11.5 | 8.6 | -0.17 | 0.824 | -1.39 | 1.06 |
| | Patients who were not dually eligible | 81,842 | 7.7 | 5.3 | 89,267 | 7.4 | 5.3 | -0.34 | 0.281 | -0.85 | 0.18 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; ED = emergency department; LCI = lower confidence interval; N = number; pp = percentage point; PY = performance year; UCI = upper confidence interval.

**Exhibit D-26: Difference in Impact for Quality Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Impact on Patients who were Dually Eligible (DiD; pp) | Impact on Patients who were not Dually Eligible (DiD; pp) | Difference in Impact (DDD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|
| Mortality Rate | -0.09 | -0.05 | -0.04 | 0.843 | -0.34 | 0.27 |
| ED Use | 1.96 | 0.21 | 1.75 | 0.171 | -0.35 | 3.84 |
| Readmission Rate | -0.17 | -0.34 | 0.17 | 0.813 | -1.03 | 1.37 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; ED = emergency department; LCI = lower confidence interval; pp = percentage point; PY = performance year; UCI = upper confidence interval.

**Exhibit D-27: First PAC Outcome, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Population | CJR | | | Control | | | PY 6–PY 7 Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | |
| First PAC IRF | Patients who were dually eligible | 5,539 | 13.8 | 4.7 | 4,566 | 13.1 | 6.6 | -3.91 | 0.132 | -8.18 | 0.36 |
| | Patients who were not dually eligible | 81,684 | 10.9 | 2.3 | 89,081 | 10.1 | 3.6 | -2.94 | 0.103 | -5.91 | 0.02 |
| First PAC SNF | Patients who were dually eligible | 5,539 | 49.2 | 20.7 | 4,566 | 40.4 | 16.3 | -3.78 | 0.209 | -8.72 | 1.17 |
| | Patients who were not dually eligible | 81,684 | 36.6 | 7.4 | 89,081 | 33.6 | 6.6 | -2.13 | 0.386 | -6.17 | 1.91 |
| First PAC HH | Patients who were dually eligible* | 5,539 | 31.6 | 54.3 | 4,566 | 37.7 | 49.9 | 11.89 | 0.003 | 5.23 | 18.54 |
| | Patients who were not dually eligible | 81,684 | 42.5 | 62.0 | 89,081 | 43.2 | 49.4 | 13.13 | 0.022 | 3.73 | 22.53 |
| First PAC OP PT/OT | Patients who were dually eligible | 5,539 | 2.7 | 12.7 | 4,566 | 5.4 | 18.5 | -2.31 | 0.368 | -6.54 | 1.92 |
| | Patients who were not dually eligible | 81,684 | 7.2 | 20.9 | 89,081 | 9.5 | 30.5 | -5.21 | 0.123 | -10.77 | 0.35 |
| First PAC home without HH or OP PT/OT | Patients who were dually eligible | 5,539 | 2.8 | 7.5 | 4,566 | 3.4 | 8.6 | -1.89 | 0.217 | -4.40 | 0.63 |
| | Patients who were not dually eligible | 81,684 | 2.8 | 7.4 | 89,081 | 3.7 | 9.9 | -2.85 | 0.204 | -6.53 | 0.84 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

* The sample for this estimate failed tests for parallel trends in the baseline period.

**Exhibit D-28: Difference in First PAC Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Impact on Patients who were Dually Eligible (DiD; pp) | Impact on Patients who were not Dually Eligible (DiD; pp) | Difference in Impact (DDD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|
| First PAC IRF* | -3.91 | -2.94 | -0.97 | 0.499 | -3.33 | 1.39 |
| First PAC SNF | -3.78 | -2.13 | -1.65 | 0.337 | -4.47 | 1.17 |
| First PAC HH | 11.89 | 13.13 | -1.25 | 0.692 | -6.42 | 3.92 |
| First PAC OP PT/OT | -2.31 | -5.21 | 2.90 | 0.333 | -2.03 | 7.82 |
| First PAC home without HH or OP PT/OT | -1.89 | -2.85 | 0.96 | 0.483 | -1.29 | 3.22 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; OT = occupational therapy; PAC = post-acute care; pp = percentage point; PT = physical therapy; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

* The sample for this differential impact estimate failed tests for parallel trends in the baseline period.

**Exhibit D–29:  Utilization Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Measure | Population | CJR | | | Control | | | PY 6–PY 7 Impact (DiD; pp) | p-value | 90% LCI (pp) | 90% UCI (pp) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | PY 6–PY 7 Episodes (N) | Baseline Mean (%) | PY 6–PY 7 Mean (%) | | | | |
| HH Visits | Patients who were dually eligible | 3,995 | 18.7 | 15.3 | 2,976 | 18.2 | 14.6 | 0.36 | 0.675 | -1.05 | 1.77 |
| | Patients who were not dually eligible | 56,676 | 16.0 | 12.1 | 50,374 | 15.4 | 12.3 | -0.70 | 0.313 | -1.84 | 0.45 |
| SNF Days | Patients who were dually eligible* | 1,262 | 26.5 | 28.4 | 828 | 24.2 | 26.5 | -0.79 | 0.512 | -2.80 | 1.21 |
| | Patients who were not dually eligible | 6,963 | 18.6 | 19.0 | 6,787 | 18.8 | 18.8 | -0.40 | 0.572 | -1.59 | 0.78 |
| IRF Days | Patients who were dually eligible | 314 | 10.5 | 12.1 | 316 | 10.5 | 11.8 | 0.11 | 0.846 | -0.83 | 1.05 |
| | Patients who were not dually eligible | 2,421 | 10.1 | 11.7 | 3,572 | 9.9 | 11.3 | 0.07 | 0.794 | -0.36 | 0.50 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; N = number; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

\* The sample for this estimate failed tests for parallel trends in the baseline period.

**Exhibit D-30: Difference in Impact Utilization Outcomes, PY 6–PY 7, Patients who Were Dually Eligible**

| Outcome | Impact on Patients who were Dually Eligible (DiD) | Impact on Patients who were not Dually Eligible (DiD) | Difference in Impact (DDD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|
| HH Visits | 0.4 | -0.7 | 1.1 | 0.293 | -0.6 | 2.7 |
| SNF Days | -0.8 | -0.4 | -0.4 | 0.707 | -2.1 | 1.3 |
| IRF Days | 0.1 | 0.1 | 0.0 | 0.941 | -0.9 | 1.0 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; HH = home health; IRF = inpatient rehabilitation facility; LCI = lower confidence interval; PY = performance year; SNF = skilled nursing facility; UCI = upper confidence interval.

**Exhibit D-31: 30-Day Post-Episode Payments, PY 6–PY 7, All LEJR, Elective, and Fracture LEJR Episodes**

| Measure | CJR | | | | Control | | | | PY 6–PY 7 Impact (DiD) | DiD as a Percent[b] (%) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | Baseline Episodes (N) | PY 6–PY 7 Episodes (N) | Baseline Mean | PY 6–PY 7 Mean | | | | | |
| All LEJR Episodes [a] | 114,525 | 98,744 | $1,431 | $1,790 | 141,473 | 105,150 | $1,461 | $1,761 | $60 | 4.2 | 0.050 | $10 | $110 |
| Elective LEJR Episodes [a] | 96,266 | 87,401 | $1,122 | $1,455 | 122,534 | 93,852 | $1,120 | $1,452 | $1 | 0.1 | 0.965 | -$49 | $51 |
| Hip Fracture LEJR Episodes | 18,259 | 11,266 | $3,380 | $3,833 | 18,939 | 11,183 | $3,600 | $3,642 | $411 | 12.2 | 0.009 | $153 | $669 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower-extremely joint replacement; N = number; PY = performance year; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model.

[b] Percents are calculated by dividing the impact by the risk-adjusted mean value of the outcome for CJR episodes in the baseline period.

**Exhibit D-32: 30-Day Post-Episode Payments, PY 6 and PY 7 Separated, All LEJR, Elective, and Fracture LEJR Episodes**

| Measure | Baseline Risk-Adjusted Average | | PY 6 | | | | PY 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| All LEJR Episodes [a] | $1,431 | $1,461 | $67 | 0.046 | $12 | $122 | $53 | 0.141 | -$6 | $112 |
| Elective LEJR Episodes [a] | $1,122 | $1,120 | $19 | 0.550 | -$33 | $71 | -$18 | 0.617 | -$76 | $41 |
| Hip Fracture LEJR Episodes | $3,380 | $3,600 | $318 | 0.074 | $25 | $610 | $529 | 0.002 | $255 | $804 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*: The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower-extremely joint replacement; pp = percentage points; PY = performance year; UCI = upper confidence interval.

[a] Indicates that after a holistic approach towards analyzing parallel trends, we believe the CJR and control populations may have been on relatively large differential trends in the baseline period for this outcome. This could lead to this estimate not being an unbiased causal estimate of the CJR Model. The parallel trend tests were only run on PY 6 and PY 7 combined estimates, but the differential trend limitations are still applicable since the baseline estimation is the same for combined and separated PY 6 and PY 7 results.

**Exhibit D-33: Volume Results, 2022–2023, Elective LEJR**

| Population | CJR | | | | Control | | | | 2022-2023 Impact (DiD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Beneficiary-Years (N) | 2022-2023 Beneficiary-Years (N) | Baseline Mean | 2022-2023 Mean | Baseline Beneficiary-Years (N) | 2022-2023 Beneficiary-Years (N) | Baseline Mean | 2022-2023 Mean | | | | |
| All Beneficiaries | 17,636,520 | 8,056,969 | 1,086 | 1,166 | 17,514,104 | 7,734,395 | 1,146 | 1,177 | 48 | 0.140 | -5 | 102 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between 2022 and 2023.

*Notes*: Volume Results are based on beneficiary-years and are reported as the number of LEJRs per 100,000 Medicare FFS beneficiaires. The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower-extremely joint replacement; N = number; UCI = upper confidence interval.

**Exhibit D-34:  Volume Results, 2022–2023, Elective LEJR, Patients who Were Dually Eligible**

| Population | CJR | | | | Control | | | | Impact (DiD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline Beneficiary-Years (N) | 2022-2023 Beneficiary-Years (N) | Baseline Mean | 2022-2023 Mean | Baseline Beneficiary-Years (N) | 2022-2023 Beneficiary-Years (N) | Baseline Mean | 2022-2023 Mean | | | | |
| Patients who were dually eligible | 4,225,149 | 1,455,553 | 513 | 510 | 3,240,011 | 971,082 | 549 | 528 | 47 | 0.085 | 2 | 93 |
| Patients who were not dually eligible | 13,411,371 | 6,601,416 | 1,133 | 1601 | 14,274,093 | 6,763,313 | 1,269 | 1,754 | 44 | 0.179 | -10 | 98 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between 2022 and 2023.

*Notes*:   Volume Results are based on beneficiary-years and are reported as the number of LEJRs per 100,000 Medicare FFS beneficiaires. The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower-extremely joint replacement; N = number; UCI = upper confidence interval.

**Exhibit D-35:  Difference in Impact for Volume Results, 2022–2023, Elective LEJR, Patients who Were Dually Eligible**

| Measure | Population | Impact (DiD) | Difference in Impact (DDD) | p-value | 90% LCI | 90% UCI |
|---|---|---|---|---|---|---|
| LEJR Volume | Patients who were dually eligible | 47 | 3 | 0.898 | -39 | 45 |
| | Patients who were not dually eligible | 44 | | | | |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between 2022 and 2023.

*Notes:*   The estimates in this exhibit are the result of a DDD model. DDD estimates that are significant at the 1%, 5%, or 10% significance levels are indicated by red, orange, or yellow shading, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; DDD = difference-in-difference-in-differences; LCI = lower confidence interval; LEJR = lower extremity joint replacement; UCI = upper confidence interval.

**Exhibit D-36: Volume Results, 2022–2023 Separated, Elective LEJR**

| Population | Baseline Risk-Adjusted Average (Beneficiary-Years) | | 2022 | | | | 2023 | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | CJR | Control | Impact (DiD) | p-value | 90% LCI | 90% UCI | Impact (DiD) | p-value | 90% LCI | 90% UCI |
| **All Beneficiaries** | 1,086 | 1,146 | 57 | 0.068 | 6 | 108 | 45 | 0.245 | -19 | 110 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between 2022 and 2023.

*Notes:* Volume Results are based on beneficiary-years and are reported as the number of LEJRs per 100,000 Medicare FFS beneficiaires. The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. Outcome definitions are presented in **Appendix B: Data Sources and Methods**. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; LEJR = lower extremely joint replacement; UCI = upper confidence interval.

### c. Sensitivity Analysis

In this section, we describe the results of the sensitivity analyses we conducted to examine the robustness of the reported impact estimates. Specifically, we examined our model's robustness to alternative temporal and geographic controls. In our main results for the impact of the CJR Model, our "standard DiD", we use a two-period DiD model that does not include any temporal controls and only include select state indicators as the only geographic control.

We estimated sensitivity tests for total payments on the all-LEJR sample with different combinations of temporal and geographic indicators or fixed effects in the model. **Exhibit D-37** shows the results of our main analysis and our temporal and geographic effects sensitivity test.[65] For temporal effect combinations, we see that among any given geographic-level indicator, there is very small variation in the estimates and the conclusion does not change with respect to temporal effects. Comparing our main estimate for total episode payments in the full sample to the same estimate with geographic effect combinations, we see a range of very small differences ($6) to moderately large differences ($253). This indicates that geographic controls do matter, but our standard DiD choice is appropriate since our standard DiD estimate falls in middle of these sensitivity results. Moreover, our standard DiD estimate is very close to the DiD estimates obtained from including either the full set of state, metropolitan statistical area (MSA), or hospital indicators, three approaches which we believe would have been methodologically sound alternatives to our standard DiD approach.

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[65] In each instance, we continue to allow for clustering of standard errors at the MSA level. This is the same approach taken in our standard DiD analyses.

**Exhibit D-37: Sensitivity Analysis Results for Total Episode Payments, PY 6–PY 7, All LEJR Episodes**

| Geographic-Level Indicator | Temporal-Level Indicator | PY 6–PY 7 Impact (DiD) | SE | p-value | 90% LCI | 90% UCI | p-value of difference between this specification and standard DiD |
|---|---|---|---|---|---|---|---|
| Standard DiD PY 6–PY 7 Impact | | -$975 | $616 | 0.118 | -$2,002 | $52 | Reference |
| None | None | -$722 | $610 | 0.241 | -$1,739 | $295 | 0.004 |
| | Year | -$732 | $611 | 0.235 | -$1,751 | $287 | 0.002 |
| | Quarter | -$734 | $612 | 0.235 | -$1,755 | $287 | 0.002 |
| Region | None | -$756 | $621 | 0.228 | -$1,791 | $280 | 0.011 |
| | Year | -$767 | $623 | 0.223 | -$1,806 | $273 | 0.010 |
| | Quarter | -$768 | $625 | 0.223 | -$1,811 | $274 | 0.011 |
| State | None | -$969 | $614 | 0.119 | -$1,994 | $55 | 0.609 |
| | Year | -$982 | $618 | 0.117 | -$2,012 | $48 | 0.730 |
| | Quarter | -$984 | $620 | 0.117 | -$2,019 | $50 | 0.678 |
| MSA | None | -$967 | $621 | 0.124 | -$2,002 | $68 | 0.846 |
| | Year | -$981 | $624 | 0.121 | -$2,021 | $60 | 0.884 |
| | Quarter | -$983 | $626 | 0.121 | -$2,027 | $61 | 0.842 |
| Hospital | None | -$934 | $553 | 0.096 | -$1,855 | -$13 | 0.744 |
| | Year | -$949 | $558 | 0.093 | -$1,879 | -$19 | 0.831 |
| | Quarter | -$952 | $560 | 0.094 | -$1,885 | -$18 | 0.846 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2012, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit were the result of a DiD model. DiD estimates that were significant at the 1%, 5%, or 10% significance level are indicated by red, orange, or yellow shaded cells, respectively. CJR = Comprehensive Care for Joint Replacement; DiD = difference-in-differences; LCI = lower confidence interval; MSA = metropolitan statistical area; SE = standard error; PY = performance year; UCI = upper confidence interval.

## B. Medicare Program Savings

The results presented in this section correspond to the findings presented in
**Chapter IV: Medicare Program Savings.**

**Exhibit D-38: Standardization Ratios, PY 6–PY 7, All LEJR**

| Time period | Standardization ratio |
|---|---|
| PY 6 | 1.06 |
| PY 7 | 1.05 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes*:  Standardization ratios are calculated as the average non-standardized (actual) paid amounts divided by the average standardized paid amounts for episodes. The anchor payment (Medicare Severity-Diagnosis Related Group payment for inpatient episodes) was subtracted from the total episode payment before calculating the ratio. CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year

**Exhibit D-39: Medicare Program Savings, PY 6, All LEJR**

| Savings component | Value | 90% LCI | 90% UCI |
|---|---|---|---|
| Reduction in nonstandardized paid amounts per episode | $934 | -$20 | $1,887 |
| Reconciliation payments per episode | -$78 | N/A | N/A |
| Medicare savings per episode | $1,012 | $58 | $1,965 |
| Number of PY 6 episodes | 53,316 | N/A | N/A |
| Aggregate Medicare savings | $53.9 M | $3.1 M | $104.8 M |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2022 (PY 6 intervention) as well as CJR payment contractor data for CJR participant hospitals in PY 6.

*Notes*:  Reductions in nonstandardized paid amounts are based on a estimates from a DiD model of per-episode standardized paid amounts that have been multiplied by –1 and converted to nonstandardized amounts. We do not report confidence intervals for reconciliation payments per episode and number of PY 6 episodes because these were not estimated but observed with certainty. We calculated aggregate Medicare savings by multiplying Medicare savings per episode by the number of PY 6 episodes, and Medicare savings per episode equals the estimated reduction in nonstandardized paid amounts per episode minus the average reconciliation payments per episode. Because reconciliation payments per episode depend on realized payment reductions, the asterisked intervals are not truly confidence intervals but ranges based on the confidence interval. CJR = Comprehensive Care for Joint Replacement; LCI = lower confidence interval; LEJR = lower extremity joint replacement; M = million; N/A = not applicable; PY = performance year UCI = upper confidence interval.

### 1. *Volume Sensitivity*

One limitation of the Medicare program savings analysis is that it implicitly assumes LEJR volume at participant hospitals was not impacted by the CJR Model. If the CJR Model did have an impact on LEJR volume at participant hospitals, calculation of true Medicare Savings becomes more complicated.

In prior annual reports, we did not detect statistically significant impacts on LEJR volume. However, in this report we detected a statistically significant impact on LEJR volume in PY 6, and the cumulative estimated impact over PYs 6–7 was close to significant at the 10% level. Thus, we undertake here a worst-case sensitivity analysis, in which we modify our estimated Medicare Savings under the assumption that the estimated LEJR volume impact is a causal impact of the CJR Model.

There are several caveats to this sensitivity analysis. First, we assume that the 'extra' elective LEJRs caused by the CJR Model are, on average, as costly as the average elective LEJR in a CJR hospital during PYs 6–7. In practice, this is unlikely to be true–if the CJR Model caused an increase in elective LEJR volume, it is likely that the 'extra' LEJRs were low complexity, as these are the LEJRs where hospitals have the largest incentive to increase volume. Second, we are using an estimated LEJR volume impact from a beneficiary-year level analysis. As noted in **Chapter VII. Analysis of Potential Unintended Consequences of the CJR Model**, this analysis counts an LEJR as a CJR LEJR based on the beneficiary's address, not the hospital. Thus, it is likely that our estimated volume impact is larger than the volume impact of the model specifically at CJR hospitals. Third, we assume that the 'extra' elective LEJRs caused by CJR do not result in any reduced CMS expenditure in the future–in practice, it is possible that the extra elective LEJRs cause a reduction in the rate of hip fractures, for instance, which would generate offsetting Medicare savings. Fourth, our volume analysis estimates the impact of the CJR Model on the probability of receiving at least one elective LEJR. For ease of exposition, we discuss the results in terms of rates, but this is slightly inaccurate as a small proportion of beneficiaries receive more than one elective LEJR in a year.

Our estimated volume impact is that the CJR Model increased elective LEJR counts by approximately 48.2 LEJRs per 100,000 FFS beneficiaries per year (**Exhibit D-40**). There are 5,640,591 CJR beneficiary-years in our dataset for calendar years 2022 and 2023. Thus, the estimated volume impact implies an additional 2,719 elective LEJRs during those years. Because PY 6 and PY 7 together constitute 9 quarters, we multiply the additional LEJR count by 9/8 to arrive at an estimated 3,059 additional elective LEJRs caused by the CJR Model during PY 6–7.

**Exhibit D-40: Estimated Medicare Program Savings Volume Sensitivity Analysis, PY 6–PY 7**

| Savings component | Value |
|---|---|
| Estimated volume impact | 48.2 LEJRs per 100,000 beneficiary-years |
| Number of CJR beneficiary-years | 5,640,591 |
| Estimated additional LEJRs during PYs 6-7 | 3,059 |
| Average cost of elective LEJR during PYs 6-7 | $25,263 |
| Estimated additional LEJR spending during PYs 6-7 | $77.3 M |
| Estimated Medicare savings accounting for additional LEJR spending | $35.4 M |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated in 2012 through 2014 that ended between April 2012 and March 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2022 (PY 6 intervention) as well as CJR payment contractor data for CJR participant hospitals in PY 6.

*Notes:* Results of a sensitivity analysis assuming that the CJR Model caused an additional 48.2 elective LEJRs per 100,000 FFS beneficiaries per year, the estimated impact in **Chapter VII. Analysis of Potential Unintended Consequences of the CJR Model**. This analysis represents a worst-case scenario, in which all 'extra' LEJRs have the same average complexity as the LEJRs in our analytic sample, do not cause any downstream reductions in Medicare spending, and occur only at CJR participant hospitals (rather than at non-CJR hospitals in the same MSA). CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; M = million; PY = performance year.

The average elective LEJR episode in a CJR hospital during PY 6–7 had a total cost of $25,263. This, multiplied by the 3,059 additional elective LEJRs, results in an estimated 'extra' Medicare

spending of $77.3 million dollars over PYs 6–7. Subtracting this from estimated Medicare savings over the same period ($112.7 million), estimated Medicare savings if the CJR Model increased LEJR volume by 48.2 LEJRs per 100,000 FFS beneficiaries per year is $35.4 million.

## C. Safety-Net Hospital Experiences

The results presented in this section correspond to the findings presented in **Chapter V: Safety-Net Hospital Experience in the CJR Model.**

**Exhibit D-41: SNHs Uniformly Performed Worse on Average Than Non-SNHs in Terms of NPRA, Across the Duration of the CJR Model**
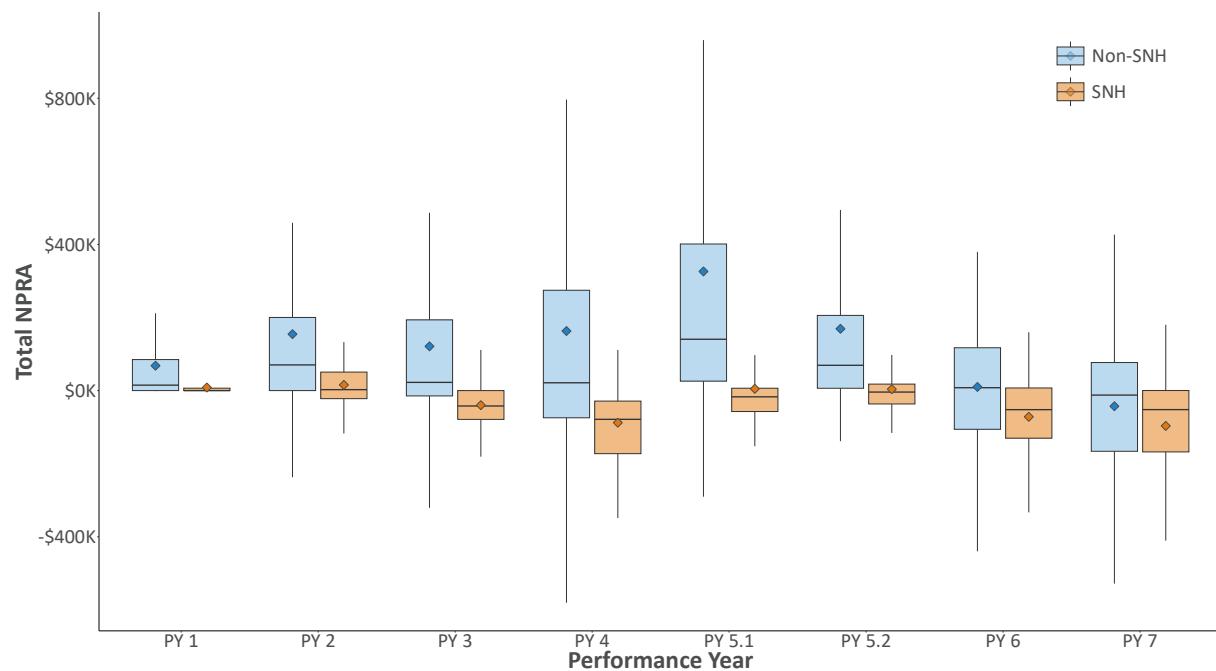


*Source:* CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes:* Box and Whisker plot of the distribution of non-SNH (blue) and SNH (orange) NPRA over the course of the CJR Model. Interior boxes represent the 25th-75th percentile interquartile range. The horizontal line represents the median. The whiskers represent 1.5x the interquartile range, approximately the 95% confidence interval for the median, the diamond represents the mean. CJR = Comprehensive Care for Joint Replacement; K = thousand; NPRA = net payment reconciliation amount; PY = performance year; SNH = safety-net hospital.

**Exhibit D-42: Average NPRA for SNH and Non-SNH CJR Participant Hospitals, PY 1–PY 7, All LEJRs**

| Time period | Non-SNH average NPRA (inter-quartile range) | SNH average NPRA (inter-quartile range) |
|---|---|---|
| PY 1 | $68,152 ($0 to $84,879) | $8,439 ($0 to $6,612) |
| PY 2 | $154,441 ($0 to $200,157) | $15,604 (-$22,107 to $50,641) |
| PY 3 | $121,106 (-$14,595 to $193,515) | -$39,970 (-$78,834 to $0) |
| PY 4 | $163,028 (-$74,433 to $274,605) | -$87,868 (-$172,655 to -$28,741) |
| PY 5.1 | $326,106 ($25,895 to $401,212) | $4,928 (-$57,297 to $6,511) |
| PY 5.2 | $169,171 ($6,364 to $205,800) | $3,814 (-$36,593 to $17,764) |
| PY 6 | $10,000 (-$105,905 to $117,289) | -$71,710 (-$130,232 to $7,218) |
| PY 7 | -$42,777 (-$166,106 to $76,813) | -$96,643 (-$167,801 to $197) |

*Source:* CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes:* In PYs 1–3, stop-gain and stop-loss limits were lower and more likely to be binding. In PY 1, the stop-loss was 0%, effectively waiving downside risk for hospitals. In PY 2 and PY 3, the stop-loss was increased but did not reach its final value of 20% until PY 4. The inter-quartile range, reported in the parentheses, is the range between the 25th percentile and 75th percentile values. CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; NPRA = net payment reconciliation amount; SNH = safety-net hospital.

**Exhibit D-43: SNHs are Substantially Over-Represented Among Hospitals with the Worst Per-Episode NPRA**
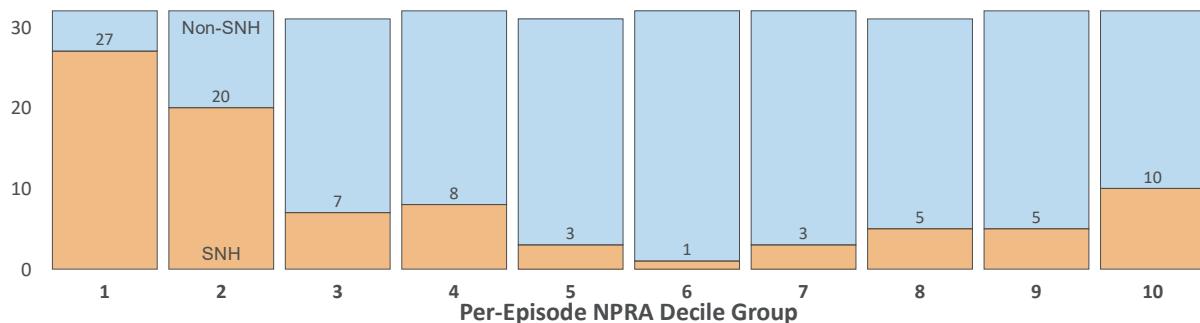


*Source:* CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PY 7.

*Notes:* This figure plots the number of SNHs and non-SNHs in each decile of the PY 7 per-episode NPRA distribution. Decile 1 contains the 10% of hospitals with the worst per-episode NPRA performance among all participant hospitals. Decile 10 contains the 10% of hospitals with the best per-episode NPRA performance. CJR = Comprehensive Care for Joint Replacement; NPRA = net payment reconciliation amount; PY = performance year; SNH = safety-net hospital.

**Exhibit D-44: Episode-Level Risk Adjustment Has Resulted in the Average Target Price for an Episode at an SNH Increasing from PY 5 Onwards, Despite the Concurrent Decrease in the Proportion of the Most Complex Episode Types (MS-DRG 469, 521, and 522 Episodes)**
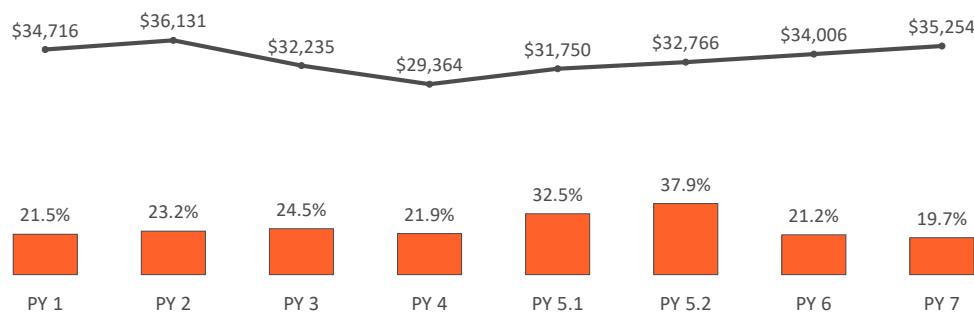


*Source:* CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1-7.

*Notes:* These figures plot the average target price at SNHs over the duration of the CJR Model. The average target price at a hospital is a function of the hospital's benchmark prices for each MS-DRG and of the mix of MS-DRG episodes performed at the hospital. The average proportion of MS-DRG 469, 521, and 522 episodes is plotted in the histogram. CJR = Comprehensive Care for Joint Replacement; MS-DRG = Medicare Severity-Diagnosis Related Group; NPRA = net payment reconciliation amount; PY = performance year; SNH = safety-net hospital.

**Exhibit D-45: Hospital-Level Average Target Prices Increased Substantially for Non-SNHs During the COVID-19 PHE Due to the Increased Proportion of the Most Complex Episode Types (MS-DRG 469, 521, and 522 Episodes)**
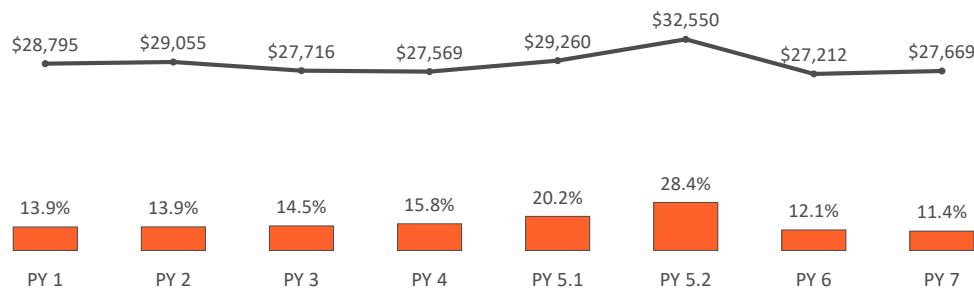


*Source:* CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes:* These figures plot the average target price at non-SNHs over the duration of the CJR Model. The average target price at a hospital is a function of the hospital's benchmark prices for each MS-DRG and of the mix of MS-DRG episodes performed at the hospital. The average proportion of MS-DRG 469, 521, and 522 episodes for non-SNHs is plotted in the histogram. CJR = Comprehensive Care for Joint Replacement; MS-DRG = Medicare Severity-Diagnosis Related Group; NPRA = net payment reconciliation amount; PHE = public health emergency; PY = performance year; SNH = safety-net hospital.

**Exhibit D-46: SNHs are Substantially More Likely to Have Recoupments Owed for High Post-Episode Spending**

| Performance Year | All Hospital HPES Proportion (%) | SNH HPES Proportion (%) |
|---|---|---|
| PY 1 | 2.1 | 5.0 |
| PY 2 | 1.0 | 2.4 |
| PY 3 | 0.6 | 2.4 |
| PY 4 | 3.4 | 8.4 |
| PY 5.1 | 2.5 | 9.3 |
| PY 5.2 | 2.5 | 3.4 |
| PY 6 | 2.8 | 7.7 |
| PY 7 | 2.5 | 6.7 |

*Source*: CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes*: CJR = Comprehensive Care for Joint Replacement; HPES = high post-episode spending; PY = performance year; SNH = safety-net hospital.

**Exhibit D-47: Quality Rating Score for SNH and Non-SNH CJR Participant Hospitals, PY 1–PY 7, All LEJR**

| Time period | Non-SNH | | | | SNH | | | |
|---|---|---|---|---|---|---|---|---|
| | Below acceptable | Acceptable | Good | Excellent | Below acceptable | Acceptable | Good | Excellent |
| PY 1 | 18 | 29 | 111 | 51 | 6 | 11 | 62 | 3 |
| PY 2 | 29 | 21 | 114 | 47 | 4 | 11 | 63 | 5 |
| PY 3 | 26 | 30 | 131 | 41 | 7 | 11 | 65 | 2 |
| PY 4 | 22 | 38 | 135 | 36 | 13 | 10 | 64 | 3 |
| PY 5.1 | 26 | 45 | 121 | 39 | 12 | 10 | 64 | 4 |
| PY 5.2 | 27 | 33 | 137 | 35 | 11 | 9 | 65 | 4 |
| PY 6 | 27 | 31 | 137 | 35 | 4 | 9 | 74 | 3 |
| PY 7 | 23 | 22 | 150 | 33 | 2 | 10 | 76 | 1 |

*Source*: CJR evaluation team analysis of CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes*: CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SNH = safety-net hospital.

**Exhibit D-48: Episode-Level Descriptive Statistics for SNH and Non-SNH CJR and Control Hospitals, PY 7, All LEJR**

| Statistic | CJR SNH mean | CJR Non-SNH mean | Control SNH mean | Control Non-SNH mean |
|---|---|---|---|---|
| Average LEJR episodes | 32 | 140 | 25 | 142 |
| Median LEJR episodes | 14 | 87 | 12 | 90 |
| Fracture % | 17.7% | 10.0% | 18.3% | 9.6% |
| Elective % | 82.3% | 90.0% | 81.7% | 90.4% |
| Average HCC score | 1.70 | 1.50 | 1.67 | 1.46 |
| Median HCC score | 1.33 | 1.17 | 1.35 | 1.12 |
| Dually eligible % | 29.0% | 5.3% | 21.5% | 4.5% |
| Obesity % | 31.2% | 34.9% | 38.2% | 35.1% |
| Diabetes % | 33.9% | 26.3% | 30.7% | 24.7% |
| Outpatient % | 56.8% | 69.4% | 63.5% | 73.1% |
| Average anchor LOS | 2.1 | 1.5 | 1.9 | 1.4 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between January 1, 2023, and December 31, 2023 (PY 7 intervention) as well as CJR payment contractor data for CJR participant hospitals in PYs 1–7.

*Notes:* CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; HCC = Hierarchical Condition Category; LOS = length of stay; PY = performance year; SNH = safety-net hospital.

## D. Overlap with ACOs

The results presented in this section correspond to the findings presented in **Chapter VI: Accountable Care Organization (ACO) Overlap in the CJR Model.**

### 1. What was the Pattern of CJR and Control Hospital Concurrent Participation in an Accountable Care Organization (ACO) Over Time?

We examined SSP ACO participation for CJR and control hospitals between 2013 and 2023. SSP ACOs have a larger reach than other ACO programs, including Pioneer, NextGen, and REACH ACOs, and thus had the largest overlap with the CJR and control group (**Exhibit D-66**). To study concurrent participation in CJR and ACOs during the extension period, we limited our analyses to mandatory CJR hospitals and their control hospitals with at least one episode in PY 6 or PY 7, which included 321 CJR hospitals and 315 control hospitals (**Exhibit D-49**).

The majority of CJR hospitals (57.0%) never participated in an SSP ACO between 2013 and 2023, while just over half (54.3%) of the control hospital participated for at least 1 year. Very few hospitals participated every year from 2013 to 2023. For hospitals that participated in an SSP ACO, the median number of years spent in any SSP ACO from 2013 to 2023 was 6, and this number was similar for CJR and control hospitals (**Exhibit D-50**).

**Exhibit D-49:  Overall SSP ACO Participation Rates Were Similar Between CJR and Control**

| Measures | CJR | | Control | |
|---|---|---|---|---|
| | N | Percent (%) | N | Percent (%) |
| Total number of hospitals | 321 | 100.0 | 315 | 100.0 |
| Number of hospitals that never participated in an SSP ACO | 183 | 57.0 | 144 | 45.7 |
| Number of hospitals that participated in an SSP ACO at least 1 year between 2013 and 2023 | 138 | 43.0 | 171 | 54.3 |
| Number of hospitals that participated in an SSP ACO all years between 2013 and 2023 | 2 | 0.3 | 10 | 3.2 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*  The counts in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; N = number; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-50:  Duration of SSP ACO Participation Was Similar for CJR and Control Hospitals**

| Hospital Type | Years in an SSP ACO (2013–2023) | | | | | |
|---|---|---|---|---|---|---|
| | N | 1st Quartile | Median | 3rd Quartile | Mean | Standard deviation |
| CJR | 138 | 3 | 6 | 9 | 5.66 | 3.03 |
| Control | 171 | 4 | 6 | 8 | 5.65 | 2.95 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*  The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. The reported sample size is the number of hospitals. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = Lower extremity joint replacement; N = number; SSP = Shared Savings Program; PY = performance year.

Hospitals tended to join a Shared Savings Program (SSP) ACO in distinctive waves, with ACO participation increasing in greater rates during 2014, 2015, and 2018 (**Exhibit D-51**). More CJR hospitals than control hospitals joined an SSP ACO in 2014. In contrast, more control hospitals joined an SSP ACO in 2018. After initiating ACO participation, hospitals could continue participation indefinitely, stop and restart participation, or stop and never restart participation. To examine outcome changes and select hospital characteristics based on concurrent ACO participation, we created ACO participation categories that are used for the rest of the analyses.

**Exhibit D-51: At a Hospital Level, ACO Participation Patterns Over Time Were Complex and Varied Between CJR and Control Hospitals**
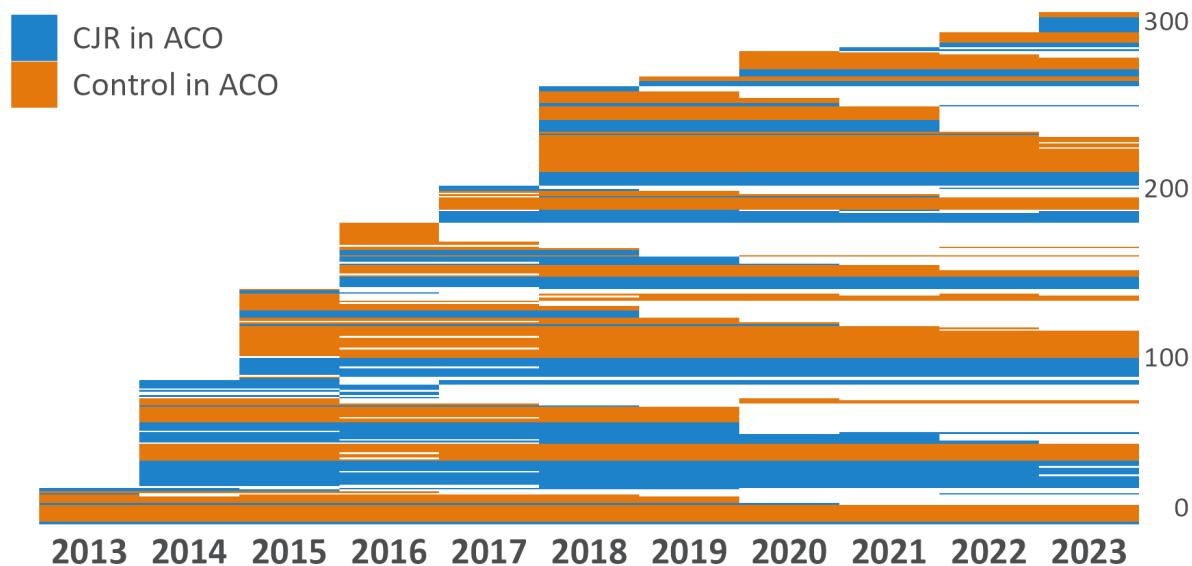


*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes initiated between January 1, 2013, and December 31, 2014, that ended between April 1, 2012, and March 31, 2015 (baseline) and episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The findings displayed are for hospitals that participated in the CJR Model extension period (and corresponding control group hospitals) with at least one LEJR episode in PY 6 or PY 7, and with at least 1 year of participation in an SSP ACO at any time during the study period. The x-axis represents the calendar year of ACO participation, and the y-axis represents the total number of hospitals. Each horizontal line in the exhibit corresponds to hospital (CJR or control) ACO participation for a given hospital, in a given calendar year. Each line in the exhibit corresponds to a hospital (CJR or control). Color delineates CJR (blue) and control (orange) hospital participation in an SSP ACO during the year. White indicates no participation in an SSP ACO in the calendar year. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

We grouped hospitals into categories based on participation in an SSP ACO, when participation started relative to the key CJR Model time points, and whether SSP ACO participation ended or was interrupted. The four groups were:

- Continued participation in an SSP ACO after joining:

  - Joined SSP ACO before 2016 (the start of the CJR Model), stayed in an SSP ACO

  - Joined SSP ACO in 2016 or later, stayed in an SSP ACO

- Left an SSP ACO between 2014 and 2023

- Never participated in an SSP ACO

This SSP ACO grouping method simplified ACO participation patterns and allowed us to characterize these patterns in a compact enough grouping to meaningfully aggregate outcomes and characteristics. It incorporated the important inflection point that is the start year of the CJR intervention period and allowed us to characterize possible CJR Model impacts. We also

incorporated a rough indicator of the duration of exposure to SSP ACO participation by including information about hospitals that left or had interruptions in ACO participation, which allowed us to look for evidence of post-exposure effects. More information about the ACO grouping method can be found in **Appendix B. Data and Methods**.

Among all hospitals in CJR, 30.2% joined an SSP ACO and stayed in the ACO from joining through 2023. This includes 9.0% who joined the SSP ACO before 2016 and 21.2% who joined in 2016 or later. In the control group, 40.9% joined and stayed through 2023— including 11.7% who joined before 2016 and 29.2% who joined in 2016 or later. In the both the CJR and control group, roughly 13% of hospitals joined an SSP ACO but had gaps in participation (**Exhibit D-52**). Gaps and exits from SSP ACO were common (occurring for almost a third of CJR hospitals who ever participated in an SSP ACO during this time and for a quarter of control hospitals); however, most hospitals that joined an SSP ACO continued participation through 2023 without subsequent gaps in participation.

**Exhibit D-52: CJR and Control Hospitals Left SSP ACOs at Similar Rates**

| ACO Participation Categories | CJR | | Control | |
|---|---|---|---|---|
| | N | Percent (%) | N | Percent (%) |
| **Total number of hospitals** | 321 | 100.0 | 315 | 100.0 |
| **Joined SSP ACO before 2016, stayed in an SSP ACO** | 29 | 9.0 | 37 | 11.7 |
| **Joined SSP ACO in 2016 or later, stayed in an SSP ACO** | 68 | 21.2 | 92 | 29.2 |
| **Left an SSP ACO between 2014 and 2023** | 41 | 12.8 | 42 | 13.3 |
| **Never participated in an SSP ACO** | 183 | 57.0 | 144 | 45.7 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; N = number; PY = performance year; SSP = Shared Savings Program.

ACO participation patterns varied by geographic region, both across and between the CJR and control hospitals (**Exhibit D-53**). High never-participation regions (never-participation rates greater than or equal to 50%) for CJR hospitals were South Atlantic (57.1% never-participation), West South Central (66.1%), and Pacific (81.8%). High never-participation regions for control hospitals were West South Central (58.2%), and Pacific (93.8%). CJR hospitals in the South Atlantic region were less likely to participate in an ACO than their control counterparts, with 57.1% never-participation among CJR hospitals compared to 38.0% among control hospitals. Hospitals in the West North Central region had very little participation in the CJR Model. There were only two control hospitals and no CJR hospitals in the West North Central region.

These geographic differences in hospitals that never participated in an SSP ACO could be due to multiple factors such as the prevalence of managed care organizations providing care outside of Medicare ACOs, regional effects of target prices, and state regulations.

**Exhibit D-53:  The West South Central and Pacific Regions had Higher Rates of ACO
Non-Participation**
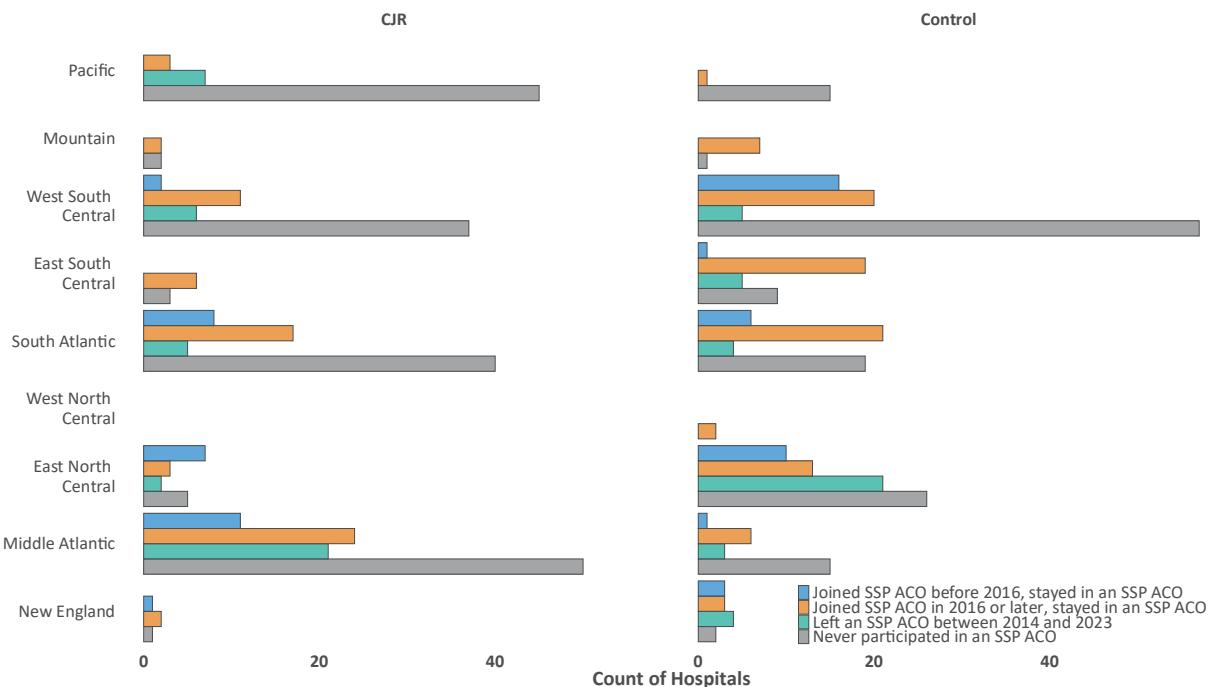


*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021,
and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR
episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement;
LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

## 2. *Were There Differences in Hospital Level Outcomes and Characteristics Associated with Concurrent Participation in the CJR Model and an SSP ACO?*

For this evaluation, we examined the distribution of reconciliation payment, hospital quality rating, HCC, episode cost, and LEJR volume by the ACO participation groups during the model extension (PY 6–PY 7). NPRA and hospital quality rating data was only available for CJR hospitals.

CJR hospitals that concurrently participated in an SSP ACO had higher average per-episode NPRA in PY 6–PY 7 than CJR hospitals that never participated in an SSP ACO (**Exhibit D-54**). For example, the median NPRA for CJR hospitals that joined an ACO in 2016 or later and continued participation was $0 in PY6 and -$349 in PY7, while the equivalent medians for the never-joined were -$183 in PY6 and -$1,153 in PY7. Per-episode NPRA varied more across hospitals that did not participate in an SSP ACO, suggesting they could have been a more diverse group of hospitals with difference model experiences. Hospitals that came and went from SSP had similar per-episode NPRA compared to hospitals that stayed in SSP (**Exhibit D-62**).

**Exhibit D-54: CJR Hospitals That Never Participated in an SSP ACO had Lower NPRA**



*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*    The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. The color-coded boxes indicate the interquartile range for SSP ACO groups by PY. The central line inside the box indicates the median. The diamond indicates the mean. The small lines that extend from the boxes are an approximate 95% confidence interval for the median. Some extreme outliers lie beyond the small extending lines and are not shown as to focus on central tendencies. The presence of these outliers can drive notable differences between the median and the mean. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; NPRA = net payment reconciliation amount; PY = performance year; SSP = Shared Savings Program.

The CJR Model linked quality and payment using a composite quality score (CQS) methodology. CQS is based on two quality measures, the total hip arthroplasty (THA)/ total knee arthroplasty (TKA) Complications measure and the HCAHPS survey measure, successful submission of patient-reported outcomes, and limited risk variable data. The composite quality score, simply referred to as quality ratings, were aggregated into four possible categories: below acceptable (CQS < 5), acceptable (CQS ≥ 5 and < 6.9), good (CQS ≥ 6.9 and ≤ 15), and excellent (CQS > 15).

There was no evidence of a relationship between SSP ACO participation and quality ratings in PY 6–PY 7 (**Exhibit D-55**). The range of good to excellent scores was 76% to 85% across the 2 years and across ACO participation patterns. More information about hospital quality ratings performance categories can be found in **Exhibit D-61**.

**Exhibit D-55:  There was No Relationship Between SSP ACO Participation and Quality Ratings**
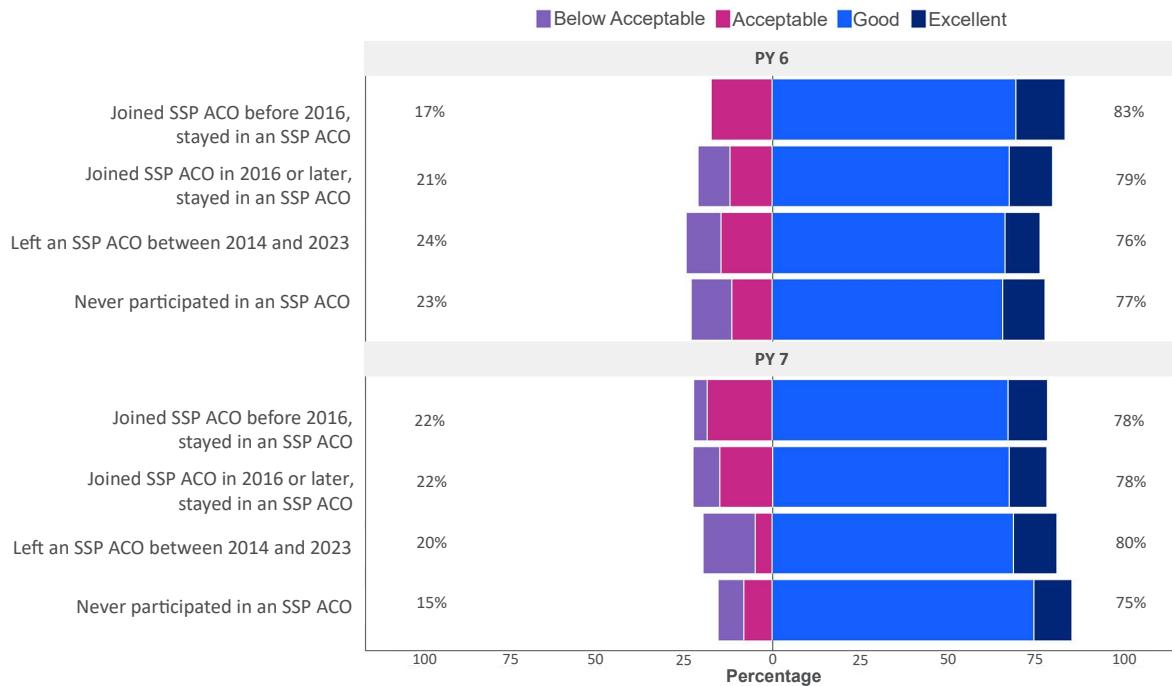


*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*   The hospital percentages in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

CJR hospitals that never participated in an SSP ACO had higher patient HCC scores (the median hospital had an average patient HCC score of 1.67) compared to their control hospital counterparts (median patient HCC score of 1.57) (**Exhibit D-56**). This was also true for hospitals that had a break in ACO participation. It is possible that a more complex patient population discourages ACO participation among CJR hospitals. More information can be found in **Exhibit D-62**.

**Exhibit D-56:　CJR Hospitals that Stopped Participating in or Never Participated in an SSP ACO had Higher Median HCC Scores Than Corresponding Control Hospitals**



*Source:*　CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:*　The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. The color-coded boxes indicate the interquartile range for SSP ACO groups by PY. The central line inside the box indicates the median. The diamond indicates the mean. The small lines that extend from the boxes are an approximate 95% confidence interval for the median. Some extreme outliers lie beyond the small extending lines and are not shown as to focus on central tendencies. The presence of these outliers can drive notable differences between the median and the mean. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; HCC = Hierarchical Condition Cateogory; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

The distribution of average hospital total episode payment per hospital was similar across ACO participation groups for control hospitals, and for CJR hospitals (**Exhibit D-57**). More information about SSP ACO participation and total episode cost can be found in **Exhibit D-63.**

**Exhibit D-57:  There was no Evidence of a Relationship Between ACO Participation and Total Episode Spending**



*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. The color-coded boxes indicate the interquartile range for SSP ACO groups by PY. The central line inside the box indicates the median. The diamond indicates the mean. The small lines that extend from the boxes are an approximate 95% confidence interval for the median. Some extreme outliers lie beyond the small extending lines and are not shown as to focus on central tendencies. The presence of these outliers can drive notable differences between the median and the mean. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; K = thousand; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

We evaluated hospital LEJR episode count (volume) differences between CJR and control hospitals using the previously defined ACO groups. CJR hospitals that never participated in SSP had lower LEJR volume those CJR hospitals that did (**Exhibit D-58**). CJR hospitals that never participated in an SSP ACO had median episode volume of 157 compared to 221 for the next lowest category (**Exhibit D-64**).

**Exhibit D-58: CJR Hospitals that Never Participated in an SSP ACO had Lower LEJR Volume**
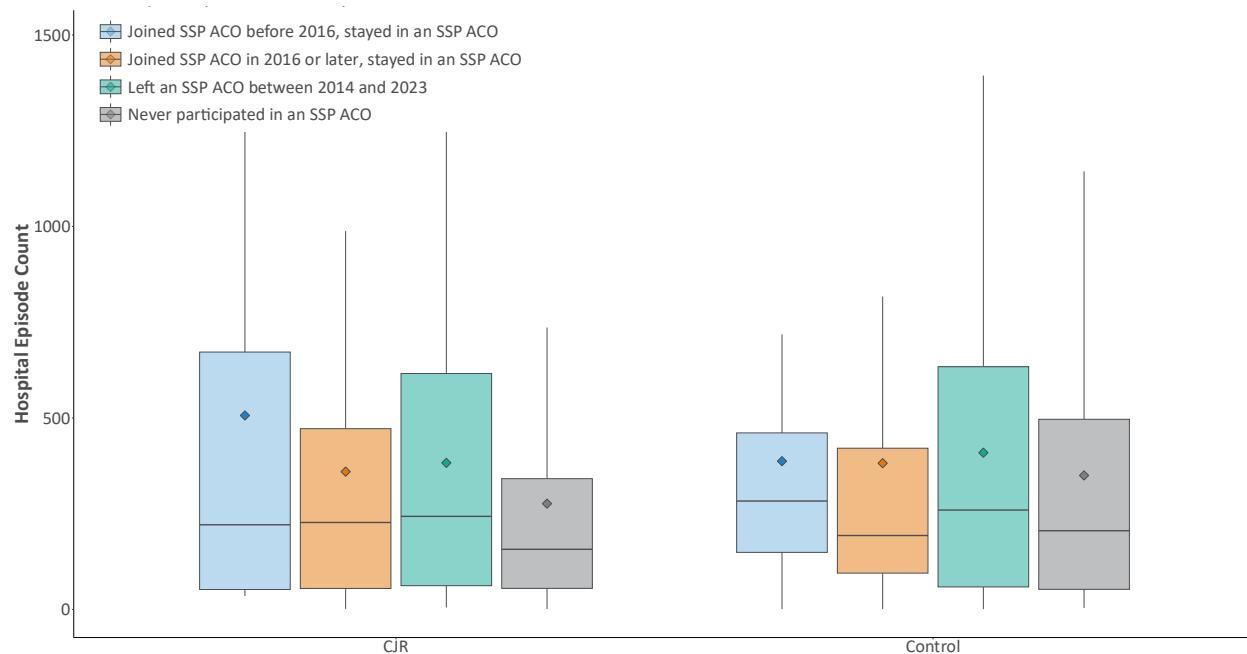


*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention).

*Notes:* The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. Some extreme outliers lie beyond the small extending lines and are not shown as to focus on central tendencies. The presence of these outliers can drive notable differences between the median and the mean. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

Safety-net hospitals (SNHs) had higher rates of never participating in an ACO, with more acute differences by SNH status for control hospitals. For CJR hospitals, 42.4% of non-SNHs never participated and 62.3% of SNHs never participated. For control hospitals, 77.1% non-SNHs never participated and 22.9% SNHs never participated (**Exhibit D-65**).

**Exhibit D-59: SSP ACO Participation by Census Region for CJR and Control Hospitals, PY 6–PY 7, ALL LEJRs**

| Region | Measure | CJR | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO |
| All Regions Combined | Number of Hospitals in ACO Group | 29 | 68 | 41 | 183 | 37 | 92 | 42 | 144 |
| | Percent of Hospitals in ACO Group | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | Percent of ACO Group in Region | 9.0% | 21.2% | 12.8% | 57.0% | 11.7% | 29.2% | 13.3% | 45.7% |
| New England | Number of Hospitals in ACO Group | 1 | 2 | 0 | 1 | 3 | 3 | 4 | 2 |
| | Percent of Hospitals in ACO Group | 3.5% | 2.9% | 0.0% | 0.6% | 8.1% | 3.3% | 9.5% | 1.4% |
| | Percent of ACO Group in Region | 25.0% | 50.0% | 0.0% | 25.0% | 25.0% | 25.0% | 33.3% | 16.7% |
| Middle Atlantic | Number of Hospitals in ACO Group | 11 | 24 | 21 | 50 | 1 | 6 | 3 | 15 |
| | Percent of Hospitals in ACO Group | 37.9% | 35.3% | 51.2% | 27.3% | 2.7% | 6.5% | 7.1% | 10.4% |
| | Percent of ACO Group in Region | 10.4% | 22.6% | 19.8% | 47.2% | 4.0% | 24.0% | 12.0% | 60.0% |

| Region | Measure | CJR | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO |
| East North Central | Number of Hospitals in ACO Group | 7 | 3 | 2 | 5 | 10 | 13 | 21 | 26 |
| | Percent of Hospitals in ACO Group | 24.1% | 4.4% | 4.9% | 2.7% | 27.0% | 14.1% | 50.0% | 18.1% |
| | Percent of ACO Group in Region | 41.2% | 17.6% | 11.8% | 29.4% | 14.3% | 18.6% | 30.0% | 37.1% |
| West North Central | Number of Hospitals in ACO Group | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | Percent of Hospitals in ACO Group | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.2% | 0.0% | 0.0% |
| | Percent of ACO Group in Region | -- | -- | -- | -- | 0.0% | 100.0% | 0.0% | 0.0% |
| South Atlantic | Number of Hospitals in ACO Group | 8 | 17 | 5 | 40 | 6 | 21 | 4 | 19 |
| | Percent of Hospitals in ACO Group | 27.6% | 25.0% | 12.2% | 21.9% | 16.2% | 22.8% | 9.5% | 13.2% |
| | Percent of ACO Group in Region | 11.4% | 24.3% | 7.1% | 57.1% | 12.0% | 42.0% | 8.0% | 38.0% |

| Region | Measure | CJR | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO |
| East South Central | Number of Hospitals in ACO Group | 0 | 6 | 0 | 3 | 1 | 19 | 5 | 9 |
| | Percent of Hospitals in ACO Group | 0.0% | 8.8% | 0.0% | 1.6% | 2.7% | 20.7% | 11.9% | 6.3% |
| | Percent of ACO Group in Region | 0.0% | 66.7% | 0.0% | 33.3% | 2.9% | 55.9% | 14.7% | 26.5% |
| West South Central | Number of Hospitals in ACO Group | 2 | 11 | 6 | 37 | 16 | 20 | 5 | 57 |
| | Percent of Hospitals in ACO Group | 6.9% | 16.2% | 14.6% | 20.2% | 43.2% | 21.7% | 11.9% | 39.6% |
| | Percent of ACO Group in Region | 3.6% | 19.6% | 10.7% | 66.1% | 16.3% | 20.4% | 5.1% | 58.2% |
| Mountain | Number of Hospitals in ACO Group | 0 | 2 | 0 | 2 | 0 | 7 | 0 | 1 |
| | Percent of Hospitals in ACO Group | 0.0% | 2.9% | 0.0% | 1.1% | 0.0% | 7.6% | 0.0% | 0.7% |
| | Percent of ACO Group in Region | 0.0% | 50.0% | 0.0% | 50.0% | 0.0% | 87.5% | 0.0% | 12.5% |

| Region | Measure | CJR | | | | Control | | | |
|--------|---------|-----|---|---|---|---------|---|---|---|
| | | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO |
| Pacific | Number of Hospitals in ACO Group | 0 | 3 | 7 | 45 | 0 | 1 | 0 | 15 |
| | Percent of Hospitals in ACO Group | 0.0% | 4.4% | 17.1% | 24.6% | 0.0% | 1.1% | 0.0% | 10.4% |
| | Percent of ACO Group in Region | 0.0% | 5.5% | 12.7% | 81.8% | 0.0% | 6.3% | 0.0% | 93.8% |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:*   Double dashes (--) indicate undefined percentages due to division by zero. The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-60: Average Per-Episode NPRA by SSP ACO Participation Group, PY 6–PY 7, CJR Participant Hospitals**

| Performance Year | ACO Participation Groups | Per-Episode NPRA | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of Hospitals | Average | Standard Deviation | 1st Quartile | Median | 3rd Quartile |
| PY 6 | Joined SSP ACO Before 2016, Stayed in the ACO | 29 | $808 | $4,121 | -$813 | $1,006 | $1,903 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 68 | -$668 | $7,611 | -$935 | $0 | $1,223 |
| | Left an SSP ACO Between 2014 and 2023 | 41 | -$1,506 | $6,599 | -$572 | $161 | $1,014 |
| | Never Participated in an SSP ACO | 183 | -$1,025 | $3,549 | -$2,613 | -$183 | $887 |
| PY 7 | Joined SSP ACO Before 2016, Stayed in the ACO | 29 | -$950 | $4,241 | -$1,283 | -$901 | $1,086 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 68 | -$656 | $3,655 | -$1,764 | -$349 | $967 |
| | Left an SSP ACO Between 2014 and 2023 | 41 | -$67 | $3,770 | -$1,480 | $0 | $1,232 |
| | Never Participated in an SSP ACO | 183 | -$1,489 | $3,760 | -$3,358 | -$1,153 | $380 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:* Positive values of NPRA indicate payments made from the government to hospitals, while negative values of NPRA indicate payments from hospitals to the government. The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; NPRA = net payment reconciliation amount; PY = performance year; SSP = Shared Savings Program;.

**Exhibit D-61: Quality Rating Performance Category by SSP ACO Participation Group, PY 6–PY 7, CJR Participant Hospitals**

| Performance Year | ACO Participation Groups | Quality Rating Performance Category | | | |
|---|---|---|---|---|---|
| | | Percent Below Acceptable (%) | Percent Acceptable (%) | Percent Good (%) | Percent Excellent (%) |
| PY 6 | Joined SSP ACO Before 2016, Stayed in the ACO | 0.0 | 17.2 | 69.0 | 13.8 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 9.0 | 11.9 | 67.2 | 11.9 |
| | Left an SSP ACO Between 2014 and 2023 | 9.8 | 14.6 | 65.9 | 9.8 |
| | Never Participated in an SSP ACO | 11.5 | 11.5 | 65.0 | 12.0 |
| PY 7 | Joined SSP ACO Before 2016, Stayed in the ACO | 3.7 | 18.5 | 66.7 | 11.1 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 7.5 | 14.9 | 67.2 | 10.4 |
| | Left an SSP ACO Between 2014 and 2023 | 14.6 | 4.9 | 68.3 | 12.2 |
| | Never Participated in an SSP ACO | 7.1 | 8.2 | 74.2 | 10.4 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:* The estimates in this exhibit are limited to extension period mandatory CJR hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-62: HCC Score Analysis by SSP ACO Participation Groups, PY 6–PY 7, for CJR and Control Hospitals**

| Model Group | ACO Participation Groups | HCC Score | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of Hospitals | Average | Standard Deviation | 1st Quartile | Median | 3rd Quartile |
| **CJR** | Joined SSP ACO Before 2016, Stayed in the ACO | 29 | 1.67 | 0.38 | 1.42 | 1.63 | 1.77 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 68 | 1.77 | 0.77 | 1.37 | 1.58 | 1.87 |
| | Left an SSP ACO Between 2014 and 2023 | 41 | 1.75 | 0.42 | 1.49 | 1.67 | 1.87 |
| | Never Participated in an SSP ACO | 183 | 1.77 | 0.51 | 1.41 | 1.67 | 2.06 |
| **Control** | Joined SSP ACO Before 2016, Stayed in the ACO | 37 | 1.69 | 0.31 | 1.53 | 1.65 | 1.82 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 92 | 1.64 | 0.38 | 1.40 | 1.58 | 1.81 |
| | Left an SSP ACO Between 2014 and 2023 | 42 | 1.59 | 0.31 | 1.38 | 1.52 | 1.76 |
| | Never Participated in an SSP ACO | 144 | 1.64 | 0.45 | 1.35 | 1.57 | 1.86 |

*Source:*   CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:*   The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; HCC = Hierarchical Condition Categories; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-63: Total Episode Payment Analysis by SSP ACO Participation Groups, PY 6–PY 7, by CJR and Control Hospitals**

| Model Group | ACO Participation Groups | Total Episode Payments | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of Hospitals | Average | Standard Deviation | 1st Quartile | Median | 3rd Quartile |
| CJR | Joined SSP ACO Before 2016, Stayed in the ACO | 29 | $30,266 | $11,497 | $22,569 | $24,755 | $31,720 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 68 | $30,457 | $13,196 | $23,354 | $27,006 | $32,117 |
| | Left an SSP ACO Between 2014 and 2023 | 41 | $30,669 | $11,815 | $24,056 | $26,544 | $31,404 |
| | Never Participated in an SSP ACO | 183 | $32,256 | $12,553 | $23,139 | $27,796 | $36,802 |
| Control | Joined SSP ACO Before 2016, Stayed in the ACO | 37 | $29,697 | $7,024 | $24,398 | $28,258 | $34,549 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 92 | $27,699 | $6,845 | $23,348 | $26,101 | $30,406 |
| | Left an SSP ACO Between 2014 and 2023 | 42 | $28,670 | $8,762 | $23,022 | $25,203 | $31,273 |
| | Never Participated in an SSP ACO | 144 | $29,131 | $9,753 | $22,462 | $26,622 | $32,974 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:* The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-64: Hospital LEJR Count Analysis by SSP ACO Participation Groups, PY 6–PY 7, by CJR and Control Hospitals**

| Model Group | ACO Participation Groups | Hospital LEJR Count | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of Hospitals | Average Number of LEJRs | Standard Deviation | 1st Quartile | Median | 3rd Quartile |
| CJR | Joined SSP ACO Before 2016, Stayed in the ACO | 29 | 506 | 746 | 52 | 221 | 672 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 68 | 360 | 409 | 54 | 227 | 478 |
| | Left an SSP ACO Between 2014 and 2023 | 41 | 383 | 422 | 62 | 243 | 616 |
| | Never Participated in an SSP ACO | 183 | 276 | 395 | 55 | 157 | 345 |
| Control | Joined SSP ACO Before 2016, Stayed in the ACO | 37 | 387 | 386 | 149 | 283 | 461 |
| | Joined SSP ACO in 2016 or Later, Stayed in the ACO | 92 | 382 | 558 | 95 | 193 | 425 |
| | Left an SSP ACO Between 2014 and 2023 | 42 | 409 | 457 | 55 | 260 | 661 |
| | Never Participated in an SSP ACO | 144 | 350 | 415 | 51 | 206 | 499 |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:* The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; PY = performance year; SSP = Shared Savings Program.

**Exhibit D-65: SNH Participation Analysis, PY 6–PY 7, by SSP ACO Participation Group and CJR or Control Hospital Status**

| SNH Status | Measure | CJR | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO | Joined SSP ACO Before 2016, Stayed in the ACO | Joined SSP ACO in 2016 or Later, Stayed in the ACO | Left an SSP ACO Between 2014 and 2023 | Never Participated in an SSP ACO |
| SNH and Non-SNH Combined | Number of Hospitals in ACO Group | 29 | 68 | 41 | 183 | 37 | 92 | 42 | 144 |
| | Percent of Hospitals in ACO Group | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | Percent of ACO in SNH Group | 9.0% | 21.2% | 12.8% | 57.0% | 11.7% | 29.2% | 13.3% | 45.7% |
| SNH | Number of Hospitals in ACO Group | 6 | 13 | 11 | 60 | 4 | 9 | 7 | 33 |
| | Percent of Hospitals in ACO Group | 20.7% | 19.1% | 26.8% | 32.8% | 10.8% | 9.8% | 16.7% | 22.9% |
| | Percent of ACO in SNH Group | 7.5% | 17.0% | 13.2% | 62.3% | 6.7% | 14.4% | 12.2% | 66.7% |
| Non-SNH | Number of Hospitals in ACO Group | 23 | 55 | 30 | 123 | 33 | 83 | 35 | 111 |
| | Percent of Hospitals in ACO Group | 79.3% | 80.9% | 73.2% | 67.2% | 89.2% | 90.2% | 83.3% | 77.1% |
| | Percent of ACO in Non-SNH Group | 12.6% | 31.7% | 13.4% | 42.4% | 10.0% | 23.8% | 13.0% | 53.2% |

*Source:* CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between October 1, 2021, and December 31, 2023 (PY 6–PY 7 intervention). SSP ACO provider research identifiable file years 2013–2023.

*Notes:* The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. Safety-net hospital classification determined by CMMI definition. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; CMMI = Center for Medicare & Medicaid Innovation; PY = performance year; SNH = safety-net hospital; SSP = Shared Savings Program.

**Exhibit D-66:  Count of ACO-Aligned LEJRs, 2021–2023, by ACO Type, CJR or Control Hospital, and ACO Status**

| ACO Type | Hospital Type | ACO Status | LEJR Anchor Year | | |
|---|---|---|---|---|---|
| | | | 2021 | 2022 | 2023 |
| SSP ACO Only | Control | ACO | 17,738 | 17,407 | 14,404 |
| | | Non-ACO | 31,841 | 34,087 | 26,135 |
| | CJR | ACO | 13,399 | 13,727 | 10,583 |
| | | Non-ACO | 29,243 | 32,970 | 26,452 |
| SSP, NextGen, or REACH ACO | Control | ACO | 20,376 | 21,098 | 17,088 |
| | | Non-ACO | 29,203 | 30,396 | 23,451 |
| | CJR | ACO | 15,837 | 15,680 | 12,016 |
| | | Non-ACO | 26,805 | 31,017 | 25,019 |

*Source:*  CJR evaluation team analysis of Medicare claims and enrollment data for episodes that ended between January 1, 2021, and December 31, 2023. SSP ACO provider research identifiable file years 2021–2023. NextGen ACO provider research identifiable 2021 file. ACO REACH provider files 2021–2023.

*Notes:*  The estimates in this exhibit are limited to extension period mandatory hospitals only and hospitals with at least one LEJR episode in PY 6 or PY 7. All summaries are unweighted. ACO = Accountable Care Organization; CJR = Comprehensive Care for Joint Replacement; LEJR = lower extremity joint replacement; NextGen = Next Generation; SSP = Shared Savings Program.