CMS Bundled Payments for Care Improvement Initiative Models 2-4: Year 6 Evaluation and Monitoring Annual Report – Appendices

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Submitted by:

The Lewin Group

With our partners:

Abt Associates, GDIT, and Telligen

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List of Appendices

Appendix A: Glossary of Terms & Acronym List

Exhibit A.1: Glossary

Name	Definition
90-day Post-Discharge Period (PDP)	The 90 days following discharge from the anchor hospitalization (Models 2)
Acute care hospital (ACH)	A health care facility that provides inpatient medical care and other related services for acute medical conditions or injuries.
Anchor hospital stay	The hospitalization that triggers the start of the episode of care for Models 2 and 4.
Awardee	A risk-bearing, financially responsible organization in the BPCI initiative. This entity may or may not be an episode initiator (EI).
Awardee Convener (AC)	Parent companies, health systems, or other organizations that assume financial risk under the Model for Medicare beneficiaries that initiate episodes at their respective Episode Initiating Bundled Payment Provider Organization (EI-BPPO). An AC may or may not be a Medicare provider or initiate episodes.
Baseline time period	The period of time that precedes the intervention period as a basis for comparison in difference-in-difference modeling. The baseline period spans from Q4 2011 through Q3 2012.
Beneficiary Incentive	This is one of the waivers of fraud and abuse law an Awardee may utilize. This allows Awardees to offer patients certain incentives not tied to standard provision of health care, if it supports a clinical goal.
Bundle	The services provided during the episodes that are linked for payment purposes. The bundle varies based on the model and chosen episode length.
Bundle length	A pre-specified duration of time: 30, 60, or 90 days.
Clinical episode	One of the 48 episodes of the BPCI initiative related to a specific set of MS-DRGs.
Designated Awardee Convener (DAC)	Parent companies, health systems, or other organizations that assume financial risk under the Model for Medicare beneficiaries that initiate episodes at their respective Episode Initiating Bundled Payment Provider Organization (EI-BPPO). These Awardees may or may not be Medicare providers or initiate episodes themselves. Unlike an Awardee Convener, this Awardee joined the initiative under a Facilitator Convener.
Designated Awardee (DA)	An entity that initiates episodes but, unlike a Single Awardee, joins the initiative under a Facilitator Convener (FC). The DA would have an agreement with CMS and assume financial risk for episodes initiated at its institution.
Episode Initiator (EI)	Under Model 2, an EI is the participating hospital where the BPCI episode begins or a participating PGP if one of its physicians is the patient's admitting physician or surgeon for the anchor hospitalization. Under Model 3, an EI may be a participating PGP or a participating SNF, HHA, IRF, or LTCH that admits the patient within 30 days following a hospital discharge for an MS-DRG for the relevant clinical episodes (anchor hospitalization). Under Model 4, an EI is the participating hospital where the BPCI episode begins. SAs and DAs are EIs. ACs and DACs may or may not be EIs themselves and also have one or more EIs under their Awardee structure.

Name	Definition
Episode of Care	For all three models, an episode of care is triggered by an inpatient hospitalization for one of 48 clinical groupings of MS-DRGs. For Model 2, the episode is defined as an anchor hospitalization plus post discharge services provided within 30, 60, or 90 days of discharge from the anchor stay, including all readmissions that are not explicitly excluded (certain services unrelated to the triggering hospitalization are excluded from the episode). For Model 3, the episode begins upon admission to a post-acute care setting (including home health) within 30 days of discharge from the qualifying hospitalization and includes all services provided within the 30, 60, or 90 days of this admission (again, certain services unrelated to the triggering hospitalization are excluded from the episode). For Model 4, the episode is defined as an anchor hospitalization plus post discharge services provided within 30 days of discharge from the anchor stay, including all readmissions that are not explicitly excluded (certain services unrelated to the triggering hospitalization are excluded from the episode).
Episode-specific	Specific to one of the 48 clinical episodes.
Facilitator Convener (FC)	An entity that submits a BPCI application and serves an administrative and technical assistance function on behalf of one or more Designated Awardees or Designated Awardee Conveners. A Facilitator Convener does not have an agreement with CMS, nor do they bear financial risk under the Model.
Gainsharing	This is one of the waivers of fraud and abuse law an Awardee may utilize. This allows participants to develop a methodology and share any Internal Cost Savings (ICS) and/or Net Payment Reconciliation Amounts (NPRA) as applicable.
Implementation Protocol	Awardee-submitted document that contains general Awardee information, care redesign interventions, gainsharing plan/methodology if applicable, and other details regarding waiver use.
Internal Cost Savings (ICS)	For each EIP, the measurable, actual, and verifiable cost savings realized by the EIP resulting from Care Redesign undertaken by the EIP in connection with providing items and services to Model 2, 3, or 4 beneficiaries within specific episodes of care. Internal Cost Savings does not include savings realized by any individual or entity that is not an EIP.
Model 2	Retrospective acute and post-acute care episode. The episode of care includes inpatient stay in the acute care hospital and all related services during the episode. The episode ends 30, 60, or 90 days after hospital discharge.
Model 3	Retrospective post-acute care only. The episode of care is triggered by an acute care hospital stay and begins at initiation of post-acute care services. The post-acute care services must begin within 30 days of discharge from the inpatient stay and end 30, 60, or 90 days after the initiation of the episode.
Model 4	Prospective acute care hospital stay only. CMS makes a single, prospectively determined bundled payment to the hospital that encompasses all services furnished during the inpatient stay by the hospital, physicians, and other practitioners. Related readmissions for 30 days after hospital discharge are included in the bundled payment amount.
Net Payment Reconciliation Amount (NPRA)	The Target Price minus the total dollar amount of Medicare fee-for-service expenditures for items and services (collectively referred to as "Aggregate FFS Payment" or "AFP") furnished by the Awardee, the episode initiator, EIPs, gainsharers, or third party providers during an episode of care. Not applicable for Model 4.
Participant	An ACH, PGP, SNF, LTCH, HHA, or IRF that is actually initiating episodes under the BPCI initiative *or* an Awardee that is not an episode initiator.

Name	Definition
Phase 1	An initial period before a participant is "at financial risk". During this time period," CMS and the potential participant prepare for implementation of the BPCI initiative and assumption of financial risk.
Phase 2	The phase of the initiative when a participant is considered "at risk" and is allowed to begin initiating some or all of its clinical episodes and bearing financial risk, as applicable.
Post-acute care (PAC)	All care services received by the beneficiary after discharge from the qualifying hospital stay. Includes care from the PAC provider (SNF, IRF, LTCH, HHA) as well as any potential inpatient hospitalizations (readmissions), professional services, and/or outpatient care.
Post-acute care qualifying admission	An admission to a participating (or comparison group) PAC provider within 30 days of discharge from the qualifying hospitalization upon which a Model 3 episode begins.
Post-discharge period (PDP)	Period of time starting on the day of the anchor hospitalization (Model 2 and 4), qualifying hospitalization (Model 3), or transfer hospital discharge.
Qualifying hospital stay	The acute care hospitalization that precedes the start of a Model 3 episode of care. All Model 3 episodes of care start within 30 days of discharge from this acute care qualifying hospitalization.
Risk adjustment	When sufficient sample size was available, we risk adjusted our outcomes. Without adequate risk adjustment, providers with a sicker or more service intensive patient mix would have worse outcomes and providers with healthier patients would have better outcomes even if nothing else differed. All measures were risk adjusted for service mix; demographic factors, prior health conditions based on Hierarchical Chronic Conditions (HCC) indicators, measures of prior care use, and provider characteristics.
Single Awardee (SA)	An individual Medicare provider that assumes financial risk for episodes initiated at their institution. SAs are also episode initiators.
Three-day SNF Waiver	This is one of the Medicare payment policy waivers an Awardee may utilize. This allows Model 2 participants to waive the three-day hospital stay requirement for Part A skilled nursing facility coverage.

Exhibit A.2: Acronyms

Acronym	Definition
AC	Awardee Convener
ACH	Acute Care Hospital
BPCI	Bundled Payments for Care Improvement
CHF	Congestive Heart Failure
CMS	Centers for Medicare & Medicaid Services
COPD	Chronic Obstructive Pulmonary Disease
DAC	Designated Awardee Convener
DiD	Difference in Difference
ED	Emergency Department
EI	Episode Initiator
FC	Facilitator Convener
FFS	Fee-for-service
HH	Home Health
HHA	Home Health Agency
ICS	Internal Cost Saving
IP	Implementation Protocol
IRF	Inpatient Rehabilitation Facility
LOS	Length of stay
LTCH	Long Term Care Hospital
MJRLE	Major Joint Replacement of the Lower Extremity
MS-DRG	Medicare Severity-adjusted Diagnosis Related Group
NPRA	Net Payment Reconciliation Amount
PAC	Post-acute Care
PBP	Post-Bundle Period
PCP	Primary Care Physician
PDP	Post-Discharge Period
PGP	Physician Group Practice
POS	Provider of Service
SA	Single Awardee
SNF	Skilled Nursing Facility
SPRI	Simple Pneumonia and Respiratory Infection
UTI	Urinary Tract Infection

Appendix B: BPCI Clinical Episodes and Medicare Severity Diagnosis Related Groups (MS-DRGs)

Clinical Episode	MS-DRGs that trigger the clinical episode														
Acute myocardial infarction	280	281	282												
AICD generator or lead	245	265													
Amputation	239	240	241	255	256	257	474	475	476	616	617	618			
Atherosclerosis	302	303													
Back & neck except spinal fusion	490	491	518	519	520										
Cardiac arrhythmia	308	309	310												
Cardiac defibrillator	222	223	224	225	226	227									
Cardiac valve	216	217	218	219	220	221	266	267							
Cellulitis	602	603													
Cervical spinal fusion	471	472	473												
Chest pain	313														
Chronic obstructive pulmonary disease, bronchitis, asthma	190	191	192	202	203										
Combined anterior posterior spinal fusion	453	454	455												
Complex non-cervical spinal fusion	456	457	458												
Congestive heart failure	291	292	293												
Coronary artery bypass graft	231	232	233	234	235	236									
Diabetes	637	638	639												
Double joint replacement of the lower extremity	461	462													
Esophagitis, gastroenteritis and other digestive disorders	391	392													
Fractures of the femur and hip or pelvis	533	534	535	536											
Gastrointestinal hemorrhage	377	378	379												
Gastrointestinal obstruction	388	389	390												
Hip & femur procedures except major joint	480	481	482												

Clinical Episode	MS-DRGs that trigger the clinical episode														
Lower extremity & humerus procedure except hip, foot, femur	492	493	494												
Major bowel procedure	329	330	331												
Major cardiovascular procedure	237	238	268	269	270	271	272								
Major joint replacement of the lower extremity	469	470													
Major joint replacement of the upper extremity	483	484													
Medical non-infectious orthopedic	537	538	551	552	553	554	555	556	557	558	559	560	561	562	563
Medical peripheral vascular disorders	299	300	301												
Nutritional and metabolic disorders	640	641													
Other knee procedures	485	486	487	488	489										
Other respiratory	186	187	188	189	204	205	206	207	208						
Other vascular surgery	252	253	254												
Pacemaker	242	243	244												
Pacemaker device replacement or revision	258	259	260	261	262										
Percutaneous coronary intervention	246	247	248	249	250	251	273	274							
Red blood cell disorders	811	812													
Removal of orthopedic devices	495	496	497	498	499										
Renal failure	682	683	684												
Revision of the hip or knee	466	467	468												
Sepsis	870	871	872												
Simple pneumonia and respiratory infections	177	178	179	193	194	195									
Spinal fusion (non-cervical)	459	460													
Stroke	61	62	63	64	65	66									
Syncope & collapse	312														
Transient ischemia	69														
Urinary tract infection	689	690													

Appendix C: Methods

This appendix includes the details on the methods used for the analyses included in this report.

A. Data Sources

Exhibit C.1 lists the data sources and their uses for this study. Overall, we used provider-level data sources to identify and describe Bundled Payments for Care Improvement (BPCI) participants and select comparison providers. Medicare claims and enrollment data were used to construct episodes of care for patients at BPCI-participating sites (BPCI population) and at matched comparison providers. We also used claims data to create outcome measures and beneficiary risk factors associated with the outcomes.

Exhibit C.1: Data Sources used in the BPCI Evaluation

	Dataset Name	Date Range	Dataset Contents	Use
Provider-level secondary data sources	CMS BPCI database	2013-2017	Information compiled by CMS on BPCI participants and their clinical episodes, including participant name, CMS Certification Number, location, type (hospital, skilled nursing facility (SNF), etc.), BPCI "role", Model, clinical episode(s) and length(s), BPCI participation start and end dates, and contact information.	Used to identify Quarter 4 2013 through Quarter 3 2017 BPCI participating providers and clinical episodes. Identified participants in Model 1 of BPCI to exclude from comparison group.
	Medicare Provider Enrollment, Chain, and Ownership System (PECOS)	2011-2014	Information on Medicare providers, including ownership and chain relationships among providers.	Used to identify ownership of BPCI providers and potential comparison providers and to create an indicator of whether the provider was part of a chain. Both of these characteristics were used in the creation of the comparison groups.
	Provider of Services (POS) file	2011-2015	Information on Medicare-approved institutional providers, including provider number, size, and staffing.	Used within descriptive analysis of BPCI and non-BPCI participants. Used as predictors in provider propensity model on participation in BPCI.
	Area Health Resource File (AHRF)	2011	County-level data on population, environment, geography, health care facilities, and health care professionals.	Descriptive analysis of BPCI and non-BPCI market characteristics. Used as predictors in provider propensity model on participation in BPCI.
	Master Data Management (MDM)	2013-2017	Provider- and beneficiary-level information on participation in CMS payment demonstration models or programs.	Used to identify providers who are involved in an Accountable Care Organization (ACO) or other Medicare Shared Savings programs.
	Inpatient Prospective Payment System (IPPS) annual files	2011	Hospital-level file containing provider characteristics such as bed count, resident-bed ratio, and discharge counts.	Used as predictors in provider propensity model on participation in BPCI.

	Dataset Name	Date Range	Dataset Contents	Use
Transaction-level secondary data sources	Medicare fee-for-service (FFS) claims	Jan 2010-Sep 2017	Medicare Part A and B claims.	Used to create episodes of care and outcome measures such as readmissions, emergency department (ED) visits, number of days in SNF. Also used to create risk factors including hierarchical condition categories and health care utilization prior to anchor/qualifying hospitalization.
	Medicare standardized payments	Jan 2011-Sep 2017	Medicare standardized payments for 100% of Part A and B claims received via the Integrated Data Repository (IDR) from another CMS contractor.	Used to create Medicare standardized payment amounts (Part A and B) and allowed standardized payment outcomes (including beneficiary out-of-pocket amounts).
	The Master Beneficiary Summary File (MBSF)	Jan 2010-Sep 2017	Beneficiary and enrollment information, including beneficiary unique identifier, address, date of birth/ death, sex, race, age, and Medicare enrollment status.	Used to identify eligibility for episodes of care, beneficiary demographic characteristics, and beneficiary eligibility for inclusion in the denominator for each of the outcome measures.
	Minimum Data Set (MDS)	2011-2017	Comprehensive post-acute patient assessments completed by clinicians. Required for residents of Medicare-certified SNF facilities. Administered at entry to the facility, at discharge, days 14, 30, 60, 90, and quarterly thereafter.	Used to identify whether beneficiary had a stay at a facility prior to IP admission.
	Healthcare Integrated General Ledger Accounting System (HIGLAS)	2013-2018	Transaction-level Medicare outlays for net payment reconciliation amounts (NPRA), ACO overlap adjustments, post episode spending amount and other ad hoc payments.	Used to calculate total net outlays by model for Medicare Programs Savings calculations

B. Characteristics of the Initiative and Participants

We relied on both secondary quantitative and primary qualitative data to describe the BPCI-participating providers and their implementation of the initiative. To summarize characteristics of the initiative and participants at the baseline and during the course of the initiative, Lewin ran a series of descriptive analyses on the measures included in Exhibits C.2 through C.4.

Exhibit C.2: Provider Characteristics Variable Definitions, Model 2

Variable Name	Definition	Source
Ownership	The ownership type of a provider (e.g. for-profit, non-profit, government)	2013 POS file
Urban/Rural	CBSA urban/rural indicator	2013 POS file
Part of Chain	Indicator of whether the provider is part of a chain, based on if they share a TIN with another hospital	October 2012 PECOS
Bed Count	Number of beds	2011 CMS IPPS annual files
BPCI Discharges	Number of hospital discharges for any of the 48 BPCI clinical episode groups in 2011	2011 Medicare claims
Medicare Days	Medicare days as a percent of total inpatient days according to CMS IPPS data	2011 CMS IPPS annual files
Resident-Bed Ratio	Average number of residents assigned per bed according to CMS IPPS data	2011 CMS IPPS annual files
Disproportionate Share Percent	The sum of the percentage of Medicare inpatient days attributable to patients eligible for both Medicare Part A and Supplemental Security Income (SSI), and the percentage of total inpatient days attributable to patients eligible for Medicaid but not Medicare Part A	2011 CMS IPPS annual files
Hospital Market Share	Proportion of the hospital discharges to all discharges for the 48 BPCI clinical episodes in the market	2013 Medicare claims

Exhibit C.3: BPCI-participating Physician Group Practice Characteristics Variable Definitions, Model 2[1]

Variable Name	Description	Technical Definition	Eligible Sample	Source
Physician Specialty Distribution	Percentage of physicians by broad specialty categories (see Exhibit C.4)	Each clinician was assigned the specialty associated with their NPI in Part B claims data from 2012 to 2016. When a physician was matched to more than one specialty, which occurred in approximately 8% of cases, we assigned a single specialty and category.[2] Hospitalists identified using the methodology for the 'hospitalist physician group practice (PGP),' as described in third row of this exhibit, were placed in the hospital-based category.	All physician NPIs associated with BPCI PGP TINs. Approximately 3.9% of clinicians were dropped from the analysis due to lack of a specialty in the data.	TIN/NPI Crosswalk as of Q4 2016 from reconciliation contractor; 2012–2016 Part B Claims
Single-specialty PGP	Number of PGPs identified as single-specialty PGPs	Using the specialty categories assigned to each physician when calculating the physician specialty distribution, we calculated the percentage of physicians in each of the specialty categories at each PGP. Based on the methodology of Welch et. al. (2013), a PGP was then defined as single-specialty if at least 90% of physicians at the practice were in the same specialty category. A PGP identified as a single-specialty practice in any year from 2012–2016 is counted as a single-specialty practice.	All BPCI Model 2 PGPs with at least one NPI during the baseline period and at least one NPI during the intervention period.	TIN/NPI Crosswalk as of Q4 2016 from reconciliation contractor; 2012–2016 Medicare Part B Claims

[1] To count clinicians at a PGP, each clinician was weighted by the proportion of the year that they were employed at the PGP, as reported on the TIN/NPI crosswalk. For example, if a PGP had a clinician with a listed start date of February 1, 2012 and an end date of August 1, 2012, the clinician was employed for 183 days (inclusive of the end date) out of 366, for a count of 0.5.

[2] CMS. (February 2017). Medicare Data on Provider Practice and Specialty (MD-PPAS): User Documentation Version 2.2.

Variable Name	Description	Technical Definition	Eligible Sample	Source
Hospitalist PGP	Number of PGPs identified as hospitalist PGPs	We identified BPCI PGP hospitalist practices using a two-step process based on the methodology described in Welch et. al. (2014). To lessen the impact of fluctuation in the claims data, PGPs were counted as hospitalist practices if they met the criteria of the methodology in any year from 2012–2016. **Step 1:** Each physician is flagged as a hospitalist if the physician's specialty fell into the primary care category and at least 90% of their total Part B allowed charges billed under the PGP TIN occurred in a hospital setting. **Step 2:** PGPs were considered a hospitalist practice if at least 70% of the physicians at the practice during the year were flagged as a hospitalist.	All BPCI Model 2 PGPs with at least one NPI during the baseline period and at least one NPI during the intervention period.	TIN/NPI Crosswalk as of Q4 2016 from reconciliation contractor; 2012–2016 Medicare Part B Claims
Non-physicians as a Proportion of PGP Clinicians	Proportion of clinicians that are non-physicians within BPCI PGPs	Clinicians were identified as non-physicians according to the Medicare provider specialty associated with their NPI in Part B claims from 2012–2016. We then calculated the percentage of non-physicians out of total clinical staff for each PGP and each year included in the analysis.	All BPCI Model 2 PGPs with at least one NPI during the baseline period and at least one NPI during the intervention period.	TIN/NPI Crosswalk as of Q4 2016 from reconciliation contractor; 2012–2016 Medicare Part B Claims
Average Quarterly Discharges per BPCI PGP	Average number of Part A hospital discharges for BPCI clinical episodes at BPCI PGPs	To obtain these averages, both the operating and attending physician NPIs on the 2012–Q32016 Part A claims dataset were mapped to the NPIs on the TIN/NPI crosswalk. If a discharge fell within a physician's dates of employment at a PGP, the discharge was counted for that PGP. The total discharges for each PGP for each year were counted and divided by 4 to obtain a quarterly figure (they were divided by three for 2016, as the data included only three quarters of claims). Discharges related to any MS-DRG, including those that do not trigger a BPCI clinical episode, were counted in order to give an estimate of total practice size. Assigning discharges by both attending and operating physician occasionally allowed a single discharge to be counted at two different PGPs; however, this had a negligible effect on the results.	All BPCI Model 2 PGPs with at least one NPI during the baseline period and at least one NPI during the intervention period.	TIN/NPI Crosswalk as of Q4 2016, 2010-2016 Medicare Part A Claims

Exhibit C.4: Definition of Physician Specialty Categories Used to Define Physician Group Practice Characteristics

Broad Specialty Category	Included Physician Specialties
Psychiatry	Psychiatry, Geriatric Psychiatry, Neuropsychiatry
Hospital-based	Hospitalist, Emergency Medicine, Physical Medicine And Rehabilitation, Critical Care (Intensivists), Diagnostic Radiology, Anesthesiology, Pathology, Pain Management, Interventional Pain Management, Radiation Oncology, Interventional Radiology, Nuclear Medicine
Ob-Gyn	Obstetrics & Gynecology, Gynecological Oncology
Surgical specialty	Orthopedic Surgery, General Surgery, Hand Surgery, Sports Medicine, Neurosurgery, Otolaryngology, Urology, Vascular Surgery, Ophthalmology, Plastic And Reconstructive Surgery, Thoracic Surgery, Cardiac Surgery, Colorectal Surgery, Surgical Oncology, Peripheral Vascular Disease.
Medical specialty	Cardiovascular Disease, Pulmonary Disease, Nephrology, Gastroenterology, Infectious Disease, Neurology, Hematology-Oncology, Rheumatology, Endocrinology, Dermatology, Allergy/Immunology, Medical Oncology, Sleep Medicine, Addiction Medicine, Hematology, Interventional Cardiology
Primary care	Internal Medicine, Family Practice, Pediatric Medicine, Geriatric Medicine, General Practice, Hospice And Palliative Care, Osteopathic Manipulative Medicine, Preventive Medicine
Other physician	Clinic Or Group Practice, Undefined Physician Type

Note: The specialty categories in this exhibit were used to create the physician specialty distribution, single specialty PGP, and hospitalist PGP variables defined in Exhibit C.3 above. In the case that a physician had more than one listed specialty, the precedence logic in the MD-PPAS was employed. The categories are listed in approximate descending precedence order; for example, psychiatry takes precedence over emergency medicine and internal medicine.

Source: CMS. (February 2017). Medicare Data on Provider Practice and Specialty (MD-PPAS): User Documentation Version 2.2.

C. Impact of BPCI on Claims-based Outcomes

In this section, we describe the BPCI population and the methodology for creating comparison groups for each combination of Model 2 provider type and clinical episode ("stratum") analyzed in this report. We also define the outcomes and the methodology used to estimate the impact of BPCI on payments, utilization, and quality.

1. Outcomes

We used data from claims to create outcomes on payments, utilization of health care services, and quality. The following exhibits define these outcomes and characteristics. Exhibit C.5 provides detailed information about each outcome, including the name, description, technical definition, and eligible sample, organized by outcome domain.

Exhibit C.5: Claim- and Assessment-based Outcomes Definitions

Domain	Outcome Name	Description	Technical Definition	Eligible Sample[a]
Payment	Standardized Total Allowed Payment Amount	Total Medicare Part A & B standardized allowed amount, during the anchor hospital stay + 90-day PDP	The sum of Medicare payment and beneficiary out-of-pocket amounts for all health care services. Payments in the lower/upper ends are winsorized.[b]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December31, 2017; 3) had non-missing Part A and B payments during the bundle period and anchor hospital stay; 4) were alive at the beginning of the measurement period for post-bundle payment outcomes.
	Standardized Total Paid Amount	Total Medicare Part A & B standardized paid amount, during the anchor hospital stay + 90-day PDP	The sum of Medicare payment excluding beneficiary out-of-pocket amounts for all health care services. Payments in the lower/upper ends are winsorized.[b]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December31, 2017; 3) had non-missing Part A and B payments during the bundle period and anchor hospital stay; 4) were alive at the beginning of the measurement period for post-bundle payment outcomes.
	SNF Standardized Allowed Amount, 90-day PDP	Average Medicare Part A standardized allowed amount for SNF, totaled within the 90-day PDP	The sum of Medicare payment and beneficiary out-of-pocket amounts for Part A health care services provided for SNF during the 90-day PDP. Payments in the lower/upper ends are winsorized.[c]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) had non-missing Part A payments during the bundle period and anchor/qualifying hospital stay.
	IRF Standardized Allowed Amount, 90-day PDP	Average Medicare Part A standardized allowed amount for IRF, totaled within the 90-day PDP	The sum of Medicare payment and beneficiary out-of-pocket amounts for Part A health care services provided for IRF during the 90-day PDP. Payments in the lower/upper ends are winsorized.[c]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) had non-missing Part A payments during the bundle period and anchor/qualifying hospital stay.
	HHA Standardized Allowed Amount, 90-day PDP	Average Medicare Part A standardized allowed amount for HHA, totaled within the 90-day PDP	The sum of Medicare payment and beneficiary out-of-pocket amounts for Part A health care services provided for HHA during the 90-day PDP. Payments in the lower/upper ends are winsorized.[c]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) had non-missing Part A payments during the bundle period and anchor/qualifying hospital stay.

Domain	Outcome Name	Description	Technical Definition	Eligible Sample[a]
Utilization	Number of SNF Days	Average number of SNF days of care during the 90-day PDP among episodes with at least one SNF day of care	The number of days of skilled nursing facility (SNF) care (not necessarily consecutive) during the 90-day PDP.	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) were alive at the time of anchor/qualifying discharge; 4) had at least one SNF day during the 90-day PDP.
	Discharged to Post-acute Care (PAC) Settings	The proportion of episodes that were discharged from the inpatient hospital stay to any PAC setting, including HHA	The proportion of episodes where the first PAC setting was SNF, LTCH, IRF, or HHA.	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) were admitted to SNF, LTCH, or IRF within 5 days of discharge from the hospital or were admitted to home health within 14 days of anchor discharge.
	Discharged to Institutional Post-acute Care (PAC) Settings among Those Discharged to any PAC Setting	The proportion of episodes discharged from the hospital to an institutional PAC setting among episodes that were discharged to any PAC setting (including HHA)	The proportion of episodes where the first PAC setting was SNF, LTCH, or IRF among episodes that were discharged to any PAC setting.	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) had a first PAC setting of SNF, LTCH, IRF or HHA; 4) were admitted to SNF, LTCH, or IRF within 5 days of discharge from the hospital or were admitted to home health within 14 days of discharge from the hospital.
Quality	Unplanned Readmission Rate	Episodes with one or more unplanned, all-cause readmissions for any condition, 90 days after anchor discharge	Binary outcome (1= at least one readmission during measurement period; 0= no eligible readmissions during measurement period). Eligible readmissions are inpatient prospective payment system (IPPS) claims with an MS-DRG not on the list of excluded MS-DRGs for the given clinical episode.[d]	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) were discharged from the anchor hospital stay in accordance with medical advice; 4) were alive at the time of anchor discharge.
	Emergency Department (ED) Use without Hospitalization	Episodes with one or more ED visits for which the beneficiary requires medical treatment but is not admitted to the hospital 90 days after discharge from an anchor hospital stay	Binary outcome (1= at least one ED visit without readmission during measurement period; 0= no eligible ED visits without readmission during measurement period). Eligible ED visits are outpatient claims with a code indicating the beneficiary used the emergency room but was not admitted.	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) had a measurement period that ended on or before December 31, 2017; 3) were discharged from the anchor hospital in accordance with medical advice; 4) were alive at the time of anchor discharge.

Domain	Outcome Name	Description	Technical Definition	Eligible Sample[a]
Quality (Cont'd)	All-cause Mortality	Death from any cause during 90 days after discharge from the anchor hospital stay	If date of death occurred during the measurement period, then mortality outcome =1.	Beneficiaries who: 1) maintained FFS A&B enrollment throughout the measurement period or until death; 2) have a measurement period that ends on or before December 31, 2017; 3) were not enrolled in the Medicare Hospice program in the six months prior to the anchor/qualifying admission; 4) had reliable mortality status in the data; 5) were discharged from the anchor hospital in accordance with medical advice; 6) were alive at the time of anchor hospital discharge. *For beneficiaries with multiple anchor hospitalizations, one hospitalization per quarter was randomly selected for inclusion in this measure.*

Note: Payments adjust for Medicare payment policies to ensure that any differences across time and providers reflect real differences in resource use rather than Medicare payment policies (e.g., teaching payments or differential payment updates). All measures are created using claims data. PDP=post-discharge period. FFS=fee for service. HHA=home health agency. IRF=inpatient rehabilitation facility. LTCH=long term care hospital. PAC=post-acute care setting. SNF=skilled nursing facility.

[a] For all outcomes, the eligible sample was restricted to beneficiaries who: 1) had a complete FFS enrollment history six months prior to anchor hospital admission; and 2) had non-missing age and gender data.

[b] The outcome total Medicare Part A & B standardized allowed and paid payment amounts are calculated as the sum of acute payments during the inpatient stay and services during the 90-day post-discharge period after winsorizing. Acute payments are winsorized by quarter, MS-DRG, and episode initiator (EI) type at the 2nd and 98th percentile for Part A and at the 1st and 99th percentile for B. All other payments are winsorized by quarter, clinical episode, episode length, and EI type at the 1st and 99th percentiles.

[c] These Medicare Part A payment outcomes are winsorized by quarter, clinical episode and EI type at the 1st and 99th percentiles.

[d] This outcome is based on specifications for the National Quality Forum (NQF) all-cause unplanned readmission measure (NQF measure 1789). Planned admissions are excluded based on the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification System Procedure and Diagnoses codes.

2. Study Populations

The quantitative analysis used a difference-in-differences (DiD) design to estimate the differential change in payments, utilization, and quality outcomes between the baseline and intervention period for beneficiaries who received services from BPCI episode initiators (EIs) relative to beneficiaries who received services from a comparison group of non-BPCI providers. This comparison group is designed to be similar to BPCI EIs with respect to baseline characteristics that could affect their decision to participate and could be related to their performance under BPCI. Such characteristics include market-level and provider-specific attributes. Because providers voluntarily enrolled in BPCI, they were likely to be different than non-participants in ways that may bias our results. For example, BPCI EIs may have had less efficient care in the pre-intervention period and consequently had more room for improvement relative to non-participants.

We constructed comparison groups for 32 Model 2 hospital clinical episodes and 21 Model 2 physician group practice (PGP) clinical episodes that were considered to have a sufficient sample size for meaningful analysis (Exhibit C.6 below). A combination was deemed to have sufficient sample if there were at least 20 EIs with at least 1,000 clinically relevant episodes.[3] Comparison groups were selected from the universe of Medicare hospitals that had not entered Phase 2 of BPCI. For this report, we examined the 10 clinical episodes with the largest number of BPCI episodes initiated across both Model 2 hospitals and Model 2 PGPs. We also constructed overall Model 2 hospital level estimates and overall Model 2 PGP level estimates by pooling episodes for the provider type and clinical episode combinations using all clinical episodes with sufficient sample size to analyze. Finally, in order to compare results for Model 2 hospital-initiated episodes and Model 2 PGP-initiated episodes, we constructed impact estimates for the two provider types by calculating a volume-weighted average of the clinical episode estimates from the 21 clinical episodes they have in common (Exhibit C.7 below). The methods for matching treatment and comparison providers varied by BPCI provider type, and are described below.

[3] Groups were considered meaningful for the analysis if there was enough participation in BPCI, but no formal power calculation was conducted to assess minimum sample size.

Exhibit C.6: Clinical Episodes with Sufficient Volume for Analysis, Q4 2013 through Q3 2017

	Clinical Episode	Intervention Episodes: Model 2 Hospitals	Intervention Episodes: Model 2 PGPs	Total Intervention Episodes
Top 10 clinical episodes presented in the report	Major joint replacement of the lower extremity	146,492	90,992	237,484
	Sepsis	39,823	26,472	66,295
	Congestive heart failure	50,226	12,761	62,987
	Simple pneumonia and respiratory infections	32,143	13,415	45,558
	Chronic obstructive pulmonary disease, bronchitis, asthma	29,058	12,010	41,068
	Stroke	17,952	4,073	22,025
	Urinary tract infection	12,458	7,507	19,965
	Hip & femur procedures except major joint	11,181	7,401	18,582
	Renal failure	10,880	7,053	17,933
	Medical non-infectious orthopedic	9,901	4,007	13,908
Additional clinical episodes in common between Model 2 hospitals and Model 2 PGPs	Acute myocardial infarction	8,103	4,787	12,890
	Other respiratory	7,100	5,341	12,441
	Cardiac arrhythmia	8,218	3,904	12,122
	Cellulitis	7,491	3,729	11,220
	Percutaneous coronary intervention	7,542	3,369	10,911
	Esophagitis, gastroenteritis and other digestive disorders	5,935	4,795	10,730
	Gastrointestinal hemorrhage	5,761	3,203	8,964
	Spinal fusion (non-cervical)	5,076	3,326	8,402
	Nutritional and metabolic disorders	3,910	3,234	7,144
	Major joint replacement of the upper extremity	2,103	3,837	5,940
	Gastrointestinal obstruction	2,405	2,030	4,435
Remaining clinical episodes with sufficient sample size to construct comparison groups	Cardiac valve	5,480	-	5,480
	Coronary artery bypass graft	4,693	-	4,693
	Major bowel procedure	4,356	-	4,356
	Diabetes	2,296	-	2,296
	Other vascular surgery	2,115	-	2,115
	Syncope & collapse	1,955	-	1,955
	Cervical spinal fusion	1,712	-	1,712
	Revision of the hip or knee	1,611	-	1,611
	Fractures of the femur and hip or pelvis	1,578	-	1,578
	Lower extremity and humerus procedure except hip, foot, femur	1,529	-	1,529
	Transient ischemia	1,526	-	1,526

Note: Clinical episodes are ordered by the number of total intervention episodes, with the exception of gastrointestinal obstruction, which appears in the section with the additional clinical episodes in common between

Model 2 hospitals and Model 2 PGPs. The numbers of intervention episodes presented are for the analytical sample, which includes providers and episodes that met criteria for inclusion for the impact estimates.
Source: Lewin analysis of Medicare claims and enrollment data for episodes that began Q4 2013 through Q3 2017 for BPCI providers.

a. BPCI Study Population

For the hospital analysis, the BPCI treatment group was defined as hospitals that had at least five discharges in both 2011 and 2012 and participated in the clinical episode for more than one quarter. We required a minimum of five discharges in order to calculate baseline payments, utilization, and quality outcomes to include in the matching algorithm.

The BPCI PGP treatment group was defined using a slightly different approach to accommodate the comparison group approach for the analysis of PGP episodes (see section b. Comparison Group below), because we did not have reliable data on physician affiliation for non-BPCI PGPs. First, we identified BPCI-participating PGPs that participated in the clinical episode for more than one quarter. Then, we defined the BPCI PGP treatment group as *hospitals* where BPCI-participating PGPs initiated episodes. The treatment group was limited to hospitals where BPCI-participating PGPs initiated at least one BPCI PGP episode in both the baseline (Q4 2011 through Q3 2012) and intervention (Q4 2013 through Q3 2017) periods to have a consistent group of hospitals in both time periods. We also limited the PGP treatment group to hospitals that had at least five discharges in both 2011 and 2012 in order to calculate baseline outcomes for matching.[4]

The share of BPCI participants included in the analysis varied by participant type because of the inclusion criteria above. For the clinical episodes with sufficient sample size to construct comparison groups for the model- and participant type-level impact estimates, the study population included 96% of BPCI-participating hospitals and 71% of BPCI-participating PGPs. For the top 10 clinical episodes presented individually in the report, the study population included 91% of hospital participants and 66% of PGP participants.

The BPCI study population includes Phase 2 episodes initiated by BPCI EIs who were included in the treatment group of hospitals and PGPs. For PGPs, we included the episodes at the treatment group of hospitals that were admitted by BPCI-participating PGPs. If an EI participant stopped participating in the clinical episode during this period, we included the episodes that it initiated up until its withdrawal date.

b. Comparison Group

BPCI hospitals were matched to non-BPCI hospitals. For PGPs, we did not have reliable data on physician affiliation to create non-BPCI PGPs, so we instead matched hospitals where BPCI-participating PGP episodes were initiated to hospitals that had little to no admissions from BPCI-participating PGPs.

[4] When describing the creation of Model 2 PGP treatment and comparison groups, we will use the terms 'Model 2 BPCI PGP hospitals' and 'Model 2 PGP comparison hospitals'. There are portions in this section when we use the term 'BPCI participants' to define the treatment group across all EI types; for Model 2 PGPs, the 'BPCI participants' refers to the hospitals where the BPCI PGPs initiated episodes, because our unit of matching for BPCI-participating PGPs was the hospital.

Comparison providers and episodes for both participant types were selected in four steps. First, providers were selected for the comparison pool (i.e., identified as potential comparison providers) if they: (i) shared key characteristics with BPCI EIs, (ii) were eligible to participate in the BPCI initiative, (iii) were not located in markets where BPCI EIs of the same provider type accounted for over half of the discharges associated with any of the 48 BPCI clinical episodes, (iv) were not participating in BPCI, and (v) were not affiliated with BPCI participants. Second, each BPCI treatment group provider was matched with up to 15 comparison providers using statistical matching techniques to minimize the differences in the distributions of characteristics between BPCI and comparison providers. Third, episodes were constructed for beneficiaries treated by matched comparison providers based on the BPCI model rules. Finally, a sample of episodes was drawn from among those identified in the previous step to match the distribution of BPCI episodes by MS-DRG and quarter in which the episode was initiated. A detailed description of these steps is below.

Step 1: Exclude ineligible non-participating providers

Exclusions were applied for each Model, EI type, and clinical episode separately. Providers were excluded from the comparison pool if they met any of the following criteria:

- Were ineligible to participate in BPCI (e.g., in Model 2, hospitals that were not paid under Medicare's inpatient prospective payment system).
- Were owned by a BPCI-participating organization.
- Participated in any of the BPCI Models (Model 1 through Model 4).
- Were missing key matching characteristics, such as ownership status (government, non-profit, for-profit) or location (rural/urban).
- Were located in a market where BPCI providers of the same provider type accounted for over half of the discharges associated with any of the 48 BPCI clinical episodes. This exclusion avoided including providers that may be exposed to "spillover effects" of BPCI in those locations, which could cause changes in utilization for other local providers that may confound the results. Potential spillover effects include non-BPCI beneficiaries receiving care from BPCI providers, comparison providers adopting practices similar to BPCI providers, or BPCI affecting referral patterns in the market.
- Had fewer than five clinically relevant discharges during either calendar year 2011 or 2012. These providers were excluded in order to remove providers that did not have meaningful episode volume in the baseline.

A complicating factor of the hospital-level matching for PGPs was that treatment occurs at the PGP level, not the hospital level. Thus, a Model 2 BPCI PGP hospital can have both BPCI PGP and non-BPCI PGP episodes during the intervention period. In order to provide a large pool of eligible comparison hospitals for the PGPs, while also limiting the comparison pool's exposure to BPCI, hospitals were considered eligible for the PGP comparison pool as long as they had less than one percent of their patient discharges in the same clinical community treated by physicians in BPCI PGPs. Clinical communities are a broad classification of clinical episodes defined in Exhibit C.7. They represent the clinical episodes that are most likely to experience exposure to one another in the hospital setting.

Exhibit C.7: Clinical Episode and Clinical Community Relationship

Clinical Community	Clinical Episode
Surgical: Ortho Excluding Spine	• Amputation • Double joint replacement of the lower extremity • Hip and femur procedures except major joint • Lower extremity and humerus procedure except hip, foot, femur • Major joint replacement of the lower extremity • Major joint replacement of the upper extremity • Other knee procedures • Removal of orthopedic devices • Revision of the hip or knee
Surgical, Non-surgical: Cardiovascular	• Acute myocardial infarction • AICD generator or lead • Atherosclerosis • Cardiac arrhythmia • Cardiac defibrillator • Cardiac valve • Chest pain • Congestive heart failure • Coronary artery bypass graft • Major cardiovascular procedure • Medical peripheral vascular disorders • Other vascular surgery • Pacemaker • Pacemaker device replacement or revision • Percutaneous coronary intervention • Syncope & collapse
Surgical: Other	• Back and neck except spinal fusion • Cervical spinal fusion • Combined anterior posterior spinal fusion • Complex non-cervical spinal fusion • Major bowel procedure • Spinal fusion (non-cervical)

Clinical Community	Clinical Episode
Non-surgical Other	• Cellulitis • Chronic obstructive pulmonary disease, bronchitis, asthma • Diabetes • Esophagitis, gastroenteritis and other digestive disorders • Fractures of the femur and hip or pelvis • Gastrointestinal hemorrhage • Gastrointestinal obstruction • Medical non-infectious orthopedic • Nutritional and metabolic disorders • Other respiratory • Red blood cell disorders • Renal failure • Sepsis • Simple pneumonia and respiratory infections • Stroke • Transient ischemia • Urinary tract infection

Step 2: Use matching algorithms to select close matches

For each strata, we assessed the performance of a Propensity Score Matching (PSM) model using key variables, and we altered the covariates in the model if the balance was undesirable (see below for more details). In general, PSM performed well, especially for strata with larger sample sizes.

A *propensity score* is defined as the predictive probability of receiving the "treatment" (BPCI participation), conditional on a set of characteristics. This probability was estimated using a logistic regression model that included key factors thought to influence both the participation decision and performance in BPCI. These factors included market characteristics (e.g., population size, primary care physician to population ratios), provider characteristics (e.g., ownership status, number of beds), and performance- and practice pattern-related factors (e.g., historical Part A Medicare payments, use of PAC services). The variables considered for matching Model 2 by provider type are displayed in Exhibit C.8.

Exhibit C.8: Key Variables used for Matching Model 2 by Provider Type

Variable	Model 2 Hospitals	Model 2 PGPs
Ownership - Non-Profit, Government, For-Profit	X	X
Urban/Rural Location	X	X
Bed Count	X	X
Chain Indicator	X	X
SNF in Hospital		
Medicare Days as a Percent of Total Inpatient Days	X	X
Resident-Bed Ratio	X	X
Disproportionate Share Percent	X	X
Teaching Status	X	X
Population Size of Market Area	X	X
Median Household Income	X	X

Variable	Model 2 Hospitals	Model 2 PGPs
Medicare Advantage Penetration	X	X
Primary Care Providers per 10,000 in Market	X	X
SNF Beds per 10,000 in Market	X	X
Inpatient Rehabilitation Facility in Market	X	X
Provider Market Share of the 48 potential BPCI clinical episodes	X	X
Herfindahl Index of Hospital Market Shares	X	X
Herfindahl Index of SNF Market Shares		
Percentage of total discharges in the 48 BPCI clinical episodes in 2011	X	X
Number of discharges for clinical episode in 2011	X	X
Percent of patients in 2011 that went home with no post-acute care by clinical episode	X	X
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	X	X
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	X	X
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	X	X
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode	X	X
Emergency department use by clinical episode in 2011	X	X
Change in emergency department use by clinical episode from 2011 to 2012	X	X
Unplanned readmission rate by clinical episode in 2011	X	X
Change in unplanned readmission rate by clinical episode from 2011 to 2012	X	X
All-cause mortality rate in 2011 by clinical episode	X	X
Change in all-cause mortality rate by clinical episode from 2011 to 2012	X	X
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	X	X
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	X	X

Note: PGP=physician group practice. SNF=skilled nursing facility. HHA=home health agency

Using the coefficients from the logistic regression model, we constructed a propensity score as the predicted probability of participating in BPCI. Each BPCI provider was matched with up to 15 comparison providers with a propensity score absolute difference below a defined caliper. In cases where more than 15 providers fell within the caliper, the 15 closest providers were matched to the BPCI provider. Comparison providers were allowed to be used as matches for more than one BPCI provider. A caliper acts as a constraint on the "distance" between BPCI and potential comparison providers based on the difference in absolute value in their estimated propensity scores. Any comparison providers outside of the caliper of a BPCI provider would not be matched to that BPCI provider. BPCI providers with no potential matches inside the caliper were excluded from the analysis. These BPCI providers typically had outliers measured in several of the key factors used for matching, such as the number of discharges for the episode or the share of BPCI episodes in the market. Calipers were chosen based on the standard deviation of the estimated log-odds propensity score. Multiple calipers were tested for each strata to identify the specification that generated the most similar comparison group across all of the attributes considered important for matching.

The key diagnostic used to determine similarity between BPCI and comparison providers was the standardized difference in the mean of each of the matching variables between BPCI and non-BPCI providers. The standardized difference compares the differences in means in relation to the

standard deviation pooled across BPCI and comparison providers. We typically preferred the method that yielded the lowest standardized difference of means across the largest number of covariates and that resulted in the fewest number of standardized differences greater than 0.20 for any particular variable.[5] We prioritized minimizing the standardized differences of performance-related variables (90-day standardized Medicare Part A payment, unplanned readmission rates, mortality rates, and emergency department use rates). Standardized differences below 0.10 were targeted for these variables. In a few cases where the standardized differences were larger, we used alternative model specifications to improve matching.

Appendix I shows the calipers chosen for each PSM model as well as the standardized differences of each covariate included in the matching models between BPCI providers and matched comparison providers for each clinical episode. Our ability to construct comparison groups (and the share of BPCI providers included in the analysis) varied across clinical episodes. The standardized differences were less than 0.10 for each of the eight key performance measures for 19 of the 20 Model, EI type and clinical episode groups. However, the average of the standardized differences for the key performance measures was less than 0.10 for all clinical episodes.

Step 3: Construct episodes for matched comparison providers

The BPCI episode algorithm rules were applied to construct simulated episodes that would have been assigned to comparison facilities if they had participated in BPCI. We constructed simulated episodes from October 2010 through September 2017. For the Model 2 PGP hospital comparison group, we excluded episodes at the comparison hospitals that were initiated by a BPCI-participating PGPs in the same clinical community.

Step 4: Select random sample of comparison group episodes

We drew a random sample of comparison episodes from the episodes identified in the previous step. Each BPCI episode was randomly matched to one episode from the pool of comparison episodes in the same quarter with the same MS-DRG originating from the comparison providers that were matched to the BPCI provider. In the case of major joint replacement of the lower extremity, episodes were also randomly matched by whether the patient had a fracture or not. The matched comparison episode was then excluded from the pool of episodes eligible for future matching. In some cases, the comparison pool did not contain enough episodes resulting in unmatched BPCI episodes. Sensitivity analyses were performed to test the robustness of the DiD estimates using both the matched and unmatched episodes.

3. Analytical Methods

The DiD approach quantifies the impact of BPCI by comparing changes in outcomes for BPCI episodes with changes in outcomes for comparison episodes, between the baseline and intervention periods. This approach eliminates biases from time invariant differences between the BPCI and comparison episodes and controls for trends that are common between the BPCI and comparison populations.[6] The risk-adjustment regression model incorporates data from two periods prior to

[5] Stuart, E.A. (2010). Matching methods for causal inference: A review and a look forward. S*tatistical science: a review journal of the Institute of Mathematical Statistics*, 25(1), 1.

[6] While the DiD model controls for unobserved heterogeneity that is fixed over time, there is no guarantee that this unobserved heterogeneity is, in fact, fixed. It could be the case, for example, that providers with improving

BPCI implementation (baseline and Phase 1) as well as the intervention period. Phase 1 started when Awardees could begin signing up for BPCI but none had entered Phase 2, the risk-bearing or intervention phase. It encompasses the one-year period prior to the BPCI intervention period. Because some BPCI participants may have started to implement changes during Phase 1 in preparation for Phase 2, the Phase 1 period was excluded from the DiD baseline. Including Phase 1 in the DiD baseline would likely underestimate the BPCI effect given that participants started to prepare for the intervention during that period. Thus, the DiD compares changes in outcomes from the baseline period to the intervention period.

- The DiD baseline period was from October 2011 through September 2012.
- Phase 1 was from October 2012 through September 2013.
- The BPCI intervention period was from October 2013 through September 2017.

Sensitivity analyses were performed to test the robustness of the DiD estimates using a two-year baseline period, from October 2010 through September 2012. We note when the DiD estimates were not robust to the inclusion of the four additional quarters in the baseline period.

Consider the following linear model to illustrate the DiD calculation in a regression framework:

$$Y_{i,k,t} = \alpha + \beta_1 BPCI_{i,k} + \beta_2 T_t + \delta BPCI_{i,k} \cdot T_t + \boldsymbol{X}_{i,k,t}'\beta + u_{i,k,t}$$

Where $Y_{i,k,t}$ is the outcome of interest for individual *i* with provider *k* in quarter *t*, $BPCI_{i,k}$ is an indicator variable taking the value of 1 if individual *i* was treated by a BPCI provider, T_t indicates the period (i.e., baseline, Phase I, or intervention), and $X_{i,k,t}$ are beneficiary demographics, clinical characteristics observed before hospitalization, and provider characteristics. The vector β is a vector of regression coefficients that captures the impact of risk factors $\boldsymbol{X_{i,k,t}}$ on the outcome of interest. The regression coefficient β_1 captures any inherent, time invariant differences between the control and the treatment groups, β_2 provides an estimate of the potential time trends in the outcome of interest over the period before and after the intervention that is common to both the control and treatment groups, while $u_{i,k,t}$ represents a random error term. In this linear example, the DiD estimate is the coefficient δ, which determines the differential in outcome Y experienced by beneficiaries receiving services from BPCI providers during the intervention period relative to beneficiaries receiving services from providers in the comparison group.

We used multivariate regression models to control for differences in beneficiary demographics, clinical characteristics, and prior care use before the hospitalization, along with provider characteristics that might be correlated with the outcome (see Exhibit C.9). We used a variety of empirical specifications including ordinary least squares (OLS), logistic regressions, and two-part models. Regression models were selected depending on the type and characteristics of the outcome measure. For example, logistic models were estimated for the binary quality outcomes (e.g., mortality rate). OLS was estimated for the total number of days measures (e.g., number of SNF days) as well as the payment measures where all individuals by default had positive expenditures, such as total payments during the inpatient stay and 90-day PDP. Two part models were favored for payment outcomes where more than 5% of individuals had zero payments for the

outcomes are relatively more likely to sign up for the Model, introducing correlation between BPCI participation and outcomes, which could bias the results.

particular outcome. These payment outcomes included the individual Part A payments that were affected by zero-mass and skewedness.

The overall Model 2 hospital estimates and overall Model 2 PGP estimates were calculated by pooling episodes from all of the clinical episodes that had sufficient sample size to create analytical samples as described above. The inclusion criteria resulted in 32 clinical episodes for Model 2 hospitals and 21 clinical episodes for Model 2 PGPs. We pooled the episodes for these clinical episodes for each provider type and estimated the DiD separately for hospitals and PGPs. We used the same risk-adjustment model that was used for the individual clinical episodes, but also added in clinical episode dummies to control for each clinical episode. Clinical episodes without sufficient sample size were not included in these estimates.

Exhibit C.9: Predictive Risk Factors Used to Risk Adjust Claims Outcomes

Domain	Variables

Service Mix	• Alternative specifications
	  • Anchor MS-DRG
	  • MS-DRG group: anchor MS-DRG with and without complications grouped together
	  • Clinical episode (used for the all-Model and participant type estimates)

Patient Demographics & Enrollment	• Age (under 65, 65-79, 80+) • Gender • Medicaid status • Disability status • Alignment to Medicare Shared Savings Program or Pioneer ACO during BPCI episode

Prior health conditions	• Alternative specifications
	  • HCC indicators from qualifying services and diagnoses from claims and data for six months preceding the anchor admission or qualifying stay
	  • HCC indicators aggregated to risk variable groups (RV-HCC) according to NQF measure 1789 (Exhibit C.10.16 shows a crosswalk from 2013 HCC indicators to RV-HCC)
	  • HCC index, HCC indicators weighted by their relative weight in the 2013 CMS-HCC model

Utilization measures preceding the start of the anchor stay/ qualifying inpatient stay	• Alternative specifications
	  • Binary indicators for utilization of ED, inpatient, SNF, nursing facility, IRF, HHA services in the **six months** preceding the start of the episode
	  • Number of days of ED, inpatient, SNF, IRF, HHA service use in the **one month** preceding the start of the episode, and ever in a NF/SNF in the six months preceding the start of the episode
	  • Number of days of ED, inpatient, SNF, IRF, HHA service use in the **six months** preceding the start of the episode, and ever in a NF/SNF in the six months preceding the start of the episode

Geography	• Alternative specifications
	  • State indicators
	  • Census region indicators

Provider Characteristics	• Size • Ownership status • Whether the hospital was in a Comprehensive Care for Joint Replacement Model market for Model 2 episodes

Note: MS-DRG=Medicare severity diagnosis related group. ACO=accountable care organization. HCC=hierarchical condition category. NQF=National Quality Forum. ED=emergency department. SNF=skilled nursing facility. IRF=inpatient rehabilitation facility. HHA=home health agency. NF/SNF=institutional nursing facility.

Exhibit C.10: Crosswalk HCC Indicators to Risk Variable Group HCC

Risk Variable Group Label	CMS-HCCs	Description
rv1	**1, 5**	**Severe infection**
	1	HIV/AIDS
	5	Opportunistic infections
rv2	**111, 112**	**Other infectious disease & pneumonias**
	111	Aspiration and specified bacterial pneumonias
	112	Pneumococcal pneumonia, emphysema, lung abscess
rv3	**7**	**Metastatic cancer and acute leukemia**
rv4	**8, 9**	**Severe cancer**
	8	Lung, upper digestive tract, and other severe cancers
	9	Lymphatic, head and neck, brain, and other major cancers
rv6	**10**	**Breast, prostate, colorectal and other cancers and tumors**
rv9	**15-19, 119**	**Diabetes mellitus**
	15	Diabetes with renal or peripheral circulatory manifestation
	16	Diabetes with neurologic or other specified manifestation
	17	Diabetes with acute complications
	18	Diabetes with ophthalmologic or unspecified manifestation
	19	Diabetes without complication
	119	Proliferative diabetic retinopathy and vitreous hemorrhage
rv10	**21**	**Protein-calorie malnutrition**
rv11	**25, 26**	**End-Stage liver disease**
	25	End-Stage liver disease
	26	Cirrhosis of liver
rv12	**44**	**Severe hematological disorders**
rv14	**51, 52**	**Drug and alcohol disorders**
	51	Drug/alcohol psychosis
	52	Drug/alcohol dependence
rv15	**54, 55**	**Psychiatric comorbidity**
	54	Schizophrenia
	55	Major depressive, bipolar, and paranoid disorders
rv18	**67-69, 100, 101, 177**	**Hemiplegia, paraplegia, paralysis, functional disability**
	67	Quadriplegia, other extensive paralysis
	68	Paraplegia
	69	Spinal cord disorders/injuries
	100	Hemiplegia/hemiparesis
	101	Cerebral Palsy and other paralytic syndromes
	177	Amputation status, lower limb/amputation complications
rv19	**74**	**Seizure disorders and convulsions**
rv20	**80**	**Congestive Heart Failure**

Risk Variable Group Label	CMS-HCCs	Description
rv21	**81-83, 104, 105**	**Coronary atherosclerosis or angina, cerebrovascular disease**
	81	Acute myocardial infarction
	82	Unstable angina and other acute ischemic heart disease
	83	Angina pectoris/old myocardial infarction
	104	Vascular disease with complications
	105	Vascular disease
rv24	**92**	**Specified heart arrhythmias**
rv26	**108**	**Chronic obstructive pulmonary disease**
rv29	**130**	**Dialysis status**
rv30	**148, 149**	**Ulcers**
	148	Decubitus skin ulcer
	149	Chronic skin ulcer, except decubitus
rv31	**2**	**Septicemia/shock**
rv34	**79**	**Cardio-respiratory failure and shock**
rv39	**131**	**Renal failure**
rv40	**32**	**Pancreatic disease**
rv41	**38**	**Rheumatoid arthritis and inflammatory connective tissue disease**
rv42	**77**	**Respirator dependence/tracheostomy status**
rv43	**174**	**Major organ transplant status**
rv45	**158**	**Hip fracture/dislocation**

Note: CMS-HCC=Centers for Medicare & Medicaid Services hierarchical condition category.

Source: RV to HCC mapping based on the Hospital-wide Readmission Measure, *HWR Tech Report,* July 2012; modified to reflect the 2013 CMS HCC Factors that were applied to our sample.

Estimates from the multivariate regression models were used to construct model-predicted outcomes during the baseline and intervention periods for both BPCI-participating and comparison providers. To control for changes in service and case-mix over time, as well as differences between BPCI and comparison beneficiaries, we used the same reference population of beneficiaries to calculate predicted outcomes for BPCI and comparison group providers: all beneficiaries during the baseline and intervention period.

The DiD estimate was calculated by first taking the difference in the predicted outcomes between the baseline and intervention for both BPCI and comparison providers, and then taking the difference between the changes for BPCI and comparison providers. Taking the difference in such differentials across all BPCI beneficiaries yields the Effect of the Treatment on the Treated (ETT) analog of the DiD estimate. The ETT is the average gain from treatment for those who were actually treated. Standard errors of ETT estimation were computed using the Delta method.[7]

[7] The delta method expands a function of a random variable about its mean, usually with a Taylor approximation, and then takes the variance. Specifically, if Y= f(x) is any function of a random variable X, we need only

We attempted to construct a comparison group of providers that closely matched BPCI providers in key characteristics, but we could not guarantee that BPCI and comparison providers would have parallel trends during the baseline period for every outcome. We tested the null hypothesis that BPCI and comparison providers had parallel trends during the baseline for the key claim-based outcomes for all Model 2 provider types and clinical episodes in this evaluation: unplanned readmissions, emergency department use, all-cause mortality, and total Medicare allowed payment amounts for the inpatient stay plus 90 days post discharge. We also tested the null hypothesis of parallel trends in baseline for any outcome where there was visual evidence that the direction of change from baseline to intervention for BPCI differed from the change for the comparison group. In this report, we report all DiD estimates, but we note when we rejected the null hypothesis that there were parallel trends in baseline.

D. Net Savings to Medicare Due to BPCI

For Models 2 and 3 of the BPCI initiative, we calculated net Medicare savings by subtracting reconciliation payments from the change in aggregate non-standardized payments due to BPCI. Exhibit C.11 defines the measures used in this analysis.

Exhibit C.11: Definition of Measures Used in the Analysis of Net Savings to Medicare

Measure	Definition
Change in total standardized payments per episode	A per-episode estimate of the change in Medicare payments attributable to BPCI using the DiD regression model for the clinical episodes evaluated within the given Model. The payment outcome was the standardized Medicare paid amounts for services during the inpatient stay and 90 days post-discharge. The DiD estimate was multiplied by (-1) so that a positive estimate indicates a decline in payments.
Total number of BPCI episodes	The number of intervention episodes initiated by the BPCI participants across all 48 clinical episodes according to the reconciliation reports provided by CMS. These reports include all clinical episodes and provider types beyond those included in the analytical sample. Therefore, the total number of BPCI episodes may not match the number of episodes in the analytical sample.
Change in aggregate standardized payments	The DiD estimate of per-episode change in standardized payments multiplied by the total number of BPCI episodes.
Standardized to non-standardized conversion factor	A ratio of non-standardized to standardized Medicare paid amounts based on BPCI intervention episodes. For Model 2, the ratio included payments for services during the 90 days post-discharge period; for Model 3, the ratio included payments for services during the 90 days following the start of the episode. We used the same conversion factor from Q13 and applied it to Q16 estimates.
Change in aggregate non-standardized payments	The total change in standardized payments multiplied by the conversion factor. Non-standardized Medicare paid amounts reflect actual Medicare payments because they include adjustments for wages, practice expenses, and other initiatives (e.g., medical education).
Reconciliation payments	Includes performance payments to Awardees as well as any amounts owed to CMS (negative Net Payment Reconciliation Amounts) and other components. A positive value indicates that more funds have been paid than recovered. These data were extracted from CMS's HIGLAS system through Q16.

calculate the variance of X and the first derivative of the function to approximate the variance of Y. Let μ_x be the mean of X and $f'(x)$ be the first derivative, a Taylor expansion of $Y = f(x)$ about μ_x gives the approximation: $Y = f(x) \approx f(\mu_x) + f'(\mu_x)(x - \mu x)$. Taking the variance of both sides yields: $Var(Y) = Var(f(X)) \approx [f'(\mu_x)]^2 Var(X)$. For example, suppose $Y = X^2$. Then $f(x) = X^2$ and $f'(x) = 2x$, so that $Var(Y) \approx (2\mu_x)^2 Var(X)$.

Measure	Definition
Net savings to Medicare	For a given Model, the total change in non-standardized payments less reconciliation payments. A positive value indicates savings.
Reconciliation payments (downside risk not eliminated)	The performance payouts expected if CMS had not eliminated downside risk for some episodes and had required Awardees to return funds when payments were above the target.
Net savings to Medicare (downside risk not eliminated)	For a given Model, the change in aggregate non-standardized payments less reconciliation payments (downside risk not eliminated).

We also calculated net Medicare savings by clinical episode for Model 2 hospitals and Model 2 PGPs for the top 10 clinical episodes presented in this report. Because payments to the providers through the CMS HIGLAS system were not available at the clinical episode level, we used the reconciliation payments that CMS would have expected, had downside risk not been eliminated, from the provider-level reconciliation reports provided by CMS. To calculate net Medicare savings for each clinical episode, we subtracted the reconciliation payments from the change in aggregate non-standardized payments due to BPCI.

Exhibit C.12: Definition of Measures Used in the Analysis of Net Savings to Medicare with Downside Risk not Eliminated, by Clinical Episode

Measure	Definition
Number of BPCI intervention episodes	The number of intervention episodes initiated by BPCI providers for the clinical episode included in the DiD analysis for the change in standardized payments per episode.
Change in total standardized payments per episode	A per-episode estimate of the change in Medicare payments attributable to BPCI using the DiD regression model for the clinical episodes. The payment outcome was the standardized Medicare paid amounts for services during the inpatient stay and 90 days post-discharge. The DiD estimate was multiplied by (-1) so that a positive estimate indicates a decline in payments.
Standardized to non-standardized conversion factor	A ratio of non-standardized to standardized Medicare paid amounts based on BPCI intervention episodes at the clinical episode level. The ratio included payments for services during the 90-day post-discharge period for episodes initiated through Q4 2016.
Change in total non-standardized payments per episode	The change in total standardized payments per episode multiplied by the conversion factor. Non-standardized Medicare paid amounts reflect actual Medicare payments because they include adjustments for wages, practice expenses, and other initiatives (e.g., medical education).
Reconciliation payments (downside risk not eliminated)	The Medicare payouts expected if CMS had not eliminated downside risk and had required Awardees to return funds when payments were above the target.
Net savings to Medicare per episode (downside risk not eliminated)	For a given Model, the change in total non-standardized payments less reconciliation payments. A positive value indicates savings.

Appendix D: Supplemental Participant Characteristics

Exhibit D.1: Share of Model 2 Hospital BPCI Discharges among Discharges from All Eligible Hospitals, by Clinical Episode, Q4 2013 – Q3 2017

Clinical episode	Number of Eligible Discharges from BPCI Model 2 Hospitals	Share of All Eligible Hospital Discharges (%)[1]
Congestive heart failure	67,757	4.3%
Chronic obstructive pulmonary disease, bronchitis, asthma	38,691	2.9%
Hip & femur procedures except major joint	12,659	2.6%
Medical non-infectious orthopedic	12,996	2.3%
Major joint replacement of the lower extremity	196,353	10.8%
Renal failure	14,718	1.6%
Sepsis	58,107	2.7%
Simple pneumonia and respiratory infections	41,826	2.9%
Stroke	20,420	2.5%
Urinary tract infection	16,637	2.0%
M2 Hospitals Overall	**621,289**	**2.8%**

[1] All eligible hospital discharges include discharges that were eligible to be a BPCI episode from an eligible hospital. Eligible BPCI discharges are discharges in which the beneficiaries met the following criteria: 1) had a complete fee-for-service (FFS) enrollment history six months prior to anchor hospital admission; 2) maintained FFS enrollment in Medicare Parts A and B throughout the measurement period or until death; 3) had a measurement period that ended on or before December 31, 2017. Eligible hospitals include BPCI-participating hospitals and all other Inpatient Prospective Payment System (IPPS) hospitals excluding hospitals in Maryland.

Exhibit D.2: Share of Model 2 PGP BPCI Discharges among Discharges from All Eligible Hospitals, by Clinical Episode, Q4 2013 – Q3 2017

Clinical episode	Number of Eligible Discharges from BPCI Model 2 PGPs	Share of All Eligible Hospital Discharges (%)[1]
Congestive heart failure	39,983	2.5%
Chronic obstructive pulmonary disease, bronchitis, asthma	32,418	2.5%
Hip & femur procedures except major joint	11,209	2.3%
Medical non-infectious orthopedic	11,281	2.0%
Major joint replacement of the lower extremity	126,832	7.0%
Renal failure	18,494	2.1%
Sepsis	80,929	3.8%
Simple pneumonia and respiratory infections	38,545	2.6%
Stroke	15,201	1.9%
Urinary tract infection	19,421	2.3%
M2 PGP Overall	**562,656**	**2.5%**

[1] All eligible hospital discharges include discharges that were eligible to be a BPCI episode from an eligible hospital. Eligible BPCI discharges are discharges in which the beneficiaries met the following criteria: 1) had a complete fee-for-service (FFS) enrollment history six months prior to anchor hospital admission; 2) maintained FFS enrollment in Medicare Parts A and B throughout the measurement period or until death; 3) had a measurement period that ended on or before December 31, 2017. Eligible hospitals include BPCI-participating hospitals and all other Inpatient Prospective Payment System (IPPS) hospitals excluding hospitals in Maryland.

Appendix E: Impact of BPCI on Payment, Utilization, and Quality Measures, by Clinical Episode and Overall, Baseline to Intervention, Model 2 Hospitals

The following tables display risk-adjusted difference-in-differences results for the payment, utilization, and quality measures assessed in this report. Results are presented by clinical episode. Please observe the following abbreviations, which are used throughout the appendix:

- DiD = difference-in-differences
- LCI = lower confidence interval at the 5% and 10% level
- UCI = upper confidence interval at the 5% and 10% level
- PDP = post-discharge period
- IP = inpatient hospitalizations
- PAC = post-acute care
- SNF = skilled nursing facility
- IRF = inpatient rehabilitation facility
- HHA = home health agency

Note that sample sizes reflect the number of episodes initiated during the intervention period that met inclusion criteria for the given outcome. Medicare payments are risk-adjusted and standardized to remove the effect of geographic differences in wages, extra amounts to account for teaching programs and other policy factors. Results reflect Lewin analysis of Medicare claims, assessment, and enrollment data for episodes that began Q4 2011 through Q3 2012 (baseline) and Q4 2013 through Q3 2017 (intervention period) for BPCI episode initiators and the matched comparison providers.

Exhibit E.1: Chronic Obstructive Pulmonary Disease, Bronchitis, & Asthma Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	28,616	28,587	$18,935	$18,936	$18,713	$19,076	-$362	-$844	$121	-$766	$43
SNF standardized allowed amount, 90-day PDP	28,990	29,014	$2,672	$2,524	$2,698	$2,744	-$194	-$413	$24	-$377	-$11
IRF standardized allowed amount, 90-day PDP	28,990	29,014	$459	$461	$391	$466	-$73	-$173	$27	-$157	$11
HHA standardized allowed amount, 90-day PDP	28,990	29,014	$1,118	$1,228	$1,135	$1,130	$115	$54	$175	$64	$165
Number of SNF days, 90-day PDP[1]	5,866	5,075	30.5	25.9	30.8	28.8	-2.7	-4.2	-1.1	-4.0	-1.3
Patients discharged to PAC settings	29,051	29,056	39.7%	40.8%	39.7%	39.5%	1.3	-0.2	2.7	0.0	2.5
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	12,517	11,082	37.7%	35.4%	37.6%	37.5%	-2.3	-4.8	0.3	-4.4	-0.1
Emergency department use, 90-day PDP	28,607	28,697	24.0%	26.2%	24.5%	26.3%	0.4*	-0.8	1.6	-0.6	1.4
Unplanned readmission rate, 90-day PDP	28,607	28,697	32.3%	30.7%	32.8%	31.2%	0.0	-1.3	1.3	-1.1	1.1
All-cause mortality rate, 90-day PDP	28,386	28,548	8.6%	7.0%	8.3%	7.1%	-0.3	-1.1	0.5	-1.0	0.3

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.2: Congestive Heart Failure Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	49,831	49,785	$24,523	$24,820	$24,009	$24,710	-$404	-$885	$76	-$808	-$1
SNF standardized allowed amount, 90-day PDP	50,065	50,104	$4,127	$3,935	$3,896	$4,055	-$351	-$591	-$111	-$552	-$149
IRF standardized allowed amount, 90-day PDP	50,065	50,104	$513	$543	$502	$601	-$69	-$164	$26	-$149	$11
HHA standardized allowed amount, 90-day PDP	50,065	50,104	$1,426	$1,567	$1,417	$1,455	$104	$38	$170	$48	$160
Number of SNF days, 90-day PDP[1]	14,202	12,925	30.7	27.4	31.2	29.3	-1.4	-2.5	-0.4	-2.4	-0.5
Patients discharged to PAC settings	50,161	50,174	54.0%	54.3%	53.7%	52.2%	1.7	0.0	3.4	0.3	3.1
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	28,019	25,744	43.4%	41.1%	42.1%	41.6%	-1.8	-3.6	0.0	-3.3	-0.3
Emergency department use, 90-day PDP	49,604	49,698	22.2%	24.1%	21.9%	24.2%	-0.4	-1.3	0.6	-1.2	0.4
Unplanned readmission rate, 90-day PDP	49,604	49,698	37.5%	34.8%	37.3%	35.2%	-0.7	-1.8	0.4	-1.7	0.2
All-cause mortality rate, 90-day PDP	48,925	49,238	18.5%	16.9%	18.2%	16.6%	0.0	-1.0	0.9	-0.8	0.8

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.3: Hip & Femur Procedures except Major Joint Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	11,138	11,127	$43,982	$43,219	$43,554	$45,019	-$2,228	-$3,148	-$1,308	-$3,000	-$1,456
SNF standardized allowed amount, 90-day PDP	11,152	11,151	$17,834	$16,254	$17,151	$17,878	-$2,306	-$3,244	-$1,368	-$3,093	-$1,518
IRF standardized allowed amount, 90-day PDP	11,152	11,151	$3,317	$3,219	$3,651	$3,696	-$143	-$713	$426	-$621	$335
HHA standardized allowed amount, 90-day PDP	11,152	11,151	$1,958	$2,334	$1,935	$2,126	$185	$78	$293	$95	$275
Number of SNF days, 90-day PDP[1]	8,727	8,458	45.6	37.9	45.2	42.1	-4.6	-6.3	-2.9	-6.0	-3.2
Patients discharged to PAC settings	11,179	11,179	93.7%	94.2%	93.5%	93.8%	0.2	-0.9	1.4	-0.7	1.2
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	10,585	10,439	93.3%	92.8%	93.2%	93.2%	-0.7	-2.1	0.7	-1.9	0.5
Emergency department use, 90-day PDP	11,145	11,142	16.3%	18.7%	16.7%	18.9%	0.2	-1.5	1.9	-1.2	1.7
Unplanned readmission rate, 90-day PDP	11,145	11,142	21.8%	19.8%	22.1%	19.5%	0.6	-1.2	2.5	-0.9	2.2
All-cause mortality rate, 90-day PDP	10,958	10,926	10.4%	9.9%	9.7%	9.8%	-0.6	-2.0	0.7	-1.7	0.5

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.4: Major Joint Replacement of the Lower Extremity Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	145,917	145,935	$27,449	$25,689	$26,979	$26,483	-$1,265	-$1,596	-$934	-$1,543	-$987
SNF standardized allowed amount, 90-day PDP	146,257	146,383	$5,388	$4,074	$5,248	$4,678	-$744	-$1,016	-$471	-$972	-$515
IRF standardized allowed amount, 90-day PDP	146,257	146,383	$1,589	$944	$1,420	$1,180	-$405	-$593	-$218	-$562	-$248
HHA standardized allowed amount, 90-day PDP	146,257	146,383	$2,180	$2,223	$2,281	$2,275	$50	-$54	$154	-$37	$138
Number of SNF days, 90-day PDP[1]	49,143	53,230	24.3	21.3	23.8	23.0	-2.2	-2.8	-1.6	-2.7	-1.7
Patients discharged to PAC settings	146,482	146,481	86.7%	78.8%	89.4%	84.6%	-3.1	-5.8	-0.5	-5.4	-0.9
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	118,337	121,232	61.5%	46.3%	59.3%	49.9%	-5.7	-8.1	-3.3	-7.8	-3.6
Emergency department use, 90-day PDP	146,204	146,356	13.5%	14.5%	13.8%	14.7%	0.1	-0.4	0.7	-0.3	0.6
Unplanned readmission rate, 90-day PDP	146,204	146,356	9.9%	8.3%	9.5%	8.2%	-0.3	-0.8	0.1	-0.7	0.0
All-cause mortality rate, 90-day PDP	145,763	145,970	1.8%	1.7%	1.9%	1.8%	-0.1	-0.3	0.1	-0.2	0.1

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.5: Medical Non-infectious Orthopedic Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	9,747	9,694	$27,693	$27,460	$26,211	$28,212	-$2,234	-$3,264	-$1,204	-$3,098	-$1,369
SNF standardized allowed amount, 90-day PDP	9,888	9,878	$10,173	$9,309	$9,745	$10,532	-$1,651	-$2,462	-$839	-$2,331	-$970
IRF standardized allowed amount, 90-day PDP	9,888	9,878	$1,867	$1,882	$1,179	$1,562	-$368	-$699	-$38	-$646	-$91
HHA standardized allowed amount, 90-day PDP	9,888	9,878	$1,672	$1,967	$1,663	$1,881	$76	-$26	$178	-$10	$162
Number of SNF days, 90-day PDP[1]	5,326	5,213	39.3	32.2	39.0	36.1	-4.2	-6.3	-2.1	-6.0	-2.4
Patients discharged to PAC settings	9,897	9,901	70.5%	72.0%	68.0%	71.2%	-1.7	-3.9	0.6	-3.5	0.2
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	7,192	6,995	75.3%	76.0%	73.3%	76.2%	-2.2	-4.9	0.6	-4.4	0.1
Emergency department use, 90-day PDP	9,805	9,794	20.6%	23.3%	21.4%	22.6%	1.4	-0.4	3.3	-0.1	3.0
Unplanned readmission rate, 90-day PDP	9,805	9,794	23.3%	21.6%	23.5%	22.3%	-0.5	-2.4	1.4	-2.1	1.0
All-cause mortality rate, 90-day PDP	9,724	9,729	7.2%	7.0%	6.7%	7.4%	-0.8*	-2.0	0.4	-1.8	0.2

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.6: Renal Failure Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	10,757	10,737	$24,694	$23,934	$24,857	$25,296	-$1,199	-$2,089	-$310	-$1,946	-$453
SNF standardized allowed amount, 90-day PDP	10,855	10,855	$5,773	$5,319	$5,545	$5,872	-$781	-$1,326	-$236	-$1,238	-$324
IRF standardized allowed amount, 90-day PDP	10,855	10,855	$612	$705	$585	$955	-$277	-$468	-$85	-$437	-$116
HHA standardized allowed amount, 90-day PDP	10,855	10,855	$1,186	$1,331	$1,221	$1,311	$55	-$36	$146	-$21	$132
Number of SNF days, 90-day PDP[1]	3,739	3,332	36.0	30.3	36.4	34.5	-3.8	-6.2	-1.5	-5.8	-1.8
Patients discharged to PAC settings	10,869	10,865	52.2%	52.0%	51.7%	51.7%	-0.2	-2.4	1.9	-2.0	1.6
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	5,822	5,456	57.8%	56.1%	57.7%	56.7%	-0.7	-4.0	2.6	-3.5	2.1
Emergency department use, 90-day PDP	10,733	10,757	23.3%	25.0%	22.6%	24.1%	0.2	-1.5	1.9	-1.3	1.6
Unplanned readmission rate, 90-day PDP	10,733	10,757	29.8%	28.6%	29.8%	29.6%	-1.0	-2.9	1.0	-2.6	0.7
All-cause mortality rate, 90-day PDP	10,611	10,647	17.3%	16.1%	17.2%	15.2%	0.8	-1.0	2.5	-0.7	2.2

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.7: Sepsis Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	39,470	39,409	$31,537	$30,825	$31,499	$31,436	-$649	-$1,492	$194	-$1,356	$59
SNF standardized allowed amount, 90-day PDP	39,644	39,632	$6,093	$5,735	$5,699	$6,008	-$667	-$1,020	-$314	-$963	-$371
IRF standardized allowed amount, 90-day PDP	39,644	39,632	$647	$670	$657	$781	-$101	-$242	$39	-$220	$17
HHA standardized allowed amount, 90-day PDP	39,644	39,632	$1,043	$1,194	$1,085	$1,135	$102	$44	$160	$53	$151
Number of SNF days, 90-day PDP[1]	14,022	12,783	35.3	31.4	35.1	33.6	-2.5	-3.8	-1.2	-3.6	-1.4
Patients discharged to PAC settings	39,706	39,744	55.6%	54.0%	55.6%	53.9%	0.1	-1.6	1.8	-1.3	1.5
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	22,041	20,802	68.0%	63.1%	66.2%	64.2%	-2.9	-5.2	-0.6	-4.8	-1.0
Emergency department use, 90-day PDP	39,219	39,293	19.0%	20.9%	18.6%	20.6%	-0.1	-1.1	0.9	-1.0	0.8
Unplanned readmission rate, 90-day PDP	39,219	39,293	29.4%	27.8%	29.1%	28.0%	-0.6	-1.8	0.6	-1.7	0.4
All-cause mortality rate, 90-day PDP	38,608	38,709	22.3%	20.1%	22.1%	19.7%	0.1	-1.0	1.3	-0.8	1.1

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.8: Simple Pneumonia and Respiratory Infections Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	31,863	31,859	$23,118	$22,415	$22,860	$22,535	-$378	-$871	$115	-$792	$36
SNF standardized allowed amount, 90-day PDP	32,044	32,075	$4,729	$4,356	$4,486	$4,616	-$504	-$786	-$223	-$741	-$268
IRF standardized allowed amount, 90-day PDP	32,044	32,075	$460	$518	$441	$485	$13	-$82	$108	-$67	$93
HHA standardized allowed amount, 90-day PDP	32,044	32,075	$1,095	$1,247	$1,078	$1,162	$69	$17	$122	$25	$113
Number of SNF days, 90-day PDP[1]	9,639	8,801	32.8	28.5	32.8	31.2	-2.8	-4.2	-1.4	-3.9	-1.6
Patients discharged to PAC settings	32,117	32,119	49.6%	48.9%	49.7%	47.7%	1.3	-0.2	2.8	0.0	2.6
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	16,229	15,191	58.6%	54.2%	57.7%	54.2%	-0.9	-3.0	1.1	-2.7	0.8
Emergency department use, 90-day PDP	31,821	31,893	20.2%	21.8%	19.8%	21.7%	-0.3	-1.3	0.7	-1.1	0.6
Unplanned readmission rate, 90-day PDP	31,821	31,893	26.9%	24.8%	26.6%	25.0%	-0.7	-1.7	0.4	-1.6	0.3
All-cause mortality rate, 90-day PDP	31,383	31,541	17.9%	15.4%	17.1%	14.8%	-0.1	-1.1	0.8	-0.9	0.6

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.9: Stroke Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	17,823	17,770	$31,352	$31,336	$31,859	$32,194	-$351	-$1,342	$640	-$1,183	$480
SNF standardized allowed amount, 90-day PDP	17,886	17,899	$7,884	$7,609	$7,840	$7,717	-$151	-$730	$427	-$637	$334
IRF standardized allowed amount, 90-day PDP	17,886	17,899	$5,572	$5,744	$5,897	$6,436	-$366	-$872	$139	-$791	$58
HHA standardized allowed amount, 90-day PDP	17,886	17,899	$1,471	$1,640	$1,525	$1,616	$78	-$13	$170	$1	$155
Number of SNF days, 90-day PDP[1]	6,596	6,095	41.3	37.9	41.6	40.0	-1.8	-3.7	0.1	-3.4	-0.2
Patients discharged to PAC settings	17,933	17,931	66.2%	64.2%	67.0%	64.9%	0.0	-1.9	1.9	-1.6	1.6
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	11,734	11,538	78.0%	77.9%	78.5%	77.7%	0.8	-1.3	2.8	-1.0	2.5
Emergency department use, 90-day PDP	17,771	17,766	20.8%	22.3%	19.3%	21.7%	-0.9	-2.5	0.7	-2.2	0.5
Unplanned readmission rate, 90-day PDP	17,771	17,766	22.3%	19.3%	22.0%	19.3%	-0.4	-2.0	1.2	-1.7	1.0
All-cause mortality rate, 90-day PDP	17,680	17,660	17.0%	15.5%	16.7%	15.5%	-0.3*	-1.8	1.1	-1.5	0.9

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.10: Urinary Tract Infection Episodes, Model 2 Hospitals, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	12,237	12,228	$22,164	$21,870	$22,358	$23,082	-$1,018*	-$1,842	-$194	-$1,710	-$327
SNF standardized allowed amount, 90-day PDP	12,436	12,433	$6,571	$6,018	$6,347	$6,810	-$1,014	-$1,574	-$455	-$1,484	-$545
IRF standardized allowed amount, 90-day PDP	12,436	12,433	$760	$763	$735	$843	-$104	-$310	$102	-$277	$69
HHA standardized allowed amount, 90-day PDP	12,436	12,433	$1,290	$1,540	$1,413	$1,501	$162	$65	$258	$81	$243
Number of SNF days, 90-day PDP[1]	4,727	4,414	37.4	31.1	36.5	34.6	-4.4	-6.3	-2.4	-6.0	-2.7
Patients discharged to PAC settings	12,456	12,456	57.6%	58.0%	56.5%	56.6%	0.3	-1.8	2.5	-1.4	2.1
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	7,388	6,989	60.3%	57.6%	57.7%	58.0%	-3.1	-6.2	0.1	-5.7	-0.4
Emergency department use, 90-day PDP	12,362	12,374	22.7%	25.5%	23.4%	24.2%	2.0	0.2	3.7	0.5	3.5
Unplanned readmission rate, 90-day PDP	12,362	12,374	26.6%	25.9%	28.3%	26.4%	1.3	-0.8	3.3	-0.5	3.0
All-cause mortality rate, 90-day PDP	12,193	12,191	12.5%	10.9%	11.3%	10.0%	-0.2	-1.5	1.1	-1.3	0.9

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit E.11: Model 2 Hospital Episodes Overall, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	448,815	448,476	$26,753	$26,316	$26,488	$26,851	-$800	-$1,072	-$527	-$1,028	-$571
SNF standardized allowed amount, 90-day PDP	451,493	451,695	$5,246	$4,554	$5,095	$5,061	-$658	-$838	-$478	-$809	-$507
IRF standardized allowed amount, 90-day PDP	451,493	451,695	$1,227	$1,024	$1,130	$1,134	-$206	-$314	-$99	-$296	-$116
HHA standardized allowed amount, 90-day PDP	451,493	451,695	$1,524	$1,655	$1,545	$1,593	$82	$35	$130	$42	$122
Number of SNF days, 90-day PDP[1]	144,193	141,456	31.2	27.3	30.9	29.6	-2.5	-3.1	-2.0	-3.0	-2.1
Patients discharged to PAC settings	452,236	452,279	62.7%	60.5%	62.8%	61.0%	-0.3	-1.7	1.0	-1.4	0.7
Patients discharged to institutional PAC settings (out of those discharged to any PAC setting)	284,826	277,419	59.1%	51.5%	58.1%	53.8%	-3.3	-4.8	-1.9	-4.6	-2.1
Emergency department use, 90-day PDP	448,653	449,223	18.8%	20.4%	18.9%	20.6%	-0.1	-0.4	0.3	-0.4	0.2
Unplanned readmission rate, 90-day PDP	448,653	449,223	22.4%	20.7%	22.5%	20.9%	-0.1	-0.5	0.3	-0.5	0.2
All-cause mortality rate, 90-day PDP	445,177	446,154	10.1%	9.1%	9.8%	8.9%	-0.1	-0.4	0.1	-0.3	0.1

Note: These results include the 32 Model 2 hospital clinical episodes that had sufficient volume to allow for risk-adjustment.

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Appendix F: Impact of BPCI on Allowed Payment, Utilization, and Quality Measures, by Clinical Episode and Overall, Baseline to Intervention, Model 2 PGPs

The following tables display risk-adjusted difference-in-differences results for the payment, utilization, and quality measures assessed in this report. Results are presented by clinical episode. Please observe the following abbreviations, which are used throughout the appendix:

- DiD = difference-in-differences
- LCI = lower confidence interval at the 5% and 10% level
- UCI = upper confidence interval at the 5% and 10% level
- PDP = post-discharge period
- IP = inpatient hospitalizations
- PAC = post-acute care
- SNF = skilled nursing facility
- IRF = inpatient rehabilitation facility
- HHA = home health agency

Note that sample sizes reflect the number of episodes initiated during the intervention period that met inclusion criteria for the given outcome. Medicare payments are risk-adjusted and standardized to remove the effect of geographic differences in wages, extra amounts to account for teaching programs and other policy factors. Results reflect Lewin analysis of Medicare claims, assessment, and enrollment data for episodes that began Q4 2011 through Q3 2012 (baseline) and Q4 2013 through Q3 2017 (intervention period) for BPCI episode initiators and the matched comparison providers.

Exhibit F.1: Chronic Obstructive Pulmonary Disease, Bronchitis, & Asthma Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	11,881	11,836	$18,445	$19,129	$18,476	$19,087	$73	-$585	$731	-$479	$625
SNF standardized allowed amount, 90-day PDP	11,991	11,997	$2,483	$2,402	$2,281	$2,634	-$434	-$736	-$132	-$687	-$180
IRF standardized allowed amount, 90-day PDP	11,991	11,997	$374	$451	$326	$411	-$7	-$150	$135	-$127	$112
HHA standardized allowed amount, 90-day PDP	11,991	11,997	1,073	1,110	1,134	1,162	10	-78	97	-64	83
Number of SNF days, 90-day PDP[1]	2,050	2,093	30.7	27.2	29.9	29.2	-2.8	-5.0	-0.5	-4.7	-0.8
Patients discharged to PAC settings	12,003	12,008	36.6%	37.8%	38.2%	38.6%	0.8	-1.5	3.0	-1.1	2.7
Patients discharged to institutional PAC (of those discharged to any PAC setting)	4,686	4,502	34.0%	34.0%	34.0%	35.5%	-1.6	-5.1	1.9	-4.5	1.3
Emergency department use, 90-day PDP	11,831	11,884	26.0%	28.7%	24.1%	27.2%	-0.4	-2.3	1.5	-2.0	1.2
Unplanned readmission rate, 90-day PDP	11,831	11,884	31.6%	31.0%	33.1%	30.0%	2.4	0.5	4.4	0.8	4.1
All-cause mortality rate, 90-day PDP	11,749	11,814	7.5%	7.1%	8.4%	7.5%	0.5	-0.5	1.6	-0.4	1.4

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.2: Congestive Heart Failure Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	12,693	12,648	$24,907	$25,231	$24,463	$25,840	-$1,053*	-$1,976	-$129	-$1,828	-$278
SNF standardized allowed amount, 90-day PDP	12,723	12,726	$4,070	$4,000	$3,702	$4,240	-$609	-$978	-$240	-$919	-$299
IRF standardized allowed amount, 90-day PDP	12,723	12,726	$575	$622	$531	$540	$39	-$148	$225	-$118	$195
HHA standardized allowed amount, 90-day PDP	12,723	12,726	1,471	1,617	1,469	1,539	76	-44	196	-24	177
Number of SNF days, 90-day PDP[1]	3,614	3,376	30.4	28.0	29.7	29.3	-2.0	-3.9	-0.2	-3.6	-0.5
Patients discharged to PAC settings	12,741	12,744	54.8%	55.5%	55.0%	55.0%	0.7	-2.0	3.3	-1.5	2.9
Patients discharged to institutional PAC (of those discharged to any PAC setting)	7,327	6,849	43.4%	40.3%	42.2%	41.7%	-2.6	-6.0	0.8	-5.5	0.3
Emergency department use, 90-day PDP	12,621	12,613	23.3%	25.7%	21.8%	24.7%	-0.5	-2.3	1.4	-2.0	1.1
Unplanned readmission rate, 90-day PDP	12,621	12,613	37.6%	34.6%	38.1%	35.2%	-0.1	-2.3	2.2	-2.0	1.8
All-cause mortality rate, 90-day PDP	12,475	12,514	18.7%	16.7%	18.3%	16.1%	0.1	-1.5	1.8	-1.3	1.6

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.3: Hip & Femur Procedures except Major Joint Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	7,383	7,359	$43,802	$44,163	$42,493	$44,483	-$1,629	-$2,840	-$418	-$2,646	-$612
SNF standardized allowed amount, 90-day PDP	7,388	7,384	$17,901	$18,195	$16,680	$18,132	-$1,157	-$2,232	-$82	-$2,059	-$254
IRF standardized allowed amount, 90-day PDP	7,388	7,384	$3,146	$2,591	$3,178	$3,194	-$571	-$1,305	$164	-$1,187	$46
HHA standardized allowed amount, 90-day PDP	7,388	7,384	1,982	2,153	1,910	2,012	69	-64	202	-42	181
Number of SNF days, 90-day PDP[1]	5,877	5,641	45.7	41.2	44.1	42.5	-2.8	-4.7	-0.9	-4.4	-1.2
Patients discharged to PAC settings	7,401	7,397	93.3%	93.5%	91.9%	93.4%	-1.3	-2.9	0.3	-2.7	0.0
Patients discharged to institutional PAC (of those discharged to any PAC setting)	6,927	6,902	92.5%	92.4%	92.4%	92.6%	-0.3	-1.9	1.2	-1.6	1.0
Emergency department use, 90-day PDP	7,384	7,375	17.8%	18.5%	18.0%	18.9%	-0.2	-2.3	1.9	-2.0	1.6
Unplanned readmission rate, 90-day PDP	7,384	7,375	20.8%	18.8%	21.2%	18.5%	0.7	-1.5	2.9	-1.1	2.6
All-cause mortality rate, 90-day PDP	7,230	7,217	9.5%	10.8%	11.1%	10.3%	2.0	0.3	3.8	0.6	3.5

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.4: Major Joint Replacement of the Lower Extremity Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	90,927	90,774	$26,029	$23,424	$25,628	$25,144	-$2,121	-$2,480	-$1,761	-$2,423	-$1,819
SNF standardized allowed amount, 90-day PDP	90,934	90,940	$4,817	$3,050	$4,745	$4,168	-$1,190	-$1,469	-$911	-$1,424	-$956
IRF standardized allowed amount, 90-day PDP	90,934	90,940	$1,184	$415	$1,153	$994	-$611	-$814	-$407	-$781	-$440
HHA standardized allowed amount, 90-day PDP	90,934	90,940	2,147	1,696	1,955	1,933	-429	-562	-296	-541	-318
Number of SNF days, 90-day PDP[1]	25,491	28,943	24.2	18.9	23.9	23.1	-4.5	-5.3	-3.7	-5.2	-3.9
Patients discharged to PAC settings	90,987	90,989	83.3%	67.1%	78.8%	72.8%	-10.2	-13.9	-6.5	-13.3	-7.1
Patients discharged to institutional PAC (of those discharged to any PAC setting)	57,312	69,360	57.4%	44.1%	59.1%	49.4%	-3.6	-6.3	-0.8	-5.9	-1.3
Emergency department use, 90-day PDP	90,920	90,920	13.6%	13.9%	13.2%	14.3%	-0.8	-1.4	-0.1	-1.3	-0.2
Unplanned readmission rate, 90-day PDP	90,920	90,920	9.0%	7.4%	8.5%	7.5%	-0.5	-1.1	0.0	-1.0	-0.1
All-cause mortality rate, 90-day PDP	90,676	90,678	1.8%	1.7%	1.8%	1.7%	-0.1	-0.3	0.2	-0.3	0.1

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.5: Medical Non-infectious Orthopedic Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	3,954	3,916	$27,086	$27,469	$26,147	$28,165	-$1,636	-$2,934	-$337	-$2,726	-$546
SNF standardized allowed amount, 90-day PDP	4,002	4,004	$9,772	$10,142	$8,535	$10,071	-$1,165	-$2,112	-$219	-$1,960	-$371
IRF standardized allowed amount, 90-day PDP	4,002	4,004	$1,246	$1,474	$2,066	$1,965	$330	-$158	$818	-$80	$739
HHA standardized allowed amount, 90-day PDP	4,002	4,004	1,531	1,708	1,650	1,767	61	-99	221	-73	195
Number of SNF days, 90-day PDP[1]	2,085	2,033	38.8	36.1	37.1	36.8	-2.5	-4.9	-0.1	-4.5	-0.5
Patients discharged to PAC settings	4,003	4,006	68.9%	69.2%	66.5%	69.1%	-2.3	-5.6	1.0	-5.1	0.4
Patients discharged to institutional PAC (of those discharged to any PAC setting)	2,800	2,755	74.4%	74.9%	71.7%	74.7%	-2.4	-6.1	1.3	-5.5	0.7
Emergency department use, 90-day PDP	3,958	3,979	24.5%	25.7%	22.6%	24.5%	-0.6*	-4.0	2.8	-3.5	2.2
Unplanned readmission rate, 90-day PDP	3,958	3,979	23.8%	21.6%	23.2%	21.8%	-0.9	-3.7	2.0	-3.3	1.6
All-cause mortality rate, 90-day PDP	3,911	3,950	8.5%	8.2%	7.4%	7.6%	-0.4	-2.2	1.3	-1.9	1.0

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.6: Renal Failure Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	7,013	6,956	$24,220	$24,604	$24,443	$24,607	$220	-$919	$1,359	-$736	$1,176
SNF standardized allowed amount, 90-day PDP	7,044	7,039	$5,180	$5,545	$5,395	$5,721	$39	-$563	$641	-$466	$544
IRF standardized allowed amount, 90-day PDP	7,044	7,039	$678	$764	$603	$732	-$43	-$284	$197	-$245	$159
HHA standardized allowed amount, 90-day PDP	7,044	7,039	1,163	1,285	1,210	1,287	45	-67	157	-49	139
Number of SNF days, 90-day PDP[1]	2,267	2,284	33.9	32.9	34.5	32.7	0.9	-1.5	3.3	-1.1	2.9
Patients discharged to PAC settings	7,047	7,043	51.8%	49.9%	51.6%	51.4%	-1.8	-4.6	1.1	-4.2	0.6
Patients discharged to institutional PAC (of those discharged to any PAC setting)	3,606	3,568	56.7%	56.0%	55.8%	58.4%	-3.3	-7.5	0.8	-6.8	0.2
Emergency department use, 90-day PDP	6,961	6,992	23.3%	25.8%	22.9%	24.8%	0.6	-1.9	3.0	-1.5	2.6
Unplanned readmission rate, 90-day PDP	6,961	6,992	29.4%	29.6%	29.1%	28.3%	1.0	-1.5	3.6	-1.1	3.2
All-cause mortality rate, 90-day PDP	6,882	6,923	17.5%	16.5%	16.5%	15.6%	-0.1	-2.6	2.5	-2.2	2.1

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.7: Sepsis Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	26,348	26,199	$30,056	$29,544	$30,500	$30,076	-$88	-$994	$818	-$849	$673
SNF standardized allowed amount, 90-day PDP	26,388	26,378	$5,573	$5,538	$5,496	$5,661	-$200	-$603	$202	-$538	$138
IRF standardized allowed amount, 90-day PDP	26,388	26,378	$651	$683	$648	$719	-$39	-$219	$140	-$190	$111
HHA standardized allowed amount, 90-day PDP	26,388	26,378	1,099	1,139	1,116	1,132	23	-47	94	-35	82
Number of SNF days, 90-day PDP[1]	8,695	8,483	34.4	32.0	34.2	32.6	-0.8	-2.3	0.8	-2.0	0.5
Patients discharged to PAC settings	26,385	26,399	54.2%	52.4%	55.0%	52.9%	0.3	-1.6	2.3	-1.3	1.9
Patients discharged to institutional PAC (of those discharged to any PAC setting)	13,990	13,733	64.3%	61.3%	64.4%	62.8%	-1.4	-4.0	1.1	-3.6	0.7
Emergency department use, 90-day PDP	26,103	26,161	20.4%	21.9%	20.3%	21.9%	-0.1	-1.6	1.4	-1.3	1.1
Unplanned readmission rate, 90-day PDP	26,103	26,161	28.4%	26.1%	29.1%	26.9%	-0.2*	-1.7	1.4	-1.5	1.1
All-cause mortality rate, 90-day PDP	25,676	25,805	20.8%	19.5%	20.2%	18.4%	0.5	-0.9	1.9	-0.7	1.6

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.8: Simple Pneumonia and Respiratory Infections Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	13,344	13,305	$22,415	$22,260	$22,768	$22,635	-$21	-$825	$783	-$696	$654
SNF standardized allowed amount, 90-day PDP	13,385	13,385	$4,143	$4,340	$4,205	$4,462	-$60	-$465	$345	-$400	$280
IRF standardized allowed amount, 90-day PDP	13,385	13,385	$458	$527	$454	$502	$21	-$126	$167	-$103	$144
HHA standardized allowed amount, 90-day PDP	13,385	13,385	1,054	1,178	1,054	1,190	-12	-98	75	-84	61
Number of SNF days, 90-day PDP[1]	3,667	3,663	31.7	30.4	32.2	31.1	-0.2	-2.2	1.7	-1.8	1.4
Patients discharged to PAC settings	13,399	13,402	47.7%	47.3%	48.1%	47.5%	0.2	-2.4	2.8	-1.9	2.4
Patients discharged to institutional PAC (of those discharged to any PAC setting)	6,503	6,339	54.3%	52.2%	56.2%	53.8%	0.3	-2.8	3.4	-2.3	2.9
Emergency department use, 90-day PDP	13,270	13,307	21.8%	23.3%	20.8%	23.1%	-0.8*	-2.6	0.9	-2.3	0.6
Unplanned readmission rate, 90-day PDP	13,270	13,307	25.9%	24.5%	26.6%	24.3%	0.9	-0.9	2.7	-0.6	2.4
All-cause mortality rate, 90-day PDP	13,116	13,141	17.9%	15.1%	17.7%	14.4%	0.5	-1.0	2.0	-0.7	1.8

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.9: Stroke Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	4,059	4,052	$29,988	$29,613	$29,104	$29,237	-$508	-$2,289	$1,273	-$2,003	$987
SNF standardized allowed amount, 90-day PDP	4,069	4,067	$7,558	$7,430	$7,492	$7,242	$122	-$1,006	$1,250	-$825	$1,069
IRF standardized allowed amount, 90-day PDP	4,069	4,067	$5,468	$5,403	$4,719	$5,057	-$404	-$1,302	$494	-$1,158	$350
HHA standardized allowed amount, 90-day PDP	4,069	4,067	1,426	1,642	1,431	1,602	44	-126	214	-99	187
Number of SNF days, 90-day PDP[1]	1,406	1,433	39.8	38.0	39.7	37.7	0.2	-3.2	3.6	-2.7	3.1
Patients discharged to PAC settings	4,062	4,065	64.6%	63.0%	63.0%	63.8%	-2.3	-6.5	1.9	-5.8	1.2
Patients discharged to institutional PAC (of those discharged to any PAC setting)	2,589	2,593	77.9%	76.3%	77.9%	75.4%	0.9	-3.2	4.9	-2.5	4.2
Emergency department use, 90-day PDP	4,044	4,042	20.7%	22.4%	19.7%	22.7%	-1.3	-4.3	1.8	-3.8	1.3
Unplanned readmission rate, 90-day PDP	4,044	4,042	20.4%	16.9%	21.0%	17.8%	-0.4	-3.4	2.7	-2.9	2.2
All-cause mortality rate, 90-day PDP	4,016	4,019	17.7%	15.2%	18.0%	15.3%	0.2	-2.6	3.1	-2.2	2.6

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.10: Urinary Tract Infection Episodes, Model 2 PGP, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	7,421	7,370	$22,273	$22,999	$22,684	$23,258	$152	-$878	$1,181	-$713	$1,016
SNF standardized allowed amount, 90-day PDP	7,500	7,501	$6,799	$6,969	$6,451	$7,096	-$475	-$1,137	$187	-$1,031	$81
IRF standardized allowed amount, 90-day PDP	7,500	7,501	$324	$649	$444	$664	$105	-$102	$313	-$69	$280
HHA standardized allowed amount, 90-day PDP	7,500	7,501	1,306	1,490	1,407	1,506	86	-33	204	-14	185
Number of SNF days, 90-day PDP[1]	2,887	2,771	36.3	34.2	37.4	35.9	-0.7	-2.8	1.4	-2.4	1.1
Patients discharged to PAC settings	7,507	7,507	56.9%	58.1%	56.5%	56.9%	0.8	-2.1	3.7	-1.6	3.3
Patients discharged to institutional PAC (of those discharged to any PAC setting)	4,413	4,249	60.3%	58.5%	56.9%	58.4%	-3.3	-7.1	0.6	-6.5	0.0
Emergency department use, 90-day PDP	7,454	7,472	24.4%	27.5%	22.8%	25.4%	0.6	-1.9	3.1	-1.5	2.7
Unplanned readmission rate, 90-day PDP	7,454	7,472	26.5%	25.9%	28.6%	26.9%	1.0	-1.2	3.2	-0.8	2.9
All-cause mortality rate, 90-day PDP	7,358	7,349	13.2%	10.8%	11.1%	10.4%	-1.8*	-3.4	-0.2	-3.1	-0.4

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Exhibit F.11: Model 2 PGPs Overall, Q4 2011 – Q3 2017

Outcome	Number of BPCI Intervention Episodes	Number of Comparison Intervention Episodes	BPCI Baseline	BPCI Intervention	Comparison Baseline	Comparison Intervention	DiD	95% LCI	95% UCI	90% LCI	90% UCI
Standardized total allowed payment amount, IP through 90-day PDP	226,330	225,477	$25,401	$24,586	$25,329	$25,728	-$1,214	-$1,550	-$878	-$1,496	-$932
SNF standardized allowed amount, 90-day PDP	226,906	226,891	$5,053	$4,248	$4,898	$4,874	-$781	-$992	-$570	-$958	-$604
IRF standardized allowed amount, 90-day PDP	226,906	226,891	$924	$636	$980	$970	-$277	-$398	-$157	-$379	-$176
HHA standardized allowed amount, 90-day PDP	226,906	226,891	$1,501	$1,384	$1,487	$1,541	-$171	-$238	-$104	-$228	-$115
Number of SNF days, 90-day PDP[1]	66,247	69,053	30.6	27.1	30.4	29.5	-2.6	-3.2	-2.0	-3.1	-2.1
Patients discharged to PAC settings	227,032	227,062	61.6%	54.7%	60.7%	59.0%	-5.2	-7.3	-3.1	-7.0	-3.5
Patients discharged to institutional PAC (of those discharged to any PAC setting)	125,509	136,595	58.2%	51.2%	58.3%	53.7%	-2.3	-4.0	-0.6	-3.8	-0.9
Emergency department use, 90-day PDP	225,519	225,853	19.1%	20.4%	18.4%	20.1%	-0.5	-0.9	0.0	-0.8	-0.1
Unplanned readmission rate, 90-day PDP	225,519	225,853	20.0%	18.4%	20.3%	18.5%	0.1	-0.4	0.6	-0.3	0.5
All-cause mortality rate, 90-day PDP	223,835	224,274	9.2%	8.5%	9.0%	8.3%	0.0	-0.3	0.4	-0.3	0.3

Note: These results include the 21 Model 2 PGP clinical episodes that had sufficient volume to allow for risk adjustment.

[1] Dependent on having at least one day or visit in the given setting

* This might be a biased estimate because we rejected the null hypothesis that BPCI and matched comparison providers had parallel trends for this outcome (with 90% confidence), which is required for an unbiased estimate. Equal trends test was conducted for standardized total allowed payment amount, emergency department visits, readmission, and mortality outcomes.

Appendix G: Impact of BPCI on Payment, Utilization, and Quality Measures, by Surgical and Medical Clinical Episodes, Baseline to Intervention, Model 2 Hospital and PGPs

The following tables display risk-adjusted difference-in-differences results for the payment, utilization, and quality measures assessed in the *Comparison of Impact of BPCI among Hospitals and PGPs* section in this report. Results are based on the weighted averages of the 21 clinical episodes that Model 2 hospitals and PGPs have in common and are presented for all 21 clinical episodes and by surgical and medical clinical episodes. Please observe the following abbreviations, which are used throughout the appendix:

- DiD = difference-in-differences
- PDP = post-discharge period
- IP = inpatient hospitalizations
- PAC = post-acute care
- SNF = skilled nursing facility
- IRF = inpatient rehabilitation facility
- HHA = home health agency

Note that sample sizes reflect the number of BPCI episodes initiated during the intervention period that met inclusion criteria for the given outcome. Medicare payments are risk-adjusted and standardized to remove the effect of geographic differences in wages, extra amounts to account for teaching programs and other policy factors. Results reflect Lewin analysis of Medicare claims, assessment, and enrollment data for episodes that began Q4 2011 through Q3 2012 (baseline) and Q4 2013 through Q3 2017 (intervention period) for BPCI episode initiators and the matched comparison providers.

Exhibit G.1: Impact of BPCI on Payment, Utilization, and Quality Measures, by Medical and Surgical Clinical Episodes, Model 2 Hospitals, Clinical Episodes in Common between Model 2 Hospitals and Model 2 PGPs, Q4 2013 – Q3 2017

Outcome	All Clinical Episodes in Common: Number of Episodes	All Clinical Episodes in Common: DiD	Surgical Clinical Episodes: Number of Episodes	Surgical Clinical Episodes: DiD	Medical Clinical Episodes: Number of Episodes	Medical Clinical Episodes: DiD
Standardized total allowed payment amount, IP through 90-day PDP	420,288	-$891*	171,600	-$1,247*	248,688	-$621*
SNF standardized allowed amount, 90-day PDP	422,739	-$648*	172,102	-$793*	250,637	-$537*
IRF standardized allowed amount, 90-day PDP	387,663	-$218*	162,479	-$373*	225,184	-$100*
HHA standardized allowed amount, 90-day PDP	422,739	$77*	172,102	$55	250,637	$94*
Number of SNF days, 90-day PDP[1]	135,667	-2.47*	60,167	-2.27*	33,372	-2.63*
Patients discharged to PAC settings	423,392	-0.87	172,380	-2.71*	251,012	0.54
Patients discharged to institutional PAC settings (of those discharged to any PAC setting)	266,130	-3.34*	134,549	-5.00*	131,581	-2.08*
Emergency department use, 90-day PDP	420,062	0.00	172,009	0.03	248,053	-0.02
Unplanned readmission rate, 90-day PDP	420,062	-0.25	172,009	-0.13	248,053	-0.34
All-cause mortality rate, 90-day PDP	416,690	-0.14	171,368	-0.12	245,322	-0.16

[1] Dependent on having at least one day or visit in the given setting.

* DiD estimate statistically significant at the 5% level.

Exhibit G.2: Impact of BPCI on Payment, Utilization, and Quality Measures, by Medical and Surgical Clinical Episodes, Model 2 PGPs, Clinical Episodes in Common between Model 2 Hospitals and Model 2 PGPs, Q4 2013 – Q3 2017

Outcome	All Clinical Episodes in Common: Number of Episodes	All Clinical Episodes in Common: DiD	Surgical Clinical Episodes: Number of Episodes	Surgical Clinical Episodes: DiD	Medical Clinical Episodes: Number of Episodes	Medical Clinical Episodes: DiD
Standardized total allowed payment amount, IP through 90-day PDP	226,330	-$1,095*	108,812	-$2,041*	117,518	-$375*
SNF standardized allowed amount, 90-day PDP	226,906	-$672*	108,843	-$1,125*	118,063	-$326*
IRF standardized allowed amount, 90-day PDP	202,745	-$250*	101,645	-$580*	101,100	$2
HHA standardized allowed amount, 90-day PDP	226,906	-$149*	108,843	-$380*	118,063	$27
Number of SNF days, 90-day PDP[1]	66,247	-2.42*	32,875	-4.25*	33,372	-1.02*
Patients discharged to PAC settings	227,032	-4.09*	108,918	-9.30*	118,114	-0.13
Patients discharged to institutional PAC settings (of those discharged to any PAC setting)	125,509	-2.26*	67,407	-3.04*	58,102	-1.67*
Emergency department use, 90-day PDP	225,519	-0.42	108,810	-0.75*	116,709	-0.17
Unplanned readmission rate, 90-day PDP	225,519	0.11	108,810	-0.39	116,709	0.49
All-cause mortality rate, 90-day PDP	223,835	0.09	108,397	0.06	115,438	0.11

[1] Dependent on having at least one day or visit in the given setting.

* DiD estimate statistically significant at the 5% level.

Appendix H: Net Savings to the Medicare Program by Clinical Episode

The following tables display estimated net savings to Medicare for the top 10 clinical episodes by volume that were evaluated in this report. Results are presented by clinical episode. Please observe the following abbreviations, which are used throughout the appendix:

- LCI = lower confidence interval at the 10% level
- UCI = upper confidence interval at the 10% level

Note that sample sizes reflect the number of episodes initiated during the intervention period that met inclusion criteria for the total paid amounts used for this analysis, that is, the actual provider payments from Medicare to providers incorporating geographic and other payment adjustments and excluding beneficiary cost sharing. Payments are risk-adjusted and unstandardized to compare directly with reconciliation payments in order to calculate net savings. Results reflect Lewin analysis of Medicare claims, assessment, and enrollment data for episodes that began Q4 2013 through Q3 2017 (intervention period) for BPCI episode initiators.

Exhibit H.1: Estimated Per-Episode Savings to Medicare in the Hypothetical Scenario with Downside Risk not Eliminated (as Originally Designed), by Clinical Episode, Model 2 Hospitals, Q4 2013 – Q3 2017

Clinical Episode	Number of BPCI Intervention Episodes	Change in Total Non-standardized Payments per Episode	90% LCI	90% UCI	Reconciliation Payment per Episode	Net Savings to Medicare per Episode	Net Savings to Medicare per Episode as a Percentage of Benchmark
Chronic obstructive pulmonary disease, bronchitis, asthma	28,592	$314	$104	$732	$333	-$19	-0.1%
Congestive heart failure	49,810	$343	-$49	$736	-$11	$354	1.5%
Hip & femur procedures except major joint	11,137	$1,756	$1,053	$2,460	$2,507	-$750*	-1.6%*
Major joint replacement of the lower extremity	145,915	$1,206	$934	$1,478	$844	$363*	1.4%*
Medical non-infectious orthopedic	9,738	$1,967	$1,154	$2,779	$2,136	-$169	-0.6%
Renal failure	10,749	$1,036	$339	$1,733	$943	$93	0.4%
Sepsis	39,452	$437	-$265	$1,140	$858	-$421	-1.4%
Simple pneumonia and respiratory infections	31,842	$280	-$126	$687	$483	-$202	-0.9%
Stroke	17,822	$251	-$543	$1,044	$742	-$492	-1.6%
Urinary tract infection	12,228	$807	$156	$1,458	$1,540	-$733*	-3.2%*

Note: The change in total non-standardized payments per episode reflect the total Part A and Part B amounts paid by Medicare to providers for the qualifying inpatient stay plus 90-day post discharge period incorporating geographic and other payment adjustments and excluding beneficiary out-of-pocket expenses. It is based on a difference-in-differences model. A positive value indicates an estimated decrease in non-standardized payments per episode. A negative estimate indicates an estimated increase in non-standardized payments per episode. The 90% LCI and 90% UCI indicates the lower and upper limits, respectively, of the confidence interval for the change in non-standardized payments per episode. The reconciliation payment per episode is calculated as the target price minus the actual Medicare episode payments, divided by the total number of episodes. A positive reconciliation payment is the amount per episode paid by Medicare to participants. A negative reconciliation payment is the amount per episode that participants would have repaid to Medicare as originally designed, if downside risk had not been eliminated. Net savings to Medicare per episode is the difference between the change in total non-standardized payments and reconciliation payments. The estimates depict savings to Medicare as the model was designed, in which repayment responsibility was not waived and theoretical repayments were included in the reconciliation payment amounts. An asterisk (*) indicates the net savings to Medicare per episode was statistically significant at the 10% level.

Source: Lewin analysis of Medicare claims and enrollment data for episodes that began Q4 2011 through Q3 2017 for BPCI and comparison providers and CMS data on reconciliation payments.

Exhibit H.2: Estimated Per-Episode Savings to Medicare in the Hypothetical Scenario with Downside Risk not Eliminated (as Originally Designed), by Clinical Episode, Model 2 Physician Group Practices, Q4 2013 – Q3 2017

Clinical Episode	Number of BPCI Intervention Episodes	Change in Total Non-standardized Payments per Episode	90% LCI	90% UCI	Net Payment Reconciliation Amount per Episode	Net Savings to Medicare per Episode	Net Savings to Medicare per Episode as a Percentage of Benchmark
Chronic obstructive pulmonary disease, bronchitis, asthma	11,876	-$144	-$673	$385	-$27	-$117	-0.6%
Congestive heart failure	12,693	$877	$112	$1,643	$245	$632	2.6%
Hip & femur procedures except major joint	7,383	$1,311	$425	$2,197	$524	$787	1.8%
Major joint replacement of the lower extremity	90,926	$1,953	$1,677	$2,229	$1,237	$716*	3.1% *
Medical non-infectious orthopedic	3,953	$1,263	$267	$2,260	$99	$1,165*	4.2%*
Renal failure	7,009	-$211	-$1,109	$688	-$283	$72	0.3%
Sepsis	26,338	$8	-$695	$711	$867	-$859*	-3.0%*
Simple pneumonia and respiratory infections	13,338	-$74	-$698	$550	$146	-$219	-1.0%
Stroke	4,059	$543	-$875	$1,962	-$137	$681	2.3%
Urinary tract infection	7,416	-$250	-$1,010	$510	$51	-$301	-1.4%

Note: The change in total non-standardized payments per episode reflect the total Part A and Part B amounts paid by Medicare to providers for the qualifying inpatient stay plus 90-day post discharge period incorporating geographic and other payment adjustments and excluding beneficiary out-of-pocket expenses. It is based on a difference-in-differences model. A positive value indicates an estimated decrease in non-standardized payments per episode. A negative estimate indicates an estimated increase in non-standardized payments per episode. The 90% LCI and 90% UCI indicates the lower and upper limits, respectively, of the confidence interval for the change in non-standardized payments per episode. The reconciliation payment per episode is calculated as the target price minus the actual Medicare episode payments, divided by the total number of episodes. A positive reconciliation payment is the amount per episode paid by Medicare to participants. A negative reconciliation payment is the amount per episode that participants would have repaid to Medicare as originally designed, if downside risk had not been eliminated. Net savings to Medicare per episode is the difference between the change in total non-standardized payments and reconciliation payments. The estimates depict savings to Medicare as the model was designed, in which repayment responsibility was not waived and theoretical repayments were included in the reconciliation payment amounts. An asterisk (*) indicates the net savings to Medicare per episode was statistically significant at the 10% level.

Source: Lewin analysis of Medicare claims and enrollment data for episodes that began Q4 2011 through Q3 2017 for BPCI and comparison providers and CMS data on reconciliation payments.

Appendix I: Comparison Group Standardized Difference Tables

Exhibit I.1: Standardized Differences Before and After Matching, Model 2 Hospitals, Congestive Heart Failure

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.36	-0.04
Ownership - Government	-0.50	-0.05
Ownership - For Profit*	0.05	0.09
Urban	0.69	0.04
Bed Count	0.60	0.02
Chain Indicator	-0.04	-0.06
Medicare Days as a Percent of Total Inpatient Days	-0.27	-0.03
Resident-Bed Ratio	0.22	0.02
Disproportionate Share Percent	-0.11	-0.01
Teaching Status	0.31	-0.01
Population Size of Market Area	0.29	0.02
Median Household Income	0.52	0.00
Medicare Advantage Penetration	0.14	0.09
Primary Care Providers per 10,000 in Market	0.36	0.00
SNF Beds per 10,000 in Market	-0.42	0.01
Inpatient Rehabilitation Facility in Market	0.28	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.29	-0.05
Herfindahl Index of Hospital Market Shares	-0.45	-0.04
Percentage of total discharges in the 48 clinical episodes in 2011	-0.27	-0.05
Number of discharges for clinical episode in 2011	0.68	-0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.31	-0.02
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.28	0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.03	0.03
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.05	0.04
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.31	-0.03
Unplanned readmission rate by clinical episode in 2011	0.23	0.03
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.08	-0.01
All-cause mortality rate in 2011 by clinical episode	0.09	-0.03
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.14	0.08
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.27	0.06

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.04	-0.02
Emergency Room rate by clinical episode in 2011	-0.31	-0.01
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.10	-0.01

* These variables were not included for this model.

** Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.02 and the standard deviation was 1.43.

Exhibit I.2: Standardized Differences Before and After Matching, Model 2 Hospitals, Chronic Obstructive Pulmonary Disease, Bronchitis, Asthma

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.25	0.00
Ownership - Government	-0.56	-0.05
Ownership - For Profit*	0.21	0.02
Urban	0.81	0.04
Bed Count	0.55	-0.09
Chain Indicator	-0.04	0.01
Medicare Days as a Percent of Total Inpatient Days	-0.33	0.01
Resident-Bed Ratio	0.27	-0.04
Disproportionate Share Percent	-0.04	0.02
Teaching Status	0.41	-0.07
Population Size of Market Area	0.42	0.00
Median Household Income	0.71	0.04
Medicare Advantage Penetration	0.17	0.06
Primary Care Providers per 10,000 in Market	0.46	0.04
SNF Beds per 10,000 in Market	-0.43	-0.01
Inpatient Rehabilitation Facility in Market	0.45	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.37	-0.04
Herfindahl Index of Hospital Market Shares	-0.55	-0.05
Percentage of total discharges in the 48 clinical episodes in 2011	-0.34	-0.02
Number of discharges for clinical episode in 2011	0.52	-0.08
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.57	-0.06
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.39	-0.02
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.24	0.04
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.13	0.03

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.40	0.03
Unplanned readmission rate by clinical episode in 2011	0.33	0.05
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.03	-0.08
All-cause mortality rate in 2011 by clinical episode	0.04	-0.02
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.00	-0.02
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.60	0.03
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.13	-0.03
Emergency Room rate by clinical episode in 2011	-0.26	-0.01
Change in Emergency room rate by clinical episode from 2011 to 2012	0.04	0.02

* These variables were not included for this model.

** Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.53 and the standard deviation was 1.69.

Exhibit I.3: Standardized Differences Before and After Matching, Model 2 Hospitals, Hip & Femur Procedures Except Major Joint

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.03	-0.02
Ownership - Government	-0.49	0.02
Ownership - For Profit*	0.40	0.01
Urban	0.86	0.00
Bed Count	0.49	-0.01
Chain Indicator	-0.13	-0.03
Medicare Days as a Percent of Total Inpatient Days	-0.28	-0.03
Resident-Bed Ratio	0.25	0.01
Disproportionate Share Percent	-0.09	0.02
Teaching Status	0.35	-0.01
Population Size of Market Area	0.36	-0.02
Median Household Income	0.64	-0.01
Medicare Advantage Penetration	0.12	0.02
Primary Care Providers per 10,000 in Market	0.44	-0.01
SNF Beds per 10,000 in Market	-0.40	0.03
Inpatient Rehabilitation Facility in Market	0.71	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.61	-0.03
Herfindahl Index of Hospital Market Shares	-0.76	-0.02
Percentage of total discharges in the 48 clinical episodes in 2011	-0.33	-0.05

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Number of discharges for clinical episode in 2011	0.45	-0.04
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.27	-0.01
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.23	0.05
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.10	-0.05
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.09	0.00
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	-0.20	0.02
Unplanned readmission rate by clinical episode in 2011	0.25	-0.03
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.06	0.04
All-cause mortality rate in 2011 by clinical episode	-0.02	0.00
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.04	0.05
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.37	0.00
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.01	0.04
Emergency Room rate by clinical episode in 2011	-0.22	-0.01
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.05	0.01

*These variables were not included for this model.

**Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.70 and the standard deviation was 1.87.

Exhibit I.4: Standardized Differences Before and After Matching, Model 2 Hospitals, Medical Non-infectious Orthopedic

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	-0.08	0.02
Ownership - Government	-0.42	-0.04
Ownership - For Profit*	0.48	0.00
Urban	0.90	0.05
Bed Count	0.39	-0.01
Chain Indicator	-0.21	-0.02
Medicare Days as a Percent of Total Inpatient Days	-0.33	0.00
Resident-Bed Ratio	0.11	-0.03
Disproportionate Share Percent	-0.14	0.02
Teaching Status	0.24	-0.07

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Population Size of Market Area	0.38	-0.02
Median Household Income	0.70	0.00
Medicare Advantage Penetration	0.20	-0.03
Primary Care Providers per 10,000 in Market	0.38	-0.05
SNF Beds per 10,000 in Market	-0.54	0.05
Inpatient Rehabilitation Facility in Market	0.72	0.02
Provider Market Share of the 48 potential BPCI episodes	-0.67	0.03
Herfindahl Index of Hospital Market Shares	-0.78	0.02
Percentage of total discharges in the 48 clinical episodes in 2011	-0.25	-0.01
Number of discharges for clinical episode in 2011	0.52	-0.02
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.29	0.01
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.26	0.05
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.08	-0.06
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.13	0.02
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	-0.07	0.03
Unplanned readmission rate by clinical episode in 2011	-0.01	0.02
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.05	0.04
All-cause mortality rate in 2011 by clinical episode	-0.06	-0.01
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.10	-0.02
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.45	-0.02
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.12	0.07
Emergency Room rate by clinical episode in 2011	-0.23	0.02
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.06	-0.04

* This variable was not included for this model.

**Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.92 and the standard deviation was 1.88.

Exhibit I.5: Standardized Differences Before and After Matching, Model 2 Hospitals, Major Joint Replacement of the Lower Extremity

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.18	-0.03
Ownership - Government	-0.39	-0.02
Ownership - For Profit*	0.14	0.05

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Urban	0.67	0.02
Bed Count	0.51	-0.08
Chain Indicator	-0.07	-0.01
Medicare Days as a Percent of Total Inpatient Days	-0.12	0.01
Resident-Bed Ratio	0.27	-0.01
Disproportionate Share Percent	-0.10	0.00
Teaching Status	0.28	-0.04
Population Size of Market Area	0.30	0.03
Median Household Income	0.44	0.00
Medicare Advantage Penetration	0.06	0.02
Primary Care Providers per 10,000 in Market	0.35	0.00
SNF Beds per 10,000 in Market	-0.30	0.04
Inpatient Rehabilitation Facility in Market	0.50	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.47	-0.06
Herfindahl Index of Hospital Market Shares	-0.62	-0.05
Percentage of total discharges in the 48 clinical episodes in 2011	-0.28	0.03
Number of discharges for clinical episode in 2011	0.44	-0.08
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.44	-0.02
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.06	0.04
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.18	-0.02
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.09	0.00
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode	0.11	0.00
Unplanned readmission rate by clinical episode in 2011	0.09	0.05
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.02	0.02
All-cause mortality rate in 2011 by clinical episode	-0.10	0.01
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.06	0.01
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.09	0.00
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.01	0.00
Emergency Room rate by clinical episode in 2011	-0.20	0.03
Change in Emergency room rate by clinical episode from 2011 to 2012	0.00	-0.03

* These variables were not included for this model.

** Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.14 and the standard deviation was 1.36.

Exhibit I.6: Standardized Differences Before and After Matching, Model 2 Hospitals, Renal Failure

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.06	-0.08
Ownership - Government	-0.56	0.06
Ownership - For Profit*	0.40	0.06
Urban	0.89	0.01
Bed Count	0.49	0.01
Chain Indicator	-0.09	0.01
Medicare Days as a Percent of Total Inpatient Days	-0.35	-0.04
Resident-Bed Ratio	0.10	-0.04
Disproportionate Share Percent	0.03	-0.01
Teaching Status	0.19	-0.05
Population Size of Market Area	0.44	-0.02
Median Household Income	0.59	0.02
Medicare Advantage Penetration	0.34	-0.03
Primary Care Providers per 10,000 in Market	0.29	-0.01
SNF Beds per 10,000 in Market	-0.52	-0.01
Inpatient Rehabilitation Facility in Market	0.60	0.00
Provider Market Share of the 48 potential BPCI episodes	-0.54	-0.05
Herfindahl Index of Hospital Market Shares	-0.69	-0.05
Percentage of total discharges in the 48 clinical episodes in 2011	-0.25	-0.04
Number of discharges for clinical episode in 2011	0.57	-0.03
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.31	-0.01
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.41	0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.01	0.01
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.05	0.04
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.21	-0.03
Unplanned readmission rate by clinical episode in 2011	0.21	0.01
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.04	0.01
All-cause mortality rate in 2011 by clinical episode	-0.30	-0.01
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.13	-0.01
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.38	0.01
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.01	-0.07

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Emergency Room rate by clinical episode in 2011	-0.17	0.04
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.04	0.03

*These variables were not included for this model.

**Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -4.20 and the standard deviation was 1.88.

Exhibit I.7: Standardized Differences Before and After Matching, Model 2 Hospitals, Sepsis

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.05	0.09
Ownership - Government	-0.58	-0.02
Ownership - For Profit*	0.43	-0.08
Urban	0.81	0.02
Bed Count	0.47	-0.04
Chain Indicator	-0.20	-0.02
Medicare Days as a Percent of Total Inpatient Days	-0.26	-0.07
Resident-Bed Ratio	0.17	-0.01
Disproportionate Share Percent	-0.03	-0.05
Teaching Status	0.28	-0.04
Population Size of Market Area	0.34	0.03
Median Household Income	0.55	0.02
Medicare Advantage Penetration	0.21	0.02
Primary Care Providers per 10,000 in Market	0.21	0.00
SNF Beds per 10,000 in Market	-0.55	-0.03
Inpatient Rehabilitation Facility in Market	0.53	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.45	-0.04
Herfindahl Index of Hospital Market Shares	-0.62	-0.03
Percentage of total discharges in the 48 clinical episodes in 2011	-0.28	-0.07
Number of discharges for clinical episode in 2011	0.47	-0.08
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.38	-0.07
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.38	0.07
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.08	0.00
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.23	0.04
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.00	0.02

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Unplanned readmission rate by clinical episode in 2011	0.31	-0.02
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.01	0.01
All-cause mortality rate in 2011 by clinical episode	0.25	0.01
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.07	0.01
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.52	0.02
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.01	0.05
Emergency Room rate by clinical episode in 2011	-0.29	0.04
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.03	-0.02

*These variables were not included for this model.

**Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.74 and the standard deviation was 1.86.

Exhibit I.8: Standardized Differences Before and After Matching, Model 2 Hospitals, Simple Pneumonia and Respiratory Infections

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.23	-0.08
Ownership - Government	-0.56	-0.01
Ownership - For Profit*	0.23	0.09
Urban	0.84	-0.05
Bed Count	0.47	0.02
Chain Indicator	-0.08	-0.01
Medicare Days as a Percent of Total Inpatient Days	-0.25	-0.02
Resident-Bed Ratio	0.08	0.00
Disproportionate Share Percent	-0.13	0.04
Teaching Status	0.24	-0.04
Population Size of Market Area	0.30	0.00
Median Household Income	0.61	-0.02
Medicare Advantage Penetration	0.20	0.05
Primary Care Providers per 10,000 in Market	0.43	-0.02
SNF Beds per 10,000 in Market	-0.46	-0.04
Inpatient Rehabilitation Facility in Market	0.36	-0.02
Provider Market Share of the 48 potential BPCI episodes	-0.40	-0.03
Herfindahl Index of Hospital Market Shares	-0.55	-0.02
Percentage of total discharges in the 48 clinical episodes in 2011	-0.21	-0.02
Number of discharges for clinical episode in 2011	0.59	0.01

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.48	0.03
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.29	-0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.26	0.00
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.06	0.00
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.20	-0.05
Unplanned readmission rate by clinical episode in 2011	0.09	0.07
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.05	-0.02
All-cause mortality rate in 2011 by clinical episode	0.11	0.03
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.06	0.00
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.40	0.02
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.04	-0.02
Emergency Room rate by clinical episode in 2011	-0.33	0.01
Change in Emergency room rate by clinical episode from 2011 to 2012	0.04	-0.02

*These variables were not included for this model.

**Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -3.49 and the standard deviation was 1.66.

Exhibit I.9: Standardized Differences Before and After Matching, Model 2 Hospitals, Stroke

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.06	0.03
Ownership - Government	-0.38	-0.04
Ownership - For Profit*	0.31	0.00
Urban	0.96	0.05
Bed Count	0.79	-0.04
Chain Indicator	-0.06	-0.03
Medicare Days as a Percent of Total Inpatient Days	-0.49	-0.01
Resident-Bed Ratio	0.49	-0.04
Disproportionate Share Percent	0.08	-0.09
Teaching Status	0.53	-0.04
Population Size of Market Area	0.53	-0.07
Median Household Income	0.69	0.03

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Medicare Advantage Penetration	0.20	-0.01
Primary Care Providers per 10,000 in Market	0.42	-0.01
SNF Beds per 10,000 in Market	-0.47	0.02
Inpatient Rehabilitation Facility in Market	0.58	-0.01
Provider Market Share of the 48 potential BPCI episodes	-0.57	0.00
Herfindahl Index of Hospital Market Shares	-0.82	0.02
Percentage of total discharges in the 48 clinical episodes in 2011	-0.54	0.03
Number of discharges for clinical episode in 2011	0.84	-0.04
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.30	0.03
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.50	0.02
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.35	-0.02
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.08	0.05
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.18	-0.06
Unplanned readmission rate by clinical episode in 2011	0.13	-0.07
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.14	0.06
All-cause mortality rate in 2011 by clinical episode	-0.12	0.02
Change in all-cause mortality rate by clinical episode from 2011 to 2012*	0.01	0.01
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.49	0.00
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.09	0.00
Emergency Room rate by clinical episode in 2011	-0.20	0.00
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.09	-0.01

* These variables were not included for this model.

** Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -4.55 and the standard deviation was 2.27.

Exhibit I.10: Standardized Differences Before and After Matching, Model 2 Hospitals, Urinary Tract Infection

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.09	-0.04
Ownership - Government	-0.62	0.00
Ownership - For Profit*	0.41	0.04
Urban	0.96	0.04

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Bed Count	0.48	0.03
Chain Indicator	-0.16	-0.02
Medicare Days as a Percent of Total Inpatient Days	-0.34	0.01
Resident-Bed Ratio	0.05	-0.06
Disproportionate Share Percent	-0.01	-0.04
Teaching Status	0.29	-0.03
Population Size of Market Area	0.41	-0.01
Median Household Income	0.73	-0.02
Medicare Advantage Penetration	0.31	0.00
Primary Care Providers per 10,000 in Market	0.45	0.02
SNF Beds per 10,000 in Market	-0.56	0.05
Inpatient Rehabilitation Facility in Market	0.50	0.01
Provider Market Share of the 48 potential BPCI episodes	-0.51	-0.05
Herfindahl Index of Hospital Market Shares	-0.68	-0.05
Percentage of total discharges in the 48 clinical episodes in 2011	-0.23	0.01
Number of discharges for clinical episode in 2011	0.63	0.02
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.38	-0.03
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.37	-0.05
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.12	0.06
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.09	-0.03
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.19	-0.01
Unplanned readmission rate by clinical episode in 2011	0.04	0.02
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.11	0.00
All-cause mortality rate by clinical episode in 2011	-0.07	0.04
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.08	-0.06
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.45	0.01
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.18	-0.02
Emergency Room rate by clinical episode in 2011	-0.30	-0.08
Change in Emergency room rate by clinical episode from 2011 to 2012	0.01	0.04

* These variables were not included for this model.

** Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -4.42 and the standard deviation was 2.13.

Exhibit I.11: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Congestive Heart Failure

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.30	-0.03
Ownership - Government	-0.51	-0.04
Ownership - For Profit*	0.11	0.06
Urban	0.87	-0.03
Bed Count	0.58	-0.01
Chain Indicator	-0.16	0.02
Medicare Days as a Percent of Total Inpatient Days	-0.17	0.07
Resident-Bed Ratio	-0.02	-0.02
Disproportionate Share Percent	-0.31	0.02
Teaching Status	0.26	0.03
Population Size of Market Area	0.35	0.01
Median Household Income	0.64	-0.03
Medicare Advantage Penetration	0.13	-0.06
Primary Care Providers per 10,000 in Market	0.21	0.00
SNF Beds per 10,000 in Market	-0.55	-0.03
Inpatient Rehabilitation Facility in Market	0.52	0.09
Provider Market Share of the 48 potential BPCI episodes	-0.37	-0.09
Herfindahl Index of Hospital Market Shares	-0.62	-0.08
Percentage of total discharges in the 48 clinical episodes in 2011	-0.28	0.03
Number of discharges for clinical episode in 2011	0.78	0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.43	0.00
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.27	0.02
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.03	0.03
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode*	0.07	0.01
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.50	-0.05
Unplanned readmission rate by clinical episode in 2011	0.00	0.10
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.13	-0.12
All-cause mortality rate in 2011 by clinical episode	0.00	0.04
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.05	-0.06
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.29	0.07
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.01	-0.08

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Emergency Room rate by clinical episode in 2011	-0.40	-0.05
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.07	0.05

* These variables were not included for this model.

** Caliper was 1/4th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.75 and the standard deviation was 1.80.

Exhibit I.12: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Chronic Obstructive Pulmonary Disease, Bronchitis, Asthma

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.15	-0.08
Ownership - Government	-0.35	-0.04
Ownership - For Profit*	0.16	0.14
Urban	0.85	-0.02
Bed Count	0.72	-0.02
Chain Indicator	-0.16	-0.07
Medicare Days as a Percent of Total Inpatient Days	-0.29	0.07
Resident-Bed Ratio	-0.07	-0.03
Disproportionate Share Percent	-0.21	0.00
Teaching Status	0.21	-0.05
Population Size of Market Area	0.21	0.04
Median Household Income	0.35	-0.04
Medicare Advantage Penetration	0.31	0.05
Primary Care Providers per 10,000 in Market	0.22	-0.03
SNF Beds per 10,000 in Market	-0.56	-0.04
Inpatient Rehabilitation Facility in Market	0.38	0.08
Provider Market Share of the 48 potential BPCI episodes	-0.18	-0.16
Herfindahl Index of Hospital Market Shares	-0.43	-0.15
Percentage of total discharges in the 48 clinical episodes in 2011	-0.35	0.03
Number of discharges for clinical episode in 2011	0.86	-0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.36	-0.14
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.25	0.04
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.09	0.10
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.06	0.06
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.51	0.07

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Unplanned readmission rate by clinical episode in 2011	0.22	0.03
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.02	-0.07
All-cause mortality rate in 2011 by clinical episode	-0.03	0.08
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.11	-0.05
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.28	0.09
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.05	-0.05
Emergency Room rate by clinical episode in 2011	-0.14	-0.07
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.19	0.05

* These variables were not included for this model.

** Caliper was 1/3rd of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.15 and the standard deviation was 1.66.

Exhibit I.13: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Hip and Femur Procedures Except Major Joint

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	-0.13	-0.06
Ownership - Government	-0.12	-0.02
Ownership - For Profit*	0.31	0.09
Urban	0.74	0.00
Bed Count	0.44	-0.09
Chain Indicator	-0.20	-0.10
Medicare Days as a Percent of Total Inpatient Days	-0.24	0.01
Resident-Bed Ratio	-0.26	0.02
Disproportionate Share Percent	-0.20	0.03
Teaching Status	0.03	-0.07
Population Size of Market Area	0.23	0.05
Median Household Income	0.33	0.02
Medicare Advantage Penetration	0.14	-0.02
Primary Care Providers per 10,000 in Market	-0.03	0.00
SNF Beds per 10,000 in Market	-0.68	-0.13
Inpatient Rehabilitation Facility in Market	0.33	0.05
Provider Market Share of the 48 potential BPCI episodes	-0.54	-0.08
Herfindahl Index of Hospital Market Shares	-0.64	-0.06
Percentage of total discharges in the 48 clinical episodes in 2011	-0.16	0.10
Number of discharges for clinical episode in 2011	0.57	-0.14

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.10	0.07
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.07	0.03
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.06	-0.06
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.03	0.06
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.07	0.01
Unplanned readmission rate by clinical episode in 2011	0.16	0.04
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.08	0.05
All-cause mortality rate in 2011 by clinical episode	0.01	0.03
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.01	0.02
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.10	0.04
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.08	-0.02
Emergency Room rate by clinical episode in 2011	-0.16	0.05
Change in Emergency room rate by clinical episode from 2011 to 2012	0.00	0.01

* These variables were not included for this model.

** Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -1.94 and the standard deviation was 1.80.

Exhibit I.14: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Medical Non-infectious Orthopedic

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.08	-0.10
Ownership - Government	-0.24	0.02
Ownership - For Profit*	0.15	0.10
Urban	0.69	-0.03
Bed Count	0.55	-0.05
Chain Indicator	-0.05	0.03
Medicare Days as a Percent of Total Inpatient Days	-0.33	0.05
Resident-Bed Ratio	-0.37	-0.08
Disproportionate Share Percent	-0.28	0.04
Teaching Status	-0.08	-0.06
Population Size of Market Area	0.04	0.06

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Median Household Income	0.27	-0.01
Medicare Advantage Penetration	0.29	0.02
Primary Care Providers per 10,000 in Market	0.02	0.03
SNF Beds per 10,000 in Market	-0.62	-0.05
Inpatient Rehabilitation Facility in Market	0.24	0.00
Provider Market Share of the 48 potential BPCI episodes	-0.19	-0.04
Herfindahl Index of Hospital Market Shares	-0.35	-0.02
Percentage of total discharges in the 48 clinical episodes in 2011	-0.11	0.03
Number of discharges for clinical episode in 2011	0.56	0.03
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.17	-0.06
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.25	0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.05	0.01
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.02	0.11
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.11	0.03
Unplanned readmission rate by clinical episode in 2011	-0.06	0.10
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.06	-0.08
All-cause mortality rate in 2011 by clinical episode	0.17	-0.04
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.04	0.07
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.25	0.10
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.05	-0.08
Emergency Room rate by clinical episode in 2011	-0.17	-0.01
Change in Emergency room rate by clinical episode from 2011 to 2012	0.09	0.01

* These variables were not included for this model.

** Caliper was 1/4th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.29 and the standard deviation was 1.78.

Exhibit I.15: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Major Joint Replacement of the Lower Extremity

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	-0.01	-0.05
Ownership - Government	-0.20	-0.05
Ownership - For Profit*	0.20	0.10
Urban	0.76	0.07

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Bed Count	0.59	-0.08
Chain Indicator	-0.09	-0.09
Medicare Days as a Percent of Total Inpatient Days	-0.22	-0.05
Resident-Bed Ratio	-0.21	-0.07
Disproportionate Share Percent	-0.16	0.05
Teaching Status	0.09	-0.06
Population Size of Market Area	0.11	0.04
Median Household Income	0.34	0.01
Medicare Advantage Penetration	0.19	0.08
Primary Care Providers per 10,000 in Market	-0.02	-0.01
SNF Beds per 10,000 in Market	-0.64	-0.10
Inpatient Rehabilitation Facility in Market	0.41	0.06
Provider Market Share of the 48 potential BPCI episodes	-0.52	-0.07
Herfindahl Index of Hospital Market Shares	-0.72	-0.04
Percentage of total discharges in the 48 clinical episodes in 2011	-0.20	0.06
Number of discharges for clinical episode in 2011	0.59	-0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.18	0.00
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	-0.03	0.08
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.04	-0.08
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.12	0.05
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.25	0.02
Unplanned readmission rate by clinical episode in 2011	-0.01	-0.05
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.01	0.05
All-cause mortality rate in 2011 by clinical episode	-0.01	-0.04
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.02	0.00
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	-0.05	-0.03
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.01	0.08
Emergency Room rate by clinical episode in 2011	-0.14	-0.04
Change in Emergency room rate by clinical episode from 2011 to 2012	0.00	-0.05

* These variables were not included for this model.

** Caliper was 1/4th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -1.39 and the standard deviation was 1.85.

Exhibit I.16: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Renal Failure

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.03	-0.13
Ownership - Government	-0.27	0.01
Ownership - For Profit*	0.22	0.15
Urban	0.92	0.02
Bed Count	0.72	-0.01
Chain Indicator	-0.32	-0.02
Medicare Days as a Percent of Total Inpatient Days	-0.37	-0.02
Resident-Bed Ratio	-0.31	-0.04
Disproportionate Share Percent	-0.23	0.05
Teaching Status	0.08	-0.06
Population Size of Market Area	0.28	-0.02
Median Household Income	0.33	-0.07
Medicare Advantage Penetration	0.28	0.06
Primary Care Providers per 10,000 in Market	0.04	-0.04
SNF Beds per 10,000 in Market	-0.69	-0.06
Inpatient Rehabilitation Facility in Market	0.42	0.04
Provider Market Share of the 48 potential BPCI episodes	-0.30	-0.08
Herfindahl Index of Hospital Market Shares	-0.52	-0.07
Percentage of total discharges in the 48 clinical episodes in 2011	-0.31	-0.04
Number of discharges for clinical episode in 2011	0.86	-0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.23	-0.02
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.33	0.06
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.13	-0.02
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.02	0.17
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.44	-0.04
Unplanned readmission rate by clinical episode in 2011	0.11	0.01
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.02	0.02
All-cause mortality rate in 2011 by clinical episode	-0.09	0.07
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.06	-0.09
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.23	0.09
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.11	0.03

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Emergency Room rate by clinical episode in 2011	-0.28	-0.07
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.06	0.04

* These variables were not included for this model.

** Caliper was 1/4th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.94 and the standard deviation was 2.24.

Exhibit I.17: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Sepsis

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.10	-0.08
Ownership - Government	-0.33	0.01
Ownership - For Profit*	0.20	0.08
Urban	0.83	0.02
Bed Count	0.66	-0.03
Chain Indicator	-0.25	0.02
Medicare Days as a Percent of Total Inpatient Days	-0.21	0.04
Resident-Bed Ratio	-0.12	-0.02
Disproportionate Share Percent	-0.22	0.01
Teaching Status	0.12	0.03
Population Size of Market Area	0.16	0.04
Median Household Income	0.27	-0.02
Medicare Advantage Penetration	0.25	0.09
Primary Care Providers per 10,000 in Market	0.13	0.03
SNF Beds per 10,000 in Market	-0.59	-0.03
Inpatient Rehabilitation Facility in Market	0.44	0.03
Provider Market Share of the 48 potential BPCI episodes	-0.25	-0.10
Herfindahl Index of Hospital Market Shares	-0.47	-0.09
Percentage of total discharges in the 48 clinical episodes in 2011	-0.28	0.00
Number of discharges for clinical episode in 2011	0.65	-0.02
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.21	-0.04
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.33	-0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.11	0.02
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.11	0.07
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.27	-0.05

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Unplanned readmission rate by clinical episode in 2011	0.12	0.03
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.02	0.01
All-cause mortality rate in 2011 by clinical episode	0.35	0.04
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.00	0.01
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.26	0.07
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.04	0.00
Emergency Room rate by clinical episode in 2011	-0.19	-0.07
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.09	0.06

* These variables were not included for this model.

** Caliper was 1/20th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -1.99 and the standard deviation was 1.75.

Exhibit I.18: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Simple Pneumonia and Respiratory Infections

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.26	-0.06
Ownership - Government	-0.37	-0.03
Ownership - For Profit*	0.05	0.10
Urban	0.69	0.00
Bed Count	0.53	-0.02
Chain Indicator	-0.04	0.04
Medicare Days as a Percent of Total Inpatient Days	-0.32	0.09
Resident-Bed Ratio	-0.31	-0.02
Disproportionate Share Percent	-0.29	0.04
Teaching Status	0.12	-0.01
Population Size of Market Area	0.15	0.00
Median Household Income	0.49	-0.03
Medicare Advantage Penetration	0.12	-0.05
Primary Care Providers per 10,000 in Market	0.08	-0.04
SNF Beds per 10,000 in Market	-0.49	0.06
Inpatient Rehabilitation Facility in Market	0.19	0.04
Provider Market Share of the 48 potential BPCI episodes	-0.05	-0.04
Herfindahl Index of Hospital Market Shares	-0.26	-0.04
Percentage of total discharges in the 48 clinical episodes in 2011	-0.25	0.08
Number of discharges for clinical episode in 2011	0.73	0.03

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.32	-0.07
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.25	0.05
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.05	0.02
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.18	0.10
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.38	-0.02
Unplanned readmission rate by clinical episode in 2011	-0.11	0.07
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.19	-0.01
All-cause mortality rate in 2011 by clinical episode	0.13	-0.03
Change in all-cause mortality rate by clinical episode from 2011 to 2012	0.13	0.00
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.26	0.07
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.02	-0.01
Emergency Room rate by clinical episode in 2011	-0.21	-0.03
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.03	0.02

* These variables were not included for this model.

** Caliper was 1/10th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.56 and the standard deviation was 1.73.

Exhibit I.19: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Stroke

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.17	0.03
Ownership - Government	-0.22	0.03
Ownership - For Profit*	0.02	-0.07
Urban	0.50	0.03
Bed Count	0.30	-0.01
Chain Indicator	0.01	-0.02
Medicare Days as a Percent of Total Inpatient Days	-0.08	-0.02
Resident-Bed Ratio	-0.34	0.00
Disproportionate Share Percent	-0.32	-0.02
Teaching Status	0.08	0.01
Population Size of Market Area	-0.12	-0.05
Median Household Income	0.28	0.03

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Medicare Advantage Penetration	0.25	0.01
Primary Care Providers per 10,000 in Market	0.00	0.03
SNF Beds per 10,000 in Market	-0.43	0.01
Inpatient Rehabilitation Facility in Market	-0.09	-0.04
Provider Market Share of the 48 potential BPCI episodes	0.16	0.04
Herfindahl Index of Hospital Market Shares	0.06	0.05
Percentage of total discharges in the 48 clinical episodes in 2011	0.01	-0.04
Number of discharges for clinical episode in 2011	0.50	0.00
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.04	0.04
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.13	0.03
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	-0.19	-0.03
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	-0.08	-0.01
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.21	-0.02
Unplanned readmission rate by clinical episode in 2011	-0.06	0.00
Change in unplanned readmission rate by clinical episode from 2011 to 2012	0.06	-0.03
All-cause mortality rate in 2011 by clinical episode	0.05	0.00
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.03	0.02
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	-0.08	0.00
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	0.01	-0.01
Emergency Room rate by clinical episode in 2011	0.00	0.04
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.05	-0.02

* These variables were not included for this model.

**Caliper was 1/4th of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.90 and the standard deviation was 1.46.

Exhibit I.20: Standardized Differences Before and After Matching, Model 2 Physician Group Practices, Urinary Tract Infection

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Ownership - Non-Profit	0.11	-0.14
Ownership - Government	-0.40	0.01
Ownership - For Profit*	0.25	0.14

Variable	Standardized Difference Before Matching	Standardized Difference After Matching**
Urban	0.96	0.02
Bed Count	0.77	-0.05
Chain Indicator	-0.32	-0.06
Medicare Days as a Percent of Total Inpatient Days	-0.36	0.06
Resident-Bed Ratio	-0.03	-0.05
Disproportionate Share Percent	-0.22	0.01
Teaching Status	0.18	-0.04
Population Size of Market Area	0.22	0.00
Median Household Income	0.35	-0.04
Medicare Advantage Penetration	0.43	0.04
Primary Care Providers per 10,000 in Market	0.17	-0.08
SNF Beds per 10,000 in Market	-0.64	-0.09
Inpatient Rehabilitation Facility in Market	0.42	-0.02
Provider Market Share of the 48 potential BPCI episodes	-0.36	-0.10
Herfindahl Index of Hospital Market Shares	-0.61	-0.08
Percentage of total discharges in the 48 clinical episodes in 2011	-0.36	0.01
Number of discharges for clinical episode in 2011	0.85	-0.01
Percent of patients in 2011 that went home with no post-acute care by clinical episode	-0.45	0.02
Percent of patients in 2011 that used an inpatient rehabilitation facility as first post-acute care setting by clinical episode	0.27	0.01
Percent of patients in 2011 that used a SNF as first post-acute care setting by clinical episode	0.08	-0.01
Percent of patients in 2011 that used a long-term care hospital as first post-acute care setting by clinical episode	0.03	0.02
Percent of patients in 2011 that went home with HHA services as first post-acute care setting by clinical episode*	0.41	-0.02
Unplanned readmission rate by clinical episode in 2011	0.04	0.03
Change in unplanned readmission rate by clinical episode from 2011 to 2012	-0.01	0.01
All-cause mortality rate in 2011 by clinical episode	-0.03	0.06
Change in all-cause mortality rate by clinical episode from 2011 to 2012	-0.01	-0.03
Average 90-day standardized Medicare Part A payment amount by clinical episode in 2011	0.45	-0.03
Change in average 90-day standardized Medicare Part A payment amount by clinical episode from 2011 to 2012	-0.18	0.06
Emergency Room rate by clinical episode in 2011	-0.25	-0.06
Change in Emergency room rate by clinical episode from 2011 to 2012	-0.03	0.00

* This variable was not included for this model.

**Caliper was 1/3rd of the standard deviation of the log-odds propensity score. The mean log-odds propensity score was -2.44 and the standard deviation was 1.90.