Comprehensive End-Stage Renal Disease Care (CEC) Model

Performance Year 3 Annual Evaluation Report

Contract #: HHSM-500-2014-00033I
Task Order No. HHSM-500-T0001

Prepared for:

Centers for Medicare & Medicaid Services

Submitted by:

The Lewin Group, Inc.

November 2020

Comprehensive End-Stage Renal Disease Care (CEC) Model

Performance Year 3 Annual Evaluation Report

November 2020

The Lewin Group

Authors:

Grecia Marrufo, Brighita Negrusa, Darin Ullman, Richard Hirth,[1] Claudia Dahlerus,[1] Jennifer Wiens, Ariana Ackerman, Jessica Nelson, Naya Lindsey, Daniel Gregory, Tammie Nahra,[1] Amy Jiao,[1] Daniel Strubler, Peter Weidner, Donna Spencer, Katherine B. McKeithen,[2] and Kelsey Roberts

Lewin's address:

3160 Fairview Park Dr., Suite 600, Falls Church, VA 22042

Federal Project Officer:

Gregory Boyer, PhD
Division of Data, Research, and Analytic Methods (DRAM)
Research and Rapid Cycle Evaluation Group (RREG),
Center for Medicare & Medicaid Innovation (CMMI),
Centers for Medicare & Medicaid Services (CMS)

[1] University of Michigan, Kidney Epidemiology and Cost Center (KECC)
[2] Independent Contractor

Table of Contents

Glossary of Terms

Acronym	Definition
ACH	acute care hospital
ACO	accountable care organization
ACSC	Ambulatory Care Sensitive Condition
AHRF	Area Health Resource File
AHRQ	Agency for Healthcare Research and Quality
AIM	ACO Investment Model
A-APM	Advanced Alternative Payment Model
AR2	annual report two
AR3	annual report three
AV	arteriovenous
BETOS	Berenson-Eggers Type of Services
BMI	body mass index
CATI	Computer-Assisted Telephone Interviews
CBSA	Core-Based Statistical Area
CC	Condition Category
CCLF	CMS Claims and Claim Line Feed
CCN	CMS Certification Number
CCS	Clinical Classifications Software
CCW	Chronic Conditions Data Warehouse
CDC	Centers for Dialysis Care
CEC	Comprehensive End-Stage Renal Disease (ESRD) Care
CHF	congestive heart failure
CKD	chronic kidney disease
CME	Common Medicare Environment
CMMI	Center for Medicare & Medicaid Innovation
CMS	Centers for Medicare & Medicaid Services
CNU	Care Navigation Unit
CROWNWeb	Consolidated Renal Operations in a Web-enabled Network
CY	calendar year
DCI	Dialysis Clinic, Inc.
DFR	Dialysis Facility Report
DiD	difference-in-differences
E/M	Evaluation and Management
ED	emergency department
EHR	electronic health records
ESCO	ESRD Seamless Care Organization
ESRD	end-stage renal disease
FAI	Financial Alignment Initiative
FFS	fee-for-service
GEM	General Equivalence Mappings
HbA1c	hemoglobin A1c test
HCC	Hierarchical Condition Category
HCPCS	Healthcare Common Procedure Coding System
HMO	health maintenance organization

Acronym	Definition
HRQOL	health-related quality of life
HRSA	Health Resources and Services Administration
HWR	hospital wide readmission
IAH	Independence at Home
ICC	intra-cluster correlation coefficients
ICD-9	International Classification of Disease, 9th Revision
ICD-10	International Classification of Disease, 10th Revision
ICH CAHPS	In-Center Hemodialysis Consumer Assessment of Healthcare Providers and Systems
ICI	Individual Quality Index
IRB	Institutional Review Board
IRF	Inpatient Rehabilitation Facilities
IT	information technology
KDQOL [KDQOL-36™]	kidney disease quality of life [Kidney Disease Quality of Life Short Form 36]
LDL	low-density lipoprotein
LDO	large dialysis organization
MA	Medicare Advantage
MACRA	Medicare Access and CHIP Reauthorization Act
MBSF	Master Beneficiary Summary File
MCS	Mental Component Summary
MDM	Mahalanobis distance matching
MDS	Long Term Care Minimum Data Set
MIPS	Merit-Based Incentive Payment System
MME	morphine milligram equivalent
MMRF	Minneapolis Medical Research Foundation
NGACO	Next Generation ACO
NKC	Northwest Kidney Centers
non-LDO	non-large dialysis organization, or small dialysis organization
NPI	National Provider Identifier
NQF	National Quality Forum
OLS	ordinary least squares
ONS	oral nutritional supplements
OPTN	Organ Procurement and Transplantation Network
OREC	Original Reason for Entitlement Code
P4P	pay-for-performance
PAC	post-acute care
PBPM	per beneficiary per month
PCP	primary care provider
PCS	Physical Component Summary
PPS	Prospective Payment System
PQI	Prevention Quality Indicator
PSM	propensity score matching
PY1	performance year one (October 1, 2015 through December 31, 2016)
PY2	performance year two (January 1, 2017 to December 31, 2017)
PY3	performance year three (January 1, 2018 to December 31, 2018)
QIP	Quality Incentive Program
QQ	quantile-quantile

Acronym	Definition
RAND	Research and Development Corporation
REMIS	Renal Management Information System
SDO	small dialysis organization
SF-12	Short Form 12 (for the KDQOL-36™ survey)
SHR	standardized hospitalization ratio
SMD	standardized mean difference
SMR	standardized mortality ratio
SNF	skilled nursing facility
SRR	standardized readmission ratio
SRTR	Scientific Registry of Transplant Recipients
SSP	Shared Savings Program
TDAPA	Transitional Drug Add-on Payment Adjustment
TIN	Taxpayer Identification Number
TQS	total quality score
US	United States
USRDS	US Renal Data System
VRDC	Virtual Research Data Center

Executive Summary

A. Introduction

Medicare beneficiaries with end-stage renal disease (ESRD) are a medically complex group that requires significantly more resources than the general Medicare population. In 2016, fewer than 1% of the fee-for-service (FFS) Medicare beneficiary population had ESRD, yet they accounted for about 7% of FFS Medicare payments.[3] Beneficiaries with ESRD have more and longer hospitalizations than other beneficiaries, and their readmission rates are more than twice the rate of the general Medicare population.

In an effort to provide better care for Medicare beneficiaries with ESRD, the Centers for Medicare & Medicaid Services (CMS) launched the Comprehensive ESRD Care (CEC) Model in 2015 under the authority of the Center for Medicare & Medicaid Innovation (CMMI). The CEC Model is an Advanced Alternative Payment Model (A-APM) that creates financial incentives for dialysis facilities, nephrologists, and other Medicare providers to coordinate care for Medicare beneficiaries with ESRD. The model is designed to improve clinical and patient-centered outcomes for Medicare beneficiaries with ESRD, while promoting value and reducing per-capita payments.

The CEC Model expands the reach of recent value-based payment initiatives targeting dialysis-related care such as the ESRD Prospective Payment System (ESRD PPS) and the ESRD Quality Incentive Program (ESRD QIP). Under the CEC Model, dialysis facilities, nephrologists, and other providers partner to form ESRD Seamless Care Organizations (ESCOs). ESCOs are specialty-oriented accountable care organizations (ACOs) that assume financial responsibility for the quality of care and Medicare Part A and Part B payments of their aligned beneficiaries. The ESCOs participating in the model are separated into two waves, differentiated by the date on which they joined the CEC Model. Wave 1 includes ESCOs that joined the model on October 1, 2015; Wave 2 includes ESCOs that joined the model on January 1, 2017. Both Wave 1 and Wave 2 ESCOs had the ability to add or drop facilities on January 1, 2018. The model runs five years.

This third annual report provides findings on the impact of the CEC Model during the first three performance years (PYs): October 1, 2015 through December 31, 2016 (PY1), January 1, 2017 through December 31, 2017 (PY2), and January 1, 2018 through December 31, 2018 (PY3). The report combines findings from quantitative and qualitative data to address a core set of questions. For instance, data from follow-up interviews with Wave 1 ESCOs addressed changes in structure including partnerships, changes in the care redesign strategies they implemented, and perceived successes and challenges. This third annual report focuses on follow-up interviews with Wave 1 ESCOs, while the second annual report presented findings based on initial interviews with Wave 2 ESCOs.[4] Quantitative methods complement qualitative methods by addressing how participation in the CEC Model for both Wave 1 and Wave 2 ESCOs affected dialysis care, coordination of care

[3] National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. (2018). United States Renal Data System, 2018 Annual Data Report: Volume 2 – ESRD in the United States. Bethesda, MD.

[4] For findings from the Wave 1 ESCO site visits, please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf).

beyond dialysis, hospitalizations and emergency department (ED) visits, and Medicare payments across the continuum of care over the first three performance years.

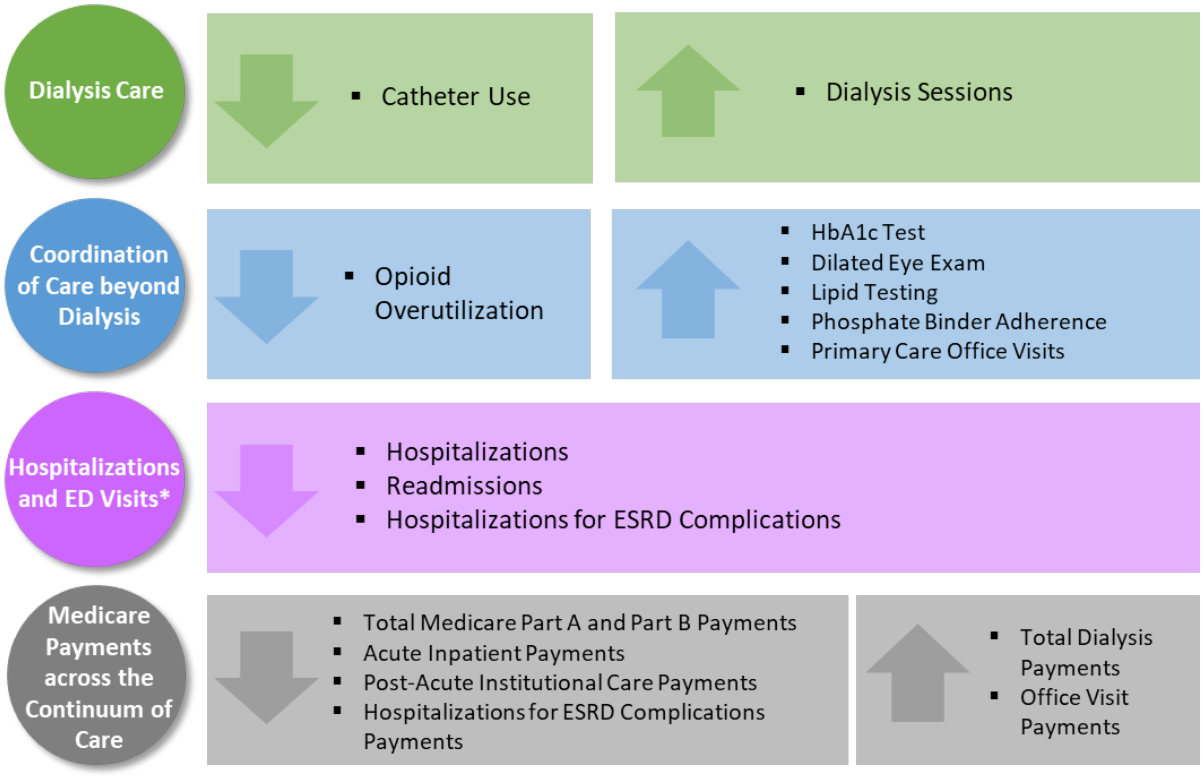
B. Overview of Findings

The CEC Model is designed to create incentives for dialysis facilities and nephrologists to coordinate care for Medicare beneficiaries with ESRD across settings by making the ESCO accountable—financially and clinically—for care delivered in other inpatient and outpatient settings. The CEC Model expanded in the second performance year. In January 2017, 24 new ESCOs joined the 13 original ESCOs that began operations in October 2015. In the third performance year, Wave 1 and Wave 2 ESCOs expanded the number of participating facilities as of January 1, 2018. Nationally, 15% of dialysis facilities are now participating in the model.

Overall, the CEC Model showed promising results over the first three years, with improvements on some quality and health care utilization measures as well as a decrease in total payments. (See **Exhibit ES-1** for a summary of the evaluation findings.) However, the magnitudes of these improvements were generally larger in PY1 and PY2, mainly driven by Wave 1 ESCOs. ESCO performance on several clinical and cost measures for PY3 continued to exceed that of a matched comparison group, yet these improvements were generally smaller than those seen in PY2. The CEC Model resulted in a $115 million aggregate reduction in payments over the first three performance years. At the same time, beneficiary-reported quality of life remained largely unchanged, suggesting that CEC payment reduction strategies had no adverse impacts on patient quality of life. Results from the first three performance years suggest that the reduction in Medicare payments for CEC beneficiaries has primarily been generated through a reduction in hospitalizations; payments also declined for institutional post-acute care. The number of hospitalizations decreased 4% and the percent of beneficiaries with at least one readmission decreased 3% across the three performance years. Additionally, ESCOs reported various interventions to improve adherence to dialysis. These interventions resulted in an increase in the number of dialysis sessions and dialysis payments, but a decrease in payments for hospitalizations associated with ESRD-related complications.

The additional year of data in AR3 updates the results from AR2 as well as implements our recommendation from the previous report to limit the analysis to beneficiaries that transition into two-sided risk arrangements. These analyses provide evidence that the CEC Model performed better for beneficiaries with ESRD than primary care-based ACOs. Spending and utilization outcomes improved under the CEC Model, whereas primary care-based ACOs showed no evidence of improved outcomes or reduced payments for beneficiaries with ESRD.

Exhibit ES-1. Summary of Evaluation Findings*



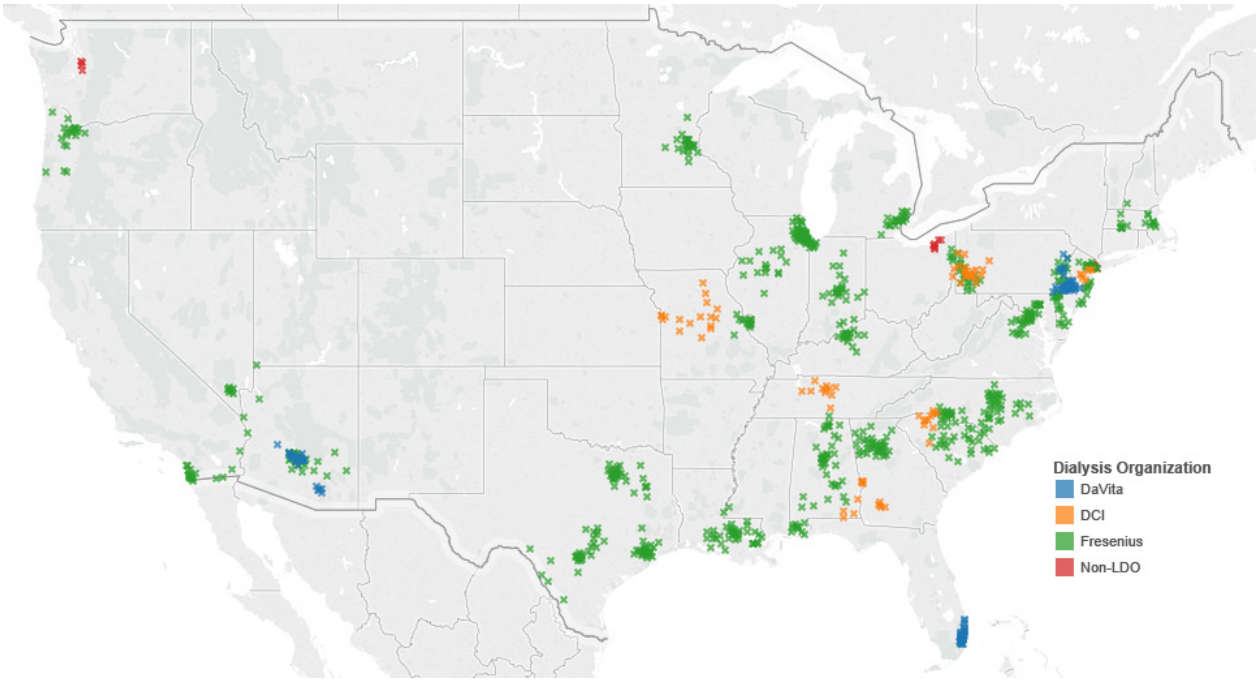
***Shows statistically significant evaluation impacts for all ESCOS across PY1-PY3**

Notes: ⬇ boxes indicate measures with a statistically significant decrease; ⬆ boxes indicate measures with a statistically significant increase. Each impact estimate is based on a difference-in-differences (DiD) analysis and reflects the difference in the regression-adjusted average outcome for beneficiaries in CEC facilities for the first three performance years (39 months) with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance identified with p-values ≤ 0.10. *We evaluated the impact of the CEC Model on the odds of experiencing at least one event in a given month and the number of events per month on the following outcomes: hospitalizations, ED visits, and readmissions. For all other measures under this domain, we only explored the impact of the CEC Model on the odds of experiencing at least one event in a given month.

1. Who Participates in the CEC Model?

Thirty-seven ESCOs, representing three large dialysis organizations (LDOs), defined as those having 200 or more dialysis facilities (DaVita, Fresenius, and Dialysis Clinic, Inc. [DCI]) and four small dialysis organizations or non-LDOs (Rogosin Institute, Atlantic Dialysis, Centers for Dialysis Care [CDC], and Northwest Kidney Centers [NKC]), joined the CEC Model as of January 2017. Of these 37 ESCOs, 13 joined the CEC Model on October 1, 2015 as Wave 1 ESCOs, while the remaining 24 ESCOs joined the CEC Model as Wave 2 ESCOs on January 1, 2017. Collectively, these ESCOs had 1,065 dialysis facilities and were spread across 30 states and Washington, D.C. The locations of participating facilities are shown in **Exhibit ES-2**.

Exhibit ES-2. Location of CEC Dialysis Facilities



Source: CEC Model participation data extracted from Salesforce on 04/25/2019.

The 37 ESCOs are diverse along several important dimensions, including geographic region, ownership, and size. While both LDOs and non-LDOs are represented in the model, Fresenius was the dominant participant, making up 72% of ESCO facilities. DaVita was the next largest group, representing 16% of ESCO facilities (all in Wave 1 ESCOs). ESCOs covered a wide range of markets in terms of Medicare Part A and Part B payments per beneficiary per month (PBPM), with no apparent selection into high-cost markets. In general, ESCOs tended to operate in larger urban markets, likely reflecting the requirement to have at least 350 patients with ESRD. In particular, ESCOs were located in many of the largest population centers in the United States (US), with the average CEC Core-Based Statistical Area (CBSA) having a population three and a half times larger than the average non-CEC CBSA. However, compared to earlier joining facilities that were overwhelmingly located in metropolitan areas, PY3 joiner facilities were often located in non-metropolitan areas, had fewer dialysis stations and were less likely to offer a late shift.

2. How Have Structural Features of the Wave 1 ESCOs Changed Over Time?

During PY1, we collected information about early model investments by Wave 1 ESCOs. These findings were provided in the Performance Year 1 Annual Evaluation Report. To monitor these features over time, we conducted a second set of site visits at Wave 1 ESCOs in PY3. This chapter summarizes changes in staffing, partnerships with other providers, information technology (IT), and use of CEC Model waivers among Wave 1 ESCOs.

Overall, the changes in ESCO structure are mostly refinements of the structures developed in PY1. There were some changes to staffing models. Notably, Fresenius transitioned its care coordination model from a remote telephonic service to a hybrid approach that retained

telephonic support while adding on-site coordinators shared across multiple facilities. The on-site presence helped build relationships with beneficiaries and facility staff and served as the "face of the ESCO." A minority of ESCOs reported new partnerships with non-dialysis providers, refinements in IT, and changes in the use of CEC Model waivers (reduced use of the transportation waiver and discontinuation of the oral nutrition supplement waiver).

3. How Has Care Redesign Evolved Under Wave 1 ESCOs?

In PY3, all ESCOs continued specific approaches implemented in PY1 and expanded centered-care coordination. Use of interdisciplinary teams was expanded to leverage knowledge of beneficiary behavior and life events to help target care coordination to high-risk individuals not identified by computer algorithms, as well as other beneficiaries that could benefit from intervention. Interdisciplinary teams also began identifying and providing care coordination to beneficiaries at risk of complications. DaVita respondents suggested that these preventive efforts led to decreases in hospitalization. Fresenius began on-boarding patients prior to formal alignment to the model and initiated care coordination closer to the start of dialysis. Several ESCOs placed greater emphasis on patient and caregiver education and expanded the range of topics to include encouragement for the use of urgent care centers as an alternative to the ED. Since the CEC Model began, ESCOs provided more preventive care during dialysis visits. The scope of care coordination also increased in PY3 to include a wider range of beneficiary needs, including transplant waitlist support and complementing the expanded emphasis of patient and caregiver education.

4. What Were Beneficiaries' Perceptions of the CEC Model?

Findings from beneficiary focus groups were similar to those reported in prior years. Most beneficiaries were unaware or only minimally aware of the CEC Model, but some recalled the letter they received from CMS describing the CEC Model. While awareness of CEC as a formal entity was limited, beneficiaries were generally aware of at least some of its activities, particularly transportation assistance and the care coordinator role. Beneficiaries generally did not perceive changes in nephrologist and staff accessibility and communication, but they did appreciate the care coordination role.

5. What Was the Association between Alignment in the CEC Model and Beneficiary Quality of Life?

Consistent with what we found in PY1 and PY2, we found little evidence of change in beneficiary quality of life during PY3, as reported in the Kidney Disease Quality of Life (KDQOL-36™) survey.[5] Compared to similar ESRD beneficiaries not participating the model, CEC beneficiaries reported slightly lower burdens on their life arising from symptoms of kidney disease and slightly fewer limitations due to their physical health. Although statistically significant, the differences were small in magnitude and judged to be not clinically meaningful. The CEC and similar ESRD beneficiaries not participating in the model did not differ in terms of the overall burden of kidney disease in their life or their reported mental health. Overall, the

[5] We also conducted a quality of life survey in PY1. The PY1 survey results are included in the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf).

findings suggest that, in the first three performance years, the CEC Model's cost savings did not occur at the expense of beneficiaries' quality of life.

6. What Were the Impacts of the CEC Model?

Overall, during the first three performance years, the CEC Model resulted in improvements in delivery and quality of dialysis care and reductions in acute care utilization and Medicare payments. The estimated impacts over the first three performance years of the model on dialysis care, coordination of care beyond dialysis, hospitalizations and ED visits, and Medicare payments across the continuum of care are summarized in **Exhibit ES-3**. Unless otherwise noted, all CEC effects are reported as impact estimates relative to similar Medicare beneficiaries with ESRD not participating in the model, and as percent changes relative to the pre-CEC period.

Exhibit ES-3. Summary of Difference-in-Differences Impact Estimates, All ESCOs PY1-PY3

Measures		CEC		Comparison		Difference-in-Differences Estimate			
		Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care	Number of Outpatient Dialysis Sessions per 1,000 Beneficiaries per Month	12,238.4	12,280.5	12,262.3	12,252.5	**51.8** ***	26.5	77.2	0.42%
	Emergency Dialysis (percent with at least one)	2.0%	2.0%	1.9%	2.0%	**-0.14** **	-0.23	-0.05	-7.1%
	Hemodialysis (percent with at least one)	92.5%	91.5%	91.8%	91.0%	**-0.27**	-0.80	0.26	-0.30%
	Peritoneal Dialysis (percent with at least one)	5.9%	6.6%	6.5%	7.0%	**0.26**	-0.28	0.79	4.3%
	Home Hemodialysis (percent with at least one)	1.5%	1.7%	1.4%	1.5%	**0.09**	-0.19	0.37	5.5%
	Home Dialysis (percent with at least one)	7.9%	8.0%	7.7%	7.8%	**0.10**	-0.16	0.35	1.2%
	Percent of Beneficiaries Starting Dialysis with No Prior Nephrology Care	26.3%	24.1%	28.1%	26.4%	**-0.51**	-2.5	1.5	-1.9%
	Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	65.3%	64.8%	65.4%	64.7%	**0.25**	-0.35	0.84	0.38%
	Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	9.4%	9.9%	11.2%	12.3%	**-0.69** ***	-1.1	-0.33	-7.4%
Coordination of Care Beyond Dialysis	Percent of Beneficiaries Receiving at Least One Low-Density Lipoprotein (LDL) Cholesterol Test in a Given Year	58.5%	57.8%	54.7%	52.0%	**2.1** ***	0.76	3.4	3.5%
	Percent of Beneficiaries Receiving at Least One Hemoglobin A1c (HbA1c) Test in a Given Year	77.9%	76.4%	77.6%	75.2%	**0.86** *	0.01	1.7	1.1%
	Percent of Beneficiaries Receiving at Least One Dilated Eye Exam in a Given Year	39.7%	41.4%	40.3%	40.4%	**1.6** ***	0.87	2.4	4.1%

Measures		CEC		Comparison		Difference-in-Differences Estimate			
		Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care Beyond Dialysis (cont.)	**Percent of Beneficiaries Receiving Flu Vaccinations^**	64.8%	68.1%	62.4%	63.9%	**1.9 *** **	0.97	2.8	2.9%
	Number of Primary Care E&M Office/Outpatient Visits per 1,000 Beneficiaries per Month	235.3	231.4	229.9	216.9	**9.1 *** **	5.0	13.1	3.8%
	Number of Specialty Care E&M Office/Outpatient Visits per 1,000 Beneficiaries per Month	436.3	435.0	430.1	425.1	**3.7**	-2.7	10.0	0.84%
	Percent of Beneficiaries Receiving Hospice Services in a Given Month	0.89%	0.85%	0.82%	0.75%	**0.02**	-0.03	0.07	2.7%
	Percent of Beneficiaries with Greater than 50 mg Average Morphine Milligram Equivalent (MME) in a Given Month	6.2%	5.5%	6.2%	5.7%	**-0.32 ***	-0.60	-0.05	-5.2%
	Percent of Beneficiaries with Greater than 80% of Days Covered for Phosphate Binder Prescription in a Given Month	34.1%	36.8%	34.1%	35.3%	**1.3 *** **	0.76	1.9	3.9%
	Percent of Beneficiaries with at Least One Contraindicated Medication Prescription Fill in a Given Month	3.5%	3.7%	3.6%	3.7%	**0.11**	-0.08	0.31	3.3%
Hospitalizations and Emergency Department Visits	**Number of Hospitalizations per 1,000 Beneficiaries per Month**	133.2	129.8	131.8	133.2	**-4.8*** **	-7.0	-2.6	-3.6%
	Number of ED Visits per 1,000 Beneficiaries per Month	141.3	151.3	148.1	158.8	**-0.74**	-3.8	2.3	-0.52%
	Number of Observation Stays per 1,000 Beneficiaries per Month	25.4	26.9	24.0	26.4	**-0.86**	-1.8	0.10	-0.03
	Number of Endocrine/Metabolic Inpatient Hospitalizations per 1,000 Beneficiaries per Month	16.6	14.2	15.8	14.0	**-0.50**	-1.0	0.01	-3.0%
	Number of Circulatory Inpatient Hospitalizations per 1,000 Beneficiaries per Month	38.3	40.5	37.7	42.1	**-2.3 *** **	-3.3	-1.3	-6.0%

Measures		CEC		Comparison		Difference-in-Differences Estimate			
		Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	**Number of Infectious Inpatient Hospitalizations per 1,000 Beneficiaries per Month**	14.1	14.3	15.1	16.2	**-0.86 *****	-1.4	-0.36	-6.1%
	Percent of Beneficiaries with at Least One Hospitalization for Vascular Access Complications in a Given Month	0.58%	0.60%	0.63%	0.65%	**-0.01**	-0.04	0.02	-1.2%
	Percent of Beneficiaries with at Least One Hospitalization for ESRD Complications in a Given Month	1.8%	2.0%	1.8%	2.0%	**-0.12 *****	-0.18	-0.06	-6.5%
	Percent of Beneficiaries with at Least One Hospitalization for Catheter-related Bloodstream Infection in a Given Month	0.14%	0.08%	0.15%	0.09%	**-0.0004**	-0.01	0.01	-0.31%
	Percent of Beneficiaries with at Least One Hospitalization for Peritonitis in a Given Month	0.10%	0.09%	0.10%	0.09%	**0.01**	-0.004	0.02	5.8%
	Percent of Beneficiaries with at Least One Hospitalization for Sepsis in a Given Month	1.1%	1.2%	1.2%	1.4%	**-0.09 *****	-0.13	-0.04	-7.6%
	Percent of Beneficiaries with at Least One Admission for Diabetes Short-Term Complications in a Given Month	0.12%	0.11%	0.13%	0.11%	**0.01**	-0.01	0.03	6.8%
	Percent of Beneficiaries with at Least One Admission for Diabetes Long-Term Complications in a Given Month	0.77%	0.68%	0.74%	0.68%	**-0.03**	-0.06	0.01	-3.3%
	Percent of Beneficiaries with at Least One Admission for Congestive Heart Failure (CHF) in a Given Month	1.5%	1.7%	1.5%	1.9%	**-0.13 *****	-0.20	-0.06	-8.4%
	Percent of Beneficiaries with at Least One Readmission within 30-days of an Index Hospitalization Stay in a Given Month	29.9%	29.1%	29.6%	29.8%	**-0.93 *****	-1.5	-0.39	-3.1%

Measures		CEC		Comparison		Difference-in-Differences Estimate			
		Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	**Percent of Beneficiaries with at Least One ED Visit within 30-days of an Acute Hospitalization in a Given Month**	20.1%	21.2%	20.8%	21.8%	**0.08**	-0.35	0.50	0.38%
Medicare Payments across the Continuum of Care	**Total Part A and Part B PBPM**	$6,396	$6,421	$6,370	$6,488	**- $93 *** **	-$147	-$39	-1.5%
	Acute Inpatient PBPM	$1,668	$1,677	$1,670	$1,739	**- $59 *** **	-$87	-$31	-3.5%
	Readmissions PBPM	$583	$585	$579	$614	**- $33 *** **	-$51	-$14	-5.6%
	Institutional Post-Acute Care PBPM	$556	$532	$536	$541	**- $30 ** **	-$51	-$8	-5.4%
	Home Health PBPM	$173	$169	$170	$165	**$1**	-$4	$6	0.63%
	Hospice PBPM	$24	$23	$22	$20	**$1**	-$1	$2	2.9%
	Hospital Outpatient PBPM	$380	$420	$408	$448	**$0**	-$9	$9	0.10%
	Office Visits PBPM	$53	$55	$52	$53	**$1 *** **	$1	$2	2.0%
	Total Part B PBPM	$4,074	$4,121	$4,065	$4,122	**-$11**	-$33	$11	-0.27%
	Total Dialysis PBPM	$2,598	$2,680	$2,605	$2,680	**$7 * ‡**	$0	$14	0.27%
	Hospitalizations for ESRD Complications PBPM	$154	$173	$149	$178	**- $11 *** **	-$17	-$5	-7.0%
	Part B Drug PBPM	$25	$36	$24	$36	**$0 ‡**	-$3	$3	-0.15%
Unintended Consequences	**Total Part D Drug Cost PBPM**	$822	$1,022	$836	$1,016	**$20 ‡**	-$36	$76	2.4%

Notes: A DiD design was used to estimate the differential change in outcomes for beneficiaries receiving care from CEC dialysis facilities between the pre-CEC and the intervention periods relative to a comparison group of beneficiaries aligned to matched dialysis facilities that were not participating in CEC. Estimates include both waves from October 2015 – December 2018 and are the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% have 8 quarters, and the remaining 33.5% participated in CEC from January 2018 to December 2018 (four quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Dialysis Care. We expected the CEC Model to incentivize better vascular access practices and improve adherence to dialysis, which could in turn reduce hospitalization rates. Vascular access-related bacteremia, caused by infected catheter sites, can require hospitalization. The successful creation of arteriovenous (AV) fistulas and AV grafts can reduce risk. Care coordination by the ESCOs may include referrals to vascular surgeons to increase the rate of fistula placements. Consistent with expectations, use of catheters for more than 90 days showed a statistically significant decrease of over 7%.[6] Because AV fistula use showed a small, statistically insignificant improvement of 0.4%, it appears that the reduction in catheter use was mainly accompanied by an increase in the use of AV grafts. There was also a small decline in emergency dialysis sessions and a small increase in total outpatient sessions, which are signs that ESCOs' reported increased efforts to promote dialysis adherence had some success.

There was no evidence of changes in patient-reported quality of dialysis care at CEC dialysis facilities. We did not expect to see changes in these measures since dialysis facilities already have financial incentives to score highly on these outcomes through the ESRD QIP,[7] and these results confirm the CEC Model has not resulted in lower dialysis quality.

Coordination of Care beyond Dialysis. Because ESCOs are accountable for all of a beneficiary's Medicare Parts A and B costs, providers have the incentive to invest in preventive services and chronic disease management activities beyond their standard dialysis care. Also, ESCOs may offer beneficiaries with ESRD more education about hospice and end-of-life care, for instance, through their partnerships with palliative care organizations. We found that CEC beneficiaries experienced a statistically significant increase in preventive health care services, such as hemoglobin A1c (HbA1c) testing, low-density lipoprotein (LDL) cholesterol testing, and dilated eye exams. CEC reduced the likelihood of a beneficiary with ESRD overusing opioid prescriptions by 5% and improved adherence to phosphate binder use by 4%. CEC beneficiaries had more evaluation and management (E/M) primary care office visits. Unlike primary care, specialty care E/M office visits did not change significantly. CEC had no statistically significant impact on hospice use.

Hospitalizations and ED Visits. By introducing incentives for reducing total cost of care, the CEC Model was expected to reduce acute hospitalization admissions, readmissions, and ED use. CEC beneficiaries experienced statistically significant reductions in hospitalizations. Specifically, CEC reduced the number of hospital visits by 4% in the first three years of the model. CEC beneficiaries were also 3% less likely to have a readmission, a change that was statistically significant. The number of ED visits decreased under the CEC Model, but this decline was not statistically significant.

Mortality. This year's report, for the first time, includes a survival analysis to study the impact of the CEC Model on mortality. This analysis was motivated by observations of favorable trends in the Standardized Mortality Ratio in the CEC population as well as the emergence of longer average time since start of dialysis in the CEC than in the matched comparison group. The latter could have occurred if mortality was lower in the CEC group. We estimated survival models, including adjustments for patient characteristics. Overall, the CEC showed a statistically

[6] There are three types of vascular access for hemodialysis: fistulas, grafts, and catheters.
[7] https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP/index.html

significant, but modest, association with better patient survival. The association was stronger among patients aligned to the CEC during their first year of dialysis. There was also some indication that the association between the CEC and survival is stronger in Wave 2, but the difference between waves was not statistically significant. Further follow-up will be required to establish whether the association differed by wave.

Medicare Payments across the Continuum of Care. ESCOs were able to reduce costs mainly through a reduction in payments for hospitalizations, although the overall impact on payments was modest. Average total Medicare Part A and Part B standardized payments, our measure of overall Medicare payments, decreased from the pre-CEC period to PY3 for both the CEC and comparison group beneficiaries. The decrease was greater for the CEC group, resulting in a 1.5% relative reduction ($93 PBPM) for CEC beneficiaries. These impacts on payments are somewhat smaller than the estimated impacts through PY2 (2%, or $114 PBPM), shown in the second annual report.[8] Overall, the CEC Model resulted in a reduction in payments of $115 million over the first three performance years.[9] Payments decreased by $29 million in PY1, $48.5 million in PY2, and $37.5 million in PY3. The $19.5 million additional decline in payments from PY1 to PY2 is due to larger reductions in payments for Wave 1 ESCOs in PY2 relative to PY1 (from $29 million to $40 million) and the additional $8.5 million reduction in payments achieved by Wave 2 ESCOs in PY2. Medicare payment declines for CEC beneficiaries relative to the comparison group were driven by lower payments for hospitalization ($59), readmissions ($33) and institutional post-acute care ($30), with partially offsetting increases in payments for office visits ($1) and dialysis ($11).

Waves 1 and 2 also experienced different results in PBPM costs. (See **Exhibit ES-4** for a comparison of Wave 1 and Wave 2 estimated payment reductions.) The decline in payments was driven by Wave 1 ESCOs. While the average reduction in payments for all ESCOs was $93 PBPM, estimates were smaller and not statistically significant for Wave 2 ESCOs ($41 PBPM in their first performance year versus $143 PBPM for Wave 1 ESCOs in their first performance year). The reduction in payments for Wave 2 ESCOs was $45 PBPM in the second performance year, compared with $193 PBPM in Waves 1 ESCOs. Notably, Wave 1 ESCOs continued to reduce payments during their third performance year (by $77 PBPM).

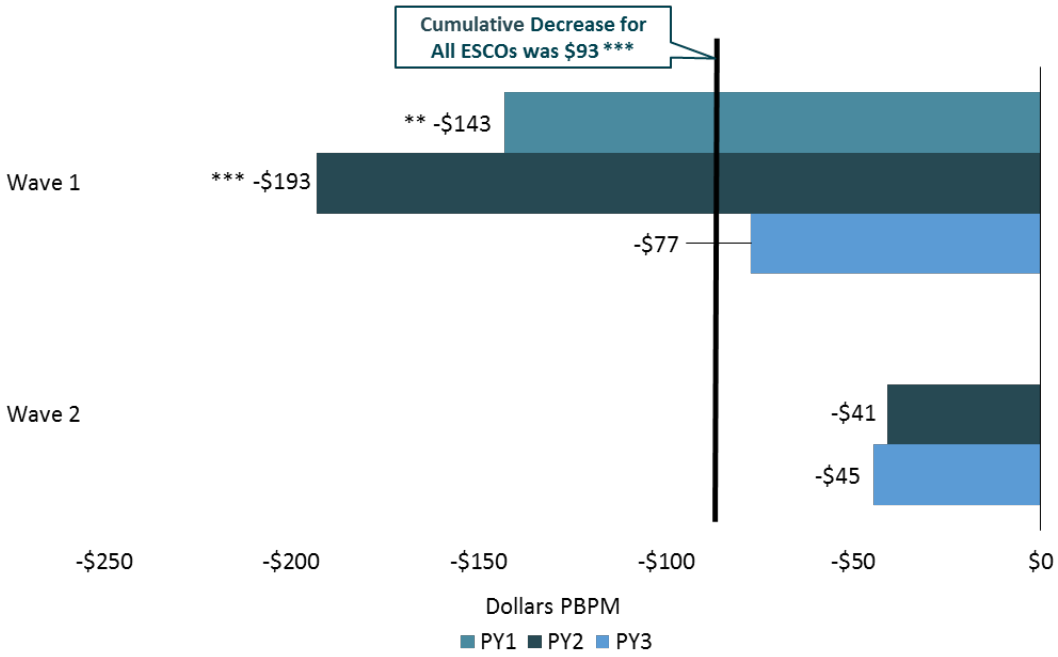
The smaller decline in Medicare payments in Wave 2 ESCOs might be attributable to differences in facilities across waves. Whereas Wave 1 ESCO facilities had higher Medicare payments and higher standardized hospitalization and readmission rates than non-CEC facilities, those joining in Wave 2 had lower payments and lower standardized hospitalization and readmission rates than non-CEC facilities. This suggests that the facilities in Wave 2 ESCOs may have had less room to improve on their pre-CEC performance. In addition, PY3 joiner facilities started from a more challenging position relative to their predecessors, with higher historic payments and utilization. Further, compared to earlier joining facilities that were overwhelmingly located in metropolitan areas, PY3 joiner facilities were often located in non-metropolitan areas and had fewer dialysis stations. The combination of these factors may present challenges to reducing payments.

[8] See CEC Model Performance Year 2 Evaluation Report at https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf

[9] These estimates do not account for payments between ESCOs and CMS resulting from PY1+PY2 reconciliation.

Additionally, Wave 1 and Wave 2 had different "lead-in" periods. Delays in the start date for Wave 1 may have allowed greater preparation time and may have contributed to differences in outcomes across the two waves. Wave 1 ESCOs may contain more motivated participants that were willing to be early adopters, while at least some Wave 2 nephrologist participants may have been motivated more strongly by gaining exemption from Merit-Based Incentive Payment System (MIPS) requirements than by enthusiasm for the model. Wave 2 also did not experience the same magnitude of improvement in its second performance year relative to its first that was seen in Wave 1's second performance year.

Exhibit ES-4. Impact of CEC on Total Part A and Part B Medicare Payments PBPM



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate. See **Appendix F**, **Exhibit F-27** (All ESCOs), **Exhibit F-28** (Wave 1), and **Exhibit F-29** (Wave 2) for detailed results.

7. What Were the Differences in Performance between the CEC and Primary Care-Based ACO Models?

We found key differences in performance between the CEC Model and the primary care-based ACO models, relative to a FFS comparison group, for four of the six outcomes that we evaluated. Specifically, Medicare payments, hospitalizations, and readmissions significantly decreased and fistula use increased among FFS beneficiaries with ESRD who became aligned to

CEC during the first year after alignment. Conversely, FFS beneficiaries with ESRD who were newly aligned to a primary care-based ACO experienced no statistically significant impacts.

8. Were There Unintended Consequences of the CEC Model?

While the CEC Model is intended to create incentives for more efficient and/or higher quality care, it is also important to monitor for potential adverse, unintended consequences. We examined if the model inadvertently shifted payments to parts of the Medicare program for which the ESCOs are not accountable (Part D prescription drug benefit); resulted in implicit or explicit selection of more favorable patients; or reduced participation of beneficiaries on the transplant waitlist.

There is no evidence that the CEC Model had an impact on these outcomes. First, there was no impact on Part D drug costs. Second, there was no evidence that physicians changed their referral patterns due to the CEC Model (such as assigning sicker dialysis patients to non-CEC rather than CEC facilities in an effort to lower ESCO costs). Finally, there was no evidence that participation in CEC impacted transplant waiting list participation.

C. Discussion

From the first three years of experience, the CEC Model appears promising, with lower payments, improvements in some utilization measures, and no obvious indicators of unintended or adverse consequences. Part A and B Medicare payments declined by $93 PBPM. Relative to the average payments at baseline $6,396, this represents a decrease in payments of 1.5%. The payment reductions were most evident in Medicare Part A with significant reductions in acute inpatient, readmission, and institutional post-acute care categories. Reductions in utilization paralleled the payment reductions, with significant declines in hospitalizations, readmissions, and ED visits. The number of dialysis treatments and payments on dialysis increased, which could be a consequence of fewer missed treatments, while hospitalizations and payments for dialysis complications declined. Significant reductions in catheter as vascular access were also observed, suggesting overall improvements in the quality of dialysis care, along with improvements in preventive services.

Utilization and payment results reinforce the qualitative findings from ESCO site visits. Improving coordination of care across institutional settings was cited as a key objective by the ESCOs, backed by new investments such as care coordination staff and IT. Reducing hospitalizations and readmissions was a particular area of emphasis. Similarly, the observed increase in the number of dialysis treatments and dialysis payments may reflect a decrease in skipped outpatient treatments, either directly or indirectly (due to less time in hospital), which was another key emphasis cited by the ESCOs. Many ESCOs sought to improve communications with local EDs in order to divert beneficiaries with conditions such as fluid overload from the inpatient setting. This improved communication was sometimes coupled with enhanced provision of standby dialysis slots to facilitate rescheduled or extra treatments in such cases. Overall, many of the care redesign strategies were enhancements or more formal extensions of processes in existence prior to the implementation of the CEC Model. Most of the changes in structure and operations reported by Wave 1 ESCOs in PY3 relative to PY1 were refinements of activities rather than major reinventions. Many ESCOs felt that building partnerships with hospice and palliative care providers was important, but it was an area where their efforts had

lagged behind other initiatives. More generally, ESCO representatives identified lack of engagement with non-participating providers and the inability to provide beneficiary incentives as limitations to the model and may have limited the reductions in payments that were achieved.

A new set of analyses showed that the CEC was associated with better survival. Although the magnitude of the effect was modest, it appeared to be stronger for beneficiaries aligned earlier in their course of dialysis. This association should continue to be monitored as more beneficiary follow-up time accrues. Other measured model effects, such as the increase in dialysis treatments and declines in hospitalizations overall and specifically due to dialysis complications are potential mechanisms that might underlie improved survival.

The CEC experience can inform efforts to develop specialty-oriented ACOs focusing on clinical populations with other chronic conditions such as diabetes, HIV, or congestive heart failure. The dialysis-dependent ESRD population may be a particularly appropriate population for the development of a specialty-oriented ACO, such as the CEC Model, because the dialysis schedule inherently creates frequent and regular interaction between patients and the at risk entities (dialysis facilities and nephrologists). Hemodialysis patients visit the dialysis unit three times weekly and see the nephrologist three to four times monthly. Home dialysis patients have less frequent (typically monthly), but still regular, contact. Frequent and regular contact with the ACO's at risk entities may provide opportunities to monitor patient condition and intervene to improve outcomes. For example, ESCO site visit participants commonly reported that the ESCO would reach out to the patient to determine the cause of a missed treatment and attempt to reschedule it to reduce the risk of adverse outcomes. In addition, ESCOs emphasized the importance of having multiple providers reiterate and reinforce patient education messages to help patients remember and adopt the guidance provided. Such opportunities to intervene are inherently more sporadic and variable across patients in the context of both primary care-based ACOs and hypothetical specialty-oriented ACOs that could be developed for other conditions. Therefore, positive outcomes for the CEC Model might not be directly generalizable to populations with other chronic illnesses, such as diabetes, HIV, or congestive heart failure. Nonetheless, the CEC experience could still provide lessons about the potential benefits of specialty providers increasing their responsibilities in an ACO context, whether that ACO is entirely comprised of a population with a particular chronic condition or only represents a defined subpopulation within a primary care-based ACO.

The findings presented in this report have several limitations. For instance, because the CEC is a voluntary model, the 37 ESCOs are not representative of the population of Medicare dialysis providers, limiting our ability to generalize the results presented here to all Medicare providers or all FFS ESRD beneficiaries. However, the addition of new participants in PY2 increased the representation of markets participating in CEC. Another limitation is that, although the analysis employed matching methods to select an appropriate comparison group to infer counterfactual outcomes for the ESCOs, the characteristics we selected for matching and the specificity of the data may not adequately account for all differences between CEC and comparison facilities and their beneficiaries. There may also be unobservable characteristics, such as motivation to participate in an A-APM, which we cannot sufficiently control for with secondary data.

Future annual reports can build on these analyses in several ways. First, with increased sample sizes and more time under the model, we can assess whether the performance of Wave 1 ESCOs

are able to rebound to or beyond levels achieved in PY2, and whether Wave 2 ESCOs are able to close the performance gap relative to Wave 1. We will also be able to do more in-depth analyses of how results may vary across particular participant types, markets, and beneficiary sub-populations. In particular, we can compare the performance of participants from LDOs and non-LDOs and investigate the experience of subpopulations who may be more vulnerable to declines in quality of care. As Medicaid data becomes available, we can explore the impact on Medicaid spending for aligned beneficiaries dually eligible for Medicare and Medicaid. Finally, we can evaluate the scalability of the model and examine what would be the impact of the model if it were implemented nationally. We can also investigate whether the protocols and processes developed for the CEC Model can be broadly implemented and sustained among providers, physicians, beneficiaries, and caregivers who are not currently participating in the CEC Model.

I. Introduction

The Centers for Medicare & Medicaid Services (CMS) launched the Comprehensive End-Stage Renal Disease (ESRD) Care (CEC) Model in 2015 under the authority of the Center for Medicare & Medicaid Innovation (CMMI). The CEC Model is designed to improve clinical and patient-centered outcomes for Medicare beneficiaries with ESRD while promoting value and reducing per capita payments. Under the CEC Model, dialysis facilities, nephrologists, and other providers can partner to form ESRD Seamless Care Organizations (ESCOs). ESCOs act as specialty-oriented accountable care organizations (ACOs), which assume responsibility for the complete care and costs of their aligned Medicare fee-for-service (FFS) beneficiaries with ESRD. The CEC Model promotes comprehensive and coordinated care and improved access to services. The CEC Model expands the reach of recent value-based payment initiatives targeting dialysis-related care such as the ESRD Prospective Payment System (PPS) and the ESRD Quality Incentive Program (QIP).[10]

The Lewin Group, Inc. (Lewin), along with its partners, the University of Michigan's Kidney Epidemiology and Cost Center, General Dynamics Information Technology, and ICF International, are under contract to CMS to evaluate the first five years of the CEC Model. The goal of the evaluation is to assess the impact of the CEC Model on the quality of care and health outcomes of its beneficiaries with ESRD, as well as their utilization of inpatient/outpatient services and Medicare payments.

This report is the third of five annual reports. It covers the 37 ESCOs operating in the first three performance years (PYs) of the model from October 1, 2015 through December 31, 2018. Of these 37 ESCOs, 13 (Wave 1) joined at the start of PY1 on October 1, 2015 and 24 (Wave 2) joined the CEC Model on January 1, 2017, at the start of PY2. Several Wave 1 and 2 ESCOs added facilities for PY3 (January 1, 2018 – December 31, 2018).[11] Overall, the number of CEC participating facilities increased from 206 in PY1, to 632 in PY2, to 949 in PY3.

Research Questions Addressed in the Third Annual Report

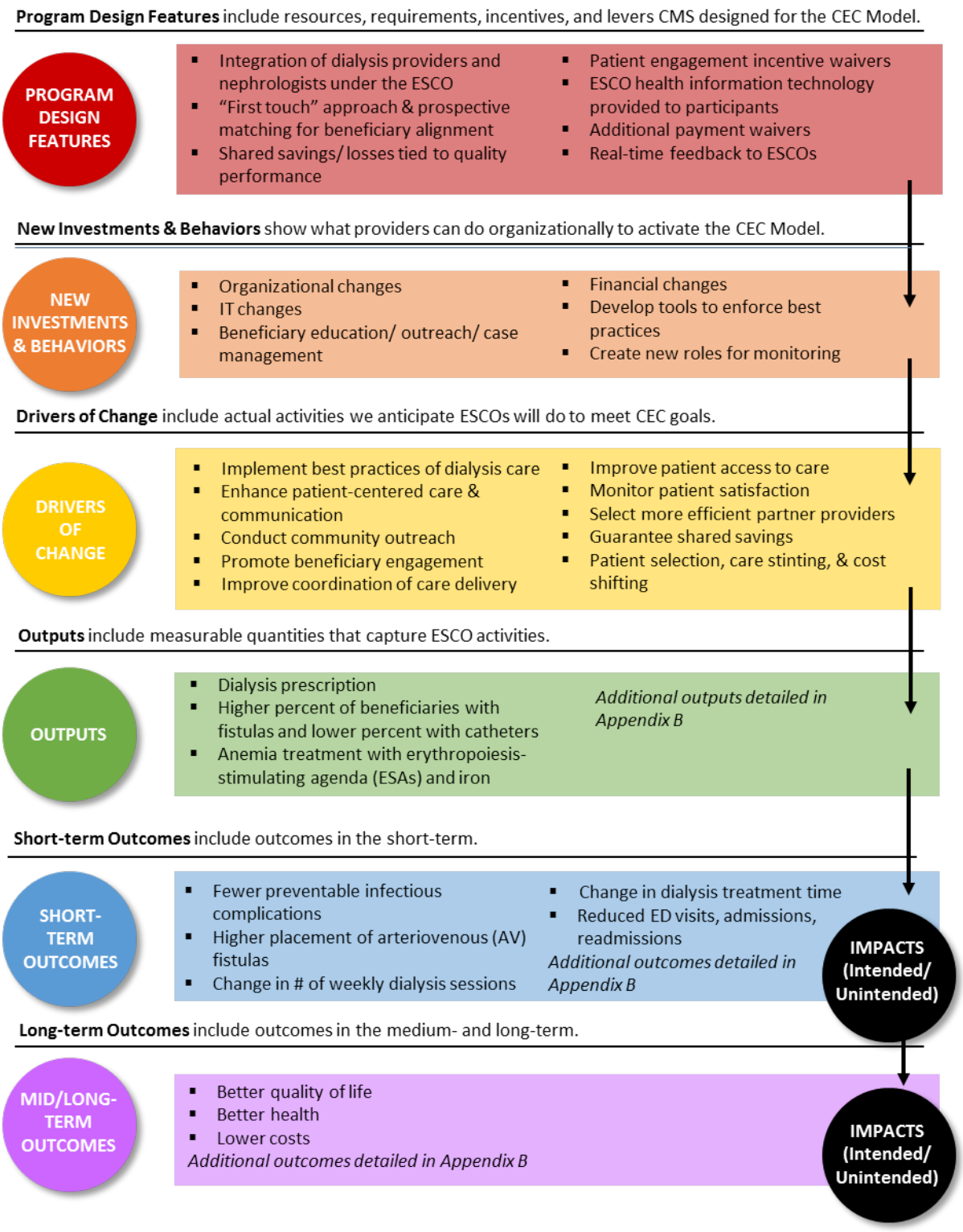
The third annual report is organized to address several core research questions[12] as detailed below. We generated these research questions based on the conceptual framework, or logic model, of the CEC Model shown in **Exhibit 1**.

[10] See the CEC Model Performance Year 1 Annual Evaluation Report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf) and the CEC Model website (https://innovation.cms.gov/initiatives/comprehensive-ESRD-care/) for additional information on the CEC Model.

[11] For more information, please see **Appendix F**.

[12] Formative evaluation research questions focus on characteristics of participants, entry decisions, investments by participants, care redesign approaches, implementation challenges, scalability and sustainability, and stories of success. Summative evaluation research questions assess impact in better care, better health, payments and utilization, and unintended consequences.

Exhibit 1. CEC Evaluation Logic Model (Abbreviated Version)



The conceptual framework that describes our understanding of the resources ESCOs bring to the CEC Model, the design features and incentives that are put in place under the CEC Model, the

actions and behaviors that participants may take, and the outcomes that may be achieved are provided in **Exhibit 1** (above) and **Appendix B**.

1. Who Participates in the CEC Model?

To provide context for the CEC Model, we describe Wave 1 and Wave 2 ESCO participants and the markets they serve and compared them to non-CEC participants and markets. We developed market profiles using data from the Provider of Service, Dialysis Facility Compare, Area Health Resource Files, and other secondary data. We also compared CEC-aligned beneficiaries to non-CEC beneficiaries to understand differences in demographic, clinical, and utilization characteristics that may influence the impact of the CEC Model on outcomes.

2. How Have Structural Features of the Wave 1 ESCOs Changed Over Time?

Using data from a second round of visits to Wave 1 ESCOs in PY3, we assessed the structural changes Wave 1 ESCOs made since original implementation (i.e., PY1) and the barriers they have encountered.[13] Data from ESCO site visits and interviews were used to investigate their decision-making processes and motivations for these changes, as well as any obstacles they faced. We provide information about changes in both risk-sharing and non-risk-sharing partnerships dialysis organizations made to operate their ESCOs, new information technology (IT) and staff investments, and uptake or changes to use of program waivers. Finally, we summarize ESCO owners' perceptions of the Model's financial and risk arrangements in its third year of performance.

3. How Has Care Redesign Evolved Under Wave 1 ESCOs?

We examined how Wave 1 ESCOs' care redesign strategies for reducing costs, improving quality, and coordinating care have evolved since implementation in PY1. Care coordination (i.e., better coordination among providers across the continuum of care) is a key focus of care redesign in the CEC Model. Care redesign strategies included increasing availability of dialysis treatments, enhancing the structure of care coordination, diverting beneficiaries from the Emergency Department (ED), and continued focus on improving medication management. Strategies to meet these goals involved on-boarding of patients prior to formal alignment, expanding patient education, enhancing risk-profiling of patients, and improving communication between providers and between providers and beneficiaries. To identify commonalities and differences across ESCOs, we looked at data from questionnaires and site visits with ESCOs regarding any changes in their approaches to care redesign since PY1 and reasons for these changes. In addition to providing information on changes or enhancements in care redesign strategies, our data allowed us to recognize challenges across ESCOs and unique innovations among participating ESCOs.

We also examined how structural changes in the organization of care has enhanced care coordination since implementation, including the strategic selection of new partners (e.g., hospitals, primary care providers [PCPs], home health agencies, specialists) or efforts to extend existing partnerships; use of IT to streamline or provide access to information across all

[13] This report presents findings from the second round of site visits with Wave 1 ESCOs. For findings from the first round of Wave 1 ESCO site visits, please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf).

partners (through adoption of health IT platforms and other communication pathways); and any changes in financial arrangements (i.e., pay for performance, care coordination payments, and shared savings distributions) that support the achievement of model outcomes.

4. What Were Beneficiaries' Perceptions of the CEC Model?

We assessed beneficiaries' perceptions of the CEC Model during focus groups with those who received services at selected Wave 1 ESCO dialysis facilities. We examined their level of awareness of the CEC Model and their impressions of their care, as well as whether they noticed changes in the quality of their care since the start of the CEC Model.

5. What Was the Association between Alignment in the CEC Model and Beneficiary Quality of Life?

We used data from the Kidney Disease Quality of Life (KDQOL-36™) survey to assess the impact of the CEC Model on beneficiaries' self-reported measures of health-related quality of life (HRQOL). The KDQOL-36™ instrument is designed to collect data on perceived burden of kidney disease, kidney disease symptoms or problems, and effects of kidney disease on quality of life and function. We analyzed physical and mental composite scores in each of these domains. The KDQOL-36™ survey was administered to both CEC beneficiaries and a matched comparison group of beneficiaries.

6. What Were the Impacts of the CEC Model?

We evaluated the impact of the CEC Model on dialysis care, coordination of non-dialysis care, inpatient and outpatient utilization outcomes such as hospitalizations, readmission, and ED visits, and the rate of Medicare payments per beneficiary per month (PBPM) across the continuum of care during the first three performance years of the model.

First, we explored indicators related to the delivery of dialysis care, which involved assessing the model's impact on pre-dialysis care, dialysis treatment modality, use of emergency dialysis treatments, and patients' experience with dialysis care. Multiple evidence-based clinical metrics were used to assess the model's impact on the care delivered by dialysis facilities and nephrologists (e.g., establishment of permanent vascular access, number of outpatient dialysis sessions, or percent of beneficiaries with unscheduled emergency dialysis sessions). To assess the extent ESCOs focused on improving pre-dialysis care, we investigated the impact of the model on the percent of beneficiaries who receive nephrology care before the start of dialysis. Additionally, we used the In-Center Hemodialysis Consumer Assessment of Healthcare Providers (ICH CAHPS®) survey to assess the impact of the CEC Model on beneficiaries' self-reported experiences with dialysis care and to capture potential unintended consequences of the model.

Second, we looked at measures associated with the coordination of care beyond dialysis, such as appropriate preventive health care, disease management, and end-of-life care. These measures included flu vaccinations and diabetes-related testing (e.g., hemoglobin A1c [HbA1c] tests and diabetic eye exams), phosphate binder adherence for disease management, and hospice use for end-of-life care (given the high mortality rate in the ESRD population and the fact that several ESCOs originally aimed to focus on hospice referrals and access to palliative care resources). Since many ESRD patients are on multiple medications for management of symptoms and comorbid (co-occurring) conditions, we added measures to examine medication management to assess opioid

overutilization and any changes in use of contraindicated medications. We also evaluated measures that evaluated the potential impact of the CEC Model on the quality of care associated with diseases that often accompany ESRD (e.g., diabetes, congestive heart failure [CHF]).

Third, we examined changes in utilization of distinct inpatient and outpatient services received by beneficiaries with ESRD related to hospitalizations, readmissions, ED visits, and outpatient visits with other providers. Given that reducing inpatient utilization has been identified as an area for needed improvement in ESRD care and was the primary focus of most ESCOs, we were especially interested in this outcome and any changes over the three performance years. Because patients with ESRD often have comorbid conditions and CEC is intended to help providers focus on the continuum of care, we also looked at cause-specific hospital admissions related to diabetes, CHF, and infections.

Fourth, an analysis of survival, comparing CEC beneficiaries to those in the matched comparison group, was estimated for the first time.

Finally, because ESCOs are expected to redesign care and adopt cost-savings strategies, this third annual report examines changes in the costs of care, using Medicare standardized payments for total Part A and Part B services and payments by type of services.[14] We also conducted additional analysis that targeted payments for claims specifically associated with hospitalizations for ESRD complications, as well as institutional post-acute care costs. All analyses accounted for the case-mix of beneficiaries by matching on key demographic, clinical, and utilization characteristics.

7. What Were the Differences in Performance between the CEC and Primary Care-Based ACO Models?

We evaluated whether ESCOs in the CEC Model were better able to provide care for Medicare beneficiaries with ESRD than primary care-based ACOs by exploring whether beneficiaries with ESRD who became aligned to CEC had better outcomes than those who became aligned to a primary care-based ACO. The results illustrate the performance of each of the care models relative to a FFS baseline.

8. Were There Unintended Consequences of the CEC Model?

ESCOs may employ multiple approaches to reduce their costs of care under the CEC Model. Strategies to deliver care more efficiently or coordinate care across providers may improve quality of care and health outcomes while reducing costs. However, strategies such as stinting on care, postponing care, changing referral patterns and transplant strategies, or substituting inferior or inappropriate services could result in worse quality of care and quality of life for beneficiaries. Still other strategies could reduce the cost of care for CEC beneficiaries while increasing costs to other payers, including other parts of the Medicare program (Medicare Part D) or Medicaid.

To assess whether the CEC Model had unintended consequences for CEC beneficiaries, we examined the impact of the CEC Model on Part D drug costs and waitlisting for transplantations.

[14] These amounts combine the Medicare payments with the patient coinsurance and copayment amounts. Then, these amounts are standardized to remove the effects of wage differences and for teaching status and other policy adjustments.

We also used Medicare claims data to assess referral patterns for dialysis to explore whether nephrologists were selectively referring healthier patients to ESCO facilities. Lastly, we explored the relative changes in the use of calcimimetics before and after Transitional Drug Add-on Payment Adjustment (TDAPA) for CEC participants and the comparison group.

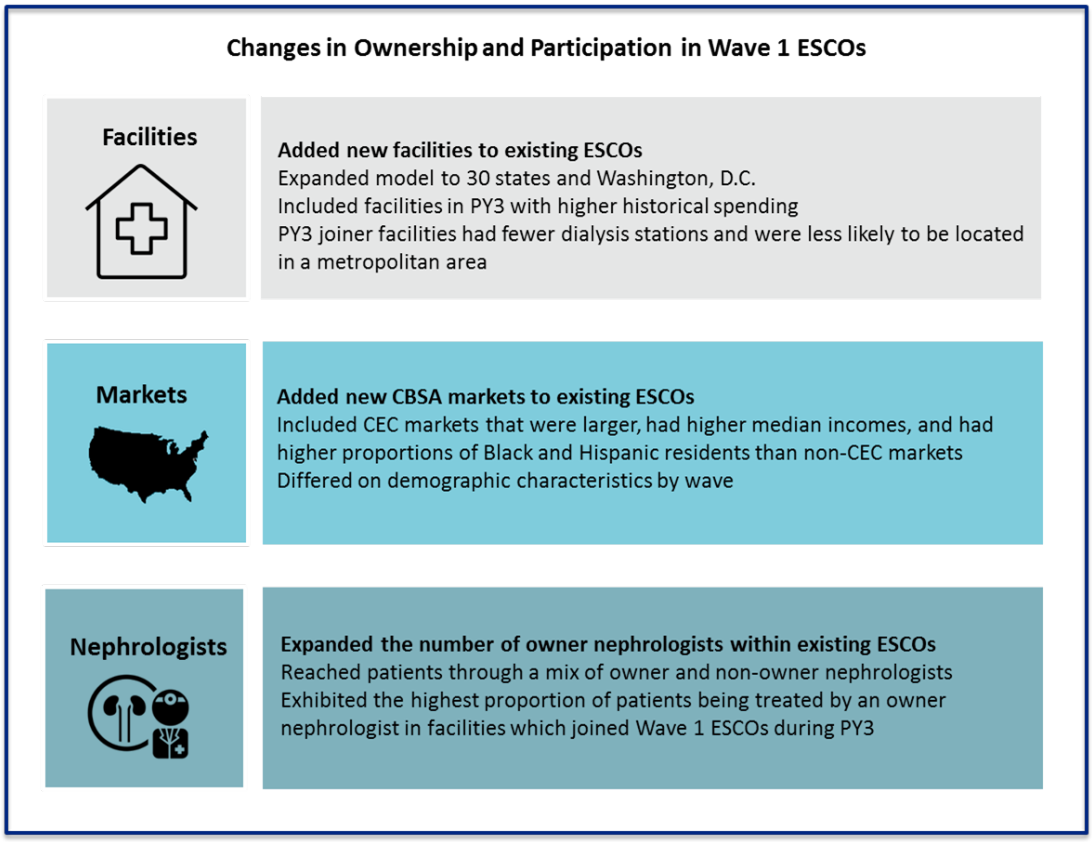
II. What Shifts Have Occurred in Wave 1 ESCOs Ownership and Participation?

The number of ESCOs and facilities participating in the CEC Model grew during the first three performance years to include 59,148 beneficiaries in PY3 (13% of the fee-for-service [FFS] Medicare ESRD population). This growth stemmed from the creation of 24 new ESCOs (i.e., Wave 2) in PY2 joining the original 13 ESCOs (i.e., Wave 1). Over this time span, the number of new facilities increased from 235 to 1,065 where this expansion occurred during each performance year within existing ESCOs and with the addition of facilities for the new Wave 2 ESCOs, as no new ESCOs were created in PY3.

Nephrologists joined the CEC model each year, bringing the count of owner nephrologists from 247 in the first quarter of PY1 to 1,616 in the final quarter of PY3. Participation of nephrologists was encouraged by the reduction in reporting requirements for CEC Model participants authorized under the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA). This addition of owner nephrologists allowed beneficiaries aligned to facilities new to the model to be treated by a nephrologist who faced the CEC care incentives.

Based on their clinical and financial success in the early years of the model, ESCOs leveraged their experience to expand in PY3. Increases in the number of facilities, owner nephrologists, and wider regional representation allowed ESCOs to reach more patients. ESCOs added 82 facilities and expanded to 5 new Medicare Core-Based Statistical Areas (CBSAs) between PY2 and PY3.

A. Key Findings



B. Methods

We constructed a dialysis facility dataset, based on data from CMS, that included facility-level characteristics from the 2015 Dialysis Facility Compare database and a summary of 2012-2014 Medicare claims, as well as market-level characteristics from 2014 based on the Area Health Resource Files, Census American Community Survey, and a summary of 2012-2014 Medicare claims. We aggregated county-level characteristics to the CBSA level[15] by weighting individual county observations by population. CEC markets were defined as those CBSAs that had at least one CEC facility, while non-CEC CBSAs were those without CEC facilities. In addition, in PY3, we conducted site visits with each of the 13 Wave 1 ESCOs, which included ESCOs from DaVita, DCI, Fresenius, and Rogosin. See **Appendix C** for a discussion of site visit selection criteria, data collection procedures, protocol development, and analysis methods.

C. Results

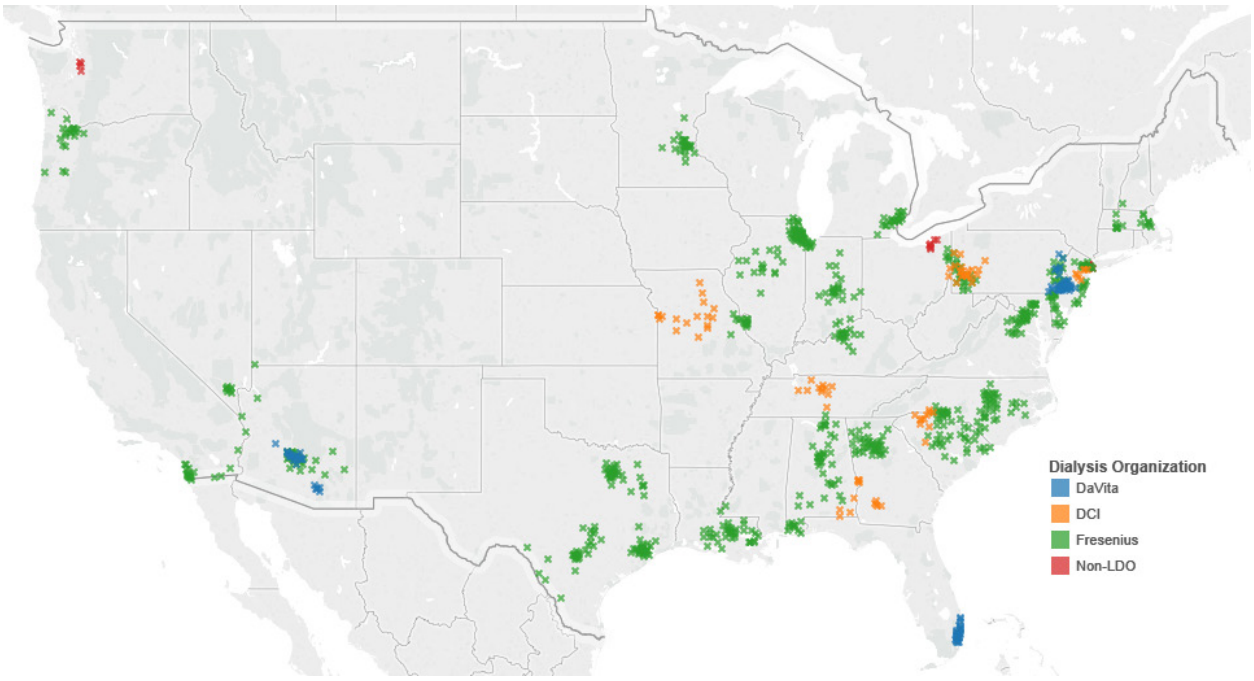
The discussion below describes the growth in ESCO and facility participation, nephrologist participation and geographic representation.

[15] CBSAs are Metropolitan CBSAs, with each CBSA Division separated, and based on the Office of Management and Budget CBSA definition.

1. What Changes Have Occurred Among Participating Facilities?

The 37 ESCOs participating in the CEC Model represent three large dialysis organizations (LDOs)—DaVita, Fresenius, and DCI—and four small dialysis organizations, or non-LDOs—Rogosin, Centers for Dialysis Care (CDC), Northwest Kidney Centers (NKC), and Atlantic. Collectively, ESCOs included 1,065 dialysis facilities across 30 states and Washington, D.C. A visualization of the location of participating facilities can be found in **Exhibit 2**.

Exhibit 2. Location of CEC Dialysis Facilities



Source: CEC Model participation data extracted from Salesforce on 04/25/2019.

CEC facilities represented about 15% of all dialysis facilities nationally in PY3. The characteristics observed in 2014 (before the start of the model) for Wave 1 and Wave 2 CEC facilities and non-CEC facilities are compared in **Exhibit 3**. CEC facilities associated with DaVita, DCI, and Fresenius represented 11%, 8%, and 75% of all CEC facilities, respectively. Combined, non-LDOs (CDC, Rogosin, NKC, and Atlantic) represented the remaining 6%. DaVita, DCI, Fresenius, and non-LDOs represented 43%, 3%, 23%, and 31% of non-CEC facilities, respectively. The distribution by dialysis organization varied across the two waves, where Fresenius facilities represented a lower share of Wave 1 facilities (59%) than Wave 2 facilities (83%). DaVita facilities represented 29% of Wave 1 facilities, but the LDO did not add any new ESCOs in Wave 2.

ESCOs had an average of around 29 facilities each, ranging from 2 to 77 facilities per ESCO. LDO ESCOs were larger than non-LDO ESCOs, with around 32 dialysis facilities on average versus 6 dialysis facilities on average. Compared to non-CEC facilities, CEC facilities had, on average, two more dialysis stations and treated around 13 more Medicare beneficiaries. More CEC facilities offered a late dialysis shift (i.e., the facility is open after 5pm). A smaller proportion of CEC facilities (46%) offered peritoneal dialysis services compared with non-CEC

facilities (62%). Standardized rates for hospitalization and mortality were very similar (within one percentage point) between CEC and non-CEC facilities. Standardized rates for readmission were an average of four percentage points lower across CEC facilities. CEC facilities had fewer patients new to dialysis. Several other characteristics were similar on average between CEC and non-CEC facilities, including profit status, vascular access rates for catheter and fistula, Medicare payments PBPM, and percent of patients with no prior nephrology care. These comparisons were similar across ESCO waves, with the exception that Wave 1 facilities had a slightly higher average number of dialysis stations and more Medicare beneficiaries relative to Wave 2 facilities.

Exhibit 3. Characteristics of CEC Facilities and Non-CEC Facilities in 2014[16,17]

Characteristics	Wave 1 CEC Facilities (N=393) Mean	Wave 2 CEC Facilities (N=672) Mean	All CEC Facilities (N=1,065) Mean	Non-CEC Facilities (N=5,125) Mean
For-Profit Facility	91.5%	90.9%	91.1%	87.2%
Chain-Owned Facility	91.8%	91.2%	91.4%	87.1%
Number of Dialysis Stations	20.6	18.6	19.4	17.0
Late Shift (facility is open after 5pm)	16.9%	21.8%	20.0%	16.6%
Peritoneal Service Offered	44.8%	47.2%	46.3%	61.5%
Medicare Beneficiary Count	72.3	57.9	63.2	50.4
Hemodialysis Beneficiary Count	68.5	54.2	59.5	46.6
Peritoneal Dialysis Beneficiary Count	5.5	4.9	5.1	5.3
Percent of Patients on Hemodialysis	94.7%	94.3%	94.5%	91.8%
Percent of Patients on Peritoneal Dialysis	7.9%	8.3%	8.2%	11.3%
Percent of Patients with Vascular Catheter	9.6%	9.4%	9.5%	10.9%
Percent of Patients with Arteriovenous Fistula	61.0%	63.5%	62.5%	63.3%
Standardized Hospitalization Ratio	1.0	1.0	1.0	0.99
Standardized Readmission Ratio	0.96	0.97	0.97	1.0
Standardized Mortality Ratio	1.0	0.94	0.96	0.97
Total Part A and Part B Standardized Payments PBPM	$6,790	$6,574	$6,654	$6,595
Facility CBSA Total Part A and Part B PBPM Ratio	1.0	1.0	1.0	1.0
DaVita Indicator	28.8%	0%	10.6%	43.2%
DCI Indicator	7.6%	7.6%	7.6%	2.7%
Fresenius Indicator	59.3%	83.5%	74.6%	23.2%
Percent of Patients New to Dialysis	10.9%	11.1%	11.0%	14.9%
Percent of Patients with No Prior Nephrology Care	45.8%	44.4%	45.0%	45.4%

Source: Lewin analysis of the 2014 Area Health Resource Files, Dialysis Facility Compare data from 2014, CEC Model participation data from Salesforce, extracted on 04/25/2019, and Medicare claims from 2012-2014.

[16] Data were not available for select characteristics for up to 101 of the 1,065 CEC facilities. Reported mean and distribution are based on all non-missing values.

[17] Dialysis facilities that joined the CEC Model in PY4 (January 2019) and dialysis facilities without beneficiaries aligned in calendar year 2014 using the first touch method are excluded. Data were not available for select characteristics for up to 1,013 of the 5,125 non-CEC facilities. Reported mean and distribution are based on all non-missing values.

The characteristics observed in 2014 for each cohort of Wave 1 and Wave 2 CEC facilities are compared in **Exhibit 4**. Column headings refer to the ESCO wave and performance year joined by the facilities.

In PY3, Wave 1 ESCOs added facilities with higher historical (2012-2014) payments both in absolute levels and relative to other facilities in their markets. For example, the 2012-2014 average total Parts A&B Payments PBPM among CEC beneficiaries in facilities that joined in PY3 was 8% higher than the average for facilities that joined in PY1 ($7,113 vs. $6,603). Compared to other facilities located in the same CBSA, payments for Wave 1 PY3 joiners was 5% higher than the average historical payments across all facilities in their CBSA, while Wave 1 PY2 joiners had historical payments 1% lower than the CBSA average. Similar patterns are present when we compare Wave 2 PY3 joiners to Wave 2 earlier joiners, but to a lesser extent.

Wave 1 PY3 joiners underperformed earlier Wave 1 joiners in some historic quality measures including mortality and readmission ratios, but they had lower hospitalization ratio and comparable catheter use. Wave 2 PY3 joiners underperformed earlier Wave 2 joiners in all four of these quality measures.

Overall, compared to their predecessors, later-joining facilities had higher historical payments. Furthermore, PY3 joiner facilities had fewer dialysis stations and were less likely to offer a late shift, which could limit their ability to accommodate missed treatments. On average, beneficiaries at PY3 joining facilities had slightly more comorbidities on the CMS Form 2728, fewer months on dialysis, and were more likely to be dually enrolled in Medicare and Medicaid. Beneficiaries at these facilities had higher historical utilization, including higher readmissions, hospitalizations, and visits to the ED.

Exhibit 4. Characteristics of CEC Facilities by Cohort[18,19]

Characteristics	Wave 1 PY1 Joiners (N=206)	Wave 1 PY2 Joiners (N=79)	Wave 1 PY3 Joiners (N=68)	Wave 2 PY2 Joiners (N=347)	Wave 2 PY3 Joiners (N=251)
Standardized Mortality Ratio (2012-2014)	0.96	0.90	1.0	0.95	1.0
Standardized Hospitalizations Ratio (2012-2014)	1.0	1.0	0.96	0.96	1.1
Standardized Readmission Ratio (2012-2014)	1.0	0.99	1.0	0.93	0.96
Late Shift Indicator	18.9%	20.3%	11.8%	26.5%	18.3%
Average Total Part A&B Payments PBPM (2012-2014)	$6,603	$6,636	$7,113	$6,395	$6,565
Facility For Profit Indicator	87.9%	96.2%	97.1%	89.6%	93.2%
Percent Patients with Vascular Catheter	9.3%	10.7%	9.2%	9.6%	9.4%
Beneficiary Count	63.7	51.4	56.4	50.8	43.1
Number of Dialysis Stations	22.1	19.8	20.9	19.6	18.7
Percent Ever Crashed Into Dialysis	44.7%	52.7%	43.9%	43.3%	46.2%
Percent Hemodialysis	96.0%	95.9%	97.3%	95.8%	96.0%

[18] Data were not available for select characteristics for up to 101 of the 1,065 CEC facilities. Reported mean and distribution are based on all non-missing values.

[19] Dialysis facilities that joined the CEC Model in PY4 (January 2019) and dialysis facilities without beneficiaries aligned in calendar year 2014 using the first touch method are excluded. Reported mean and distribution are based on all non-missing values.

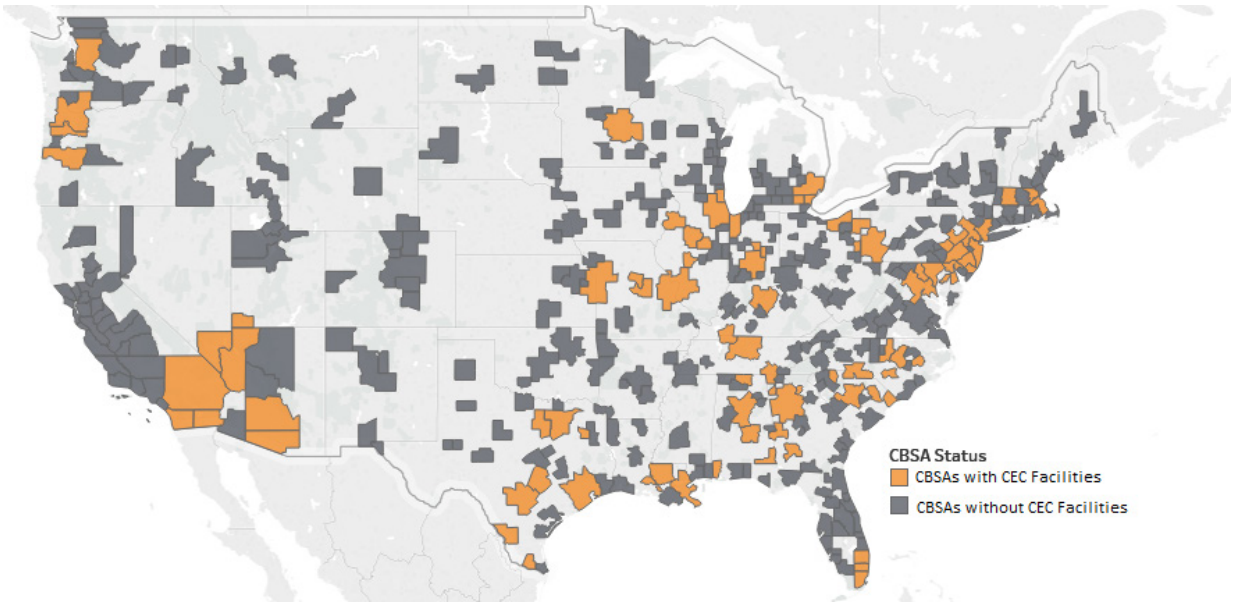
Characteristics	Wave 1 PY1 Joiners (N=206)	Wave 1 PY2 Joiners (N=79)	Wave 1 PY3 Joiners (N=68)	Wave 2 PY2 Joiners (N=347)	Wave 2 PY3 Joiners (N=251)
Percent of Beneficiaries with an ED visit in a given month (2014)	10.9%	10.4%	11.9%	11.2%	12.5%
Percent of Beneficiaries with a readmission in a given month (2014)	28.6%	28.1%	30.7%	28.2%	29.1%
Percent of beneficiaries with a hospitalization in a given month (2014)	11.5%	12.0%	12.5%	11.6%	12.2%
Months on Dialysis (2014)	63.2	60.6	60.7	63.1	61.8
Percent of Beneficiaries with Dual Medicare-Medicaid Status (2014)	46.9%	50.9%	51.0%	45.0%	47.9%

Source: Lewin analysis of the 2014 Area Health Resource Files; Dialysis Facility Compare data from 2014; CEC Model participation data from Salesforce, extracted on 04/25/2019; and Medicare claims from 2012-2014.

2. What Changes Have Occurred in the Characteristics of the Markets in which CECs Participate?

We examined whether the CBSAs in which CEC dialysis facilities were located were similar to CBSAs not containing CEC facilities across the United States. In 2014, 384 of the 389 CBSAs had at least one dialysis facility. CEC facilities were located in 87 CBSAs, as illustrated by the map in **Exhibit 5**.

Exhibit 5. CBSAs with CEC Facilities



Source: Dialysis Facility Compare data from 2014 and CEC Model participation data extracted from Salesforce on 4/25/19

Markets with CEC facilities (CEC CBSAs) differed from those without CEC facilities (non-CEC CBSAs) in some dimensions, including population size, median income, racial and ethnic demographics, and types of providers. The market characteristics of CBSAs with and without CEC facilities are compared in **Exhibit 6**. CEC CBSAs included many of the largest population centers in the United States. The average CEC CBSA had a population three times larger than the average non-CEC CBSA. CEC CBSAs also had a higher median income as well as a higher

proportion of Black and Hispanic residents. CEC CBSAs tended to have a higher rate of specialists per 10,000 residents but lower access to skilled nursing facility (SNF) beds per 10,000 residents, relative to non-CEC CBSAs. CEC CBSAs also had fewer dialysis facilities per 10,000 residents, even though these CBSAs had a similar prevalence of ESRD. Compared to non-CEC CBSAs, CEC markets had beneficiaries with ESRD who had higher total Medicare Part A and Part B standardized payments.

Within CEC markets, CBSAs with Wave 1 facilities had, on average, a larger population, fewer SNF beds, a larger Hispanic population, and a lower rate of specialists per 10,000 residents than those with Wave 2 facilities. Wave 1 CBSAs also had beneficiaries with ESRD who had higher total Medicare Part A and Part B standardized payments. Wave 1 CBSAs also had fewer dialysis facilities per 10,000 residents, even though these CBSAs had a similar prevalence of ESRD.

Exhibit 6. Characteristics of Markets with and without CEC Facilities in 2014

Characteristics	Wave 1 CEC CBSAs (N=29) Mean	Wave 2 CEC CBSAs (N=61) Mean	All CEC CBSAs (N=87) Mean	All Non-CEC CBSAs (N=297) Mean
CBSA Population	2,197,551	1,443,521	1,532,228	438,297
Median Household Income	$52,975	$52,275	$52,185	$48,865
Percent White	55.9%	65.3%	62.6%	72.6%
Percent Black	16.1%	15.8%	16.1%	9.2%
Percent Hispanic	20.5%	12.1%	14.6%	11.3%
Percent 65 & Older	13.4%	13.5%	13.4%	14.4%
PCPs per 10,000	7.2	7.8	7.6	7.4
Specialists per 10,000	9.5	11.6	10.8	8.1
SNF Beds Per 10,000	46.0	53.1	51.0	56.7
Percent Dual Eligible	2.8%	2.8%	2.8%	3.0%
Hospitals with Kidney Transplant Services per 10,000	0.01	0.01	0.01	0.005
Percent with No High School Diploma	15.7%	14.4%	14.8%	14.1%
Average Total Medicare Part A and Part B Payments	$6,567	$6,336	$6,401	$6,189
Percent ESRD	0.14%	0.14%	0.14%	0.13%
Percent of ESRD with Medicare & Medicaid	50.6%	48.6%	49.3%	48.7%
Dialysis Facilities	53.9	41.8	43.0	14.0
Dialysis Facilities per 10,000	0.31	0.37	0.36	0.43

Source: Lewin analysis of the 2014 Area Health Resource Files; Dialysis Facility Compare data from 2014; CEC Model participation data from Salesforce, extracted on 01/03/2018; and Medicare claims from 2012-2014.

The market characteristics by cohort are shown in **Exhibit 7.** In PY3, Wave 1 ESCOs added facilities in markets that were less metropolitan and lower income, with higher incidence of poverty. Compared to earlier joining facilities that were overwhelmingly located in metropolitan areas, PY3 joiner facilities were often located in non-metropolitan areas.[20] Beneficiaries aligned to these facilities may face additional challenges in accessing care, such as preventative and

[20] Based on the 2013 Rural/Urban Continuum Codes, a facility is considered metropolitan if they are located in a metropolitan county and is considered a non-metropolitan facility otherwise. Non-metropolitan includes urban and rural counties, however, all non-metropolitan CEC facilities are located in urban counties.

specialty care, which could limit success in the model.[21] The median household income in CBSAs where Wave 1 PY3 are located was 11% lower compared to the median household income in CBSAs where Wave 1 PY1 joiners are located ($49,844 vs. $56,007). On average, CBSAs where Wave 1 PY3 facilities joined have 20% of persons living below the poverty level, which is a larger proportion than their earlier counterparts—16% and 15% for CBSAs with Wave 1 PY2 joiners and Wave 1 PY3 joiners, respectively. Only 74% of CBSAs where Wave 1 PY3 joiners operate are classified as metropolitan, compared to 97% for CBSAs with Wave 1 PY1 joiners. Similar patterns are present when we compare Wave 2 PY3 joiners to Wave 2 PY2 joiners, but to a lesser extent.

Exhibit 7. Market Characteristics by Cohort

Characteristics	Wave 1 PY1 Joiners (N=206)	Wave 1 PY2 Joiners (N=79)	Wave 1 PY3 Joiners (N=68)	Wave 2 PY2 Joiners (N=347)	Wave 2 PY3 Joiners (N=251)
Population	1,707,990	2,259,720	746,787	867,044	899,875
% Persons Below Poverty Level	14.8%	16.2%	19.6%	14.9%	15.9%
Metropolitan Indicator	97.1%	92.4%	73.5%	90.5%	84.1%
Median Household Income	$56,007	$55,734	$49,844	$56,071	$52,832
Medicare Advantage Penetration	27.2%	21.7%	20.9%	29.7%	29.0%
Facility/CBSA Average Total A&B Payment Ratio	0.99	0.98	1.1	1.0	1.0

Source: Lewin analysis of the 2014 Area Health Resource Files; Dialysis Facility Compare data from 2014; CEC Model participation data from Salesforce, extracted on 01/03/2018; and Medicare claims from 2012-2014.

3. How Has the Participation of Owner Nephrologists Changed?

Wave 1 ESCOs suggested that participation of owner nephrologists contributed to success in the model because of their ability to influence care redesign across multiple facilities. Owner nephrologists are risk bearing participants in the model, and therefore have different incentives than nephrologists who are not owners in the ESCO. We analyzed whether the facility's composition of patients to owner nephrologist for the PY3 joiners was consistent with that of their predecessors. The expansion of the model, if implemented in a manner with fewer owner nephrologists, leading to higher patient volume per owner nephrologist and less care redesign, could prove less effective for beneficiaries at PY3 joiner facilities. However, our analysis showed that the rates of treatment by owner nephrologists at these facilities were mostly similar to those of earlier cohorts.

To determine the reach of the owner nephrologist in their ESCO's facility, we created a facility-level measure of the percent of beneficiaries who are treated by an owner nephrologist at least

[21] For descriptive evidence, see Appendix F Exhibit F-31 which shows lower use of preventative care for individuals aligned to non-metropolitan facilities, especially for beneficiaries at Wave 1 PY3 joiner facilities

once within a performance year.[22] The distribution of owner nephrologist reach by performance year and cohort is shown in **Exhibit 8.**[23]

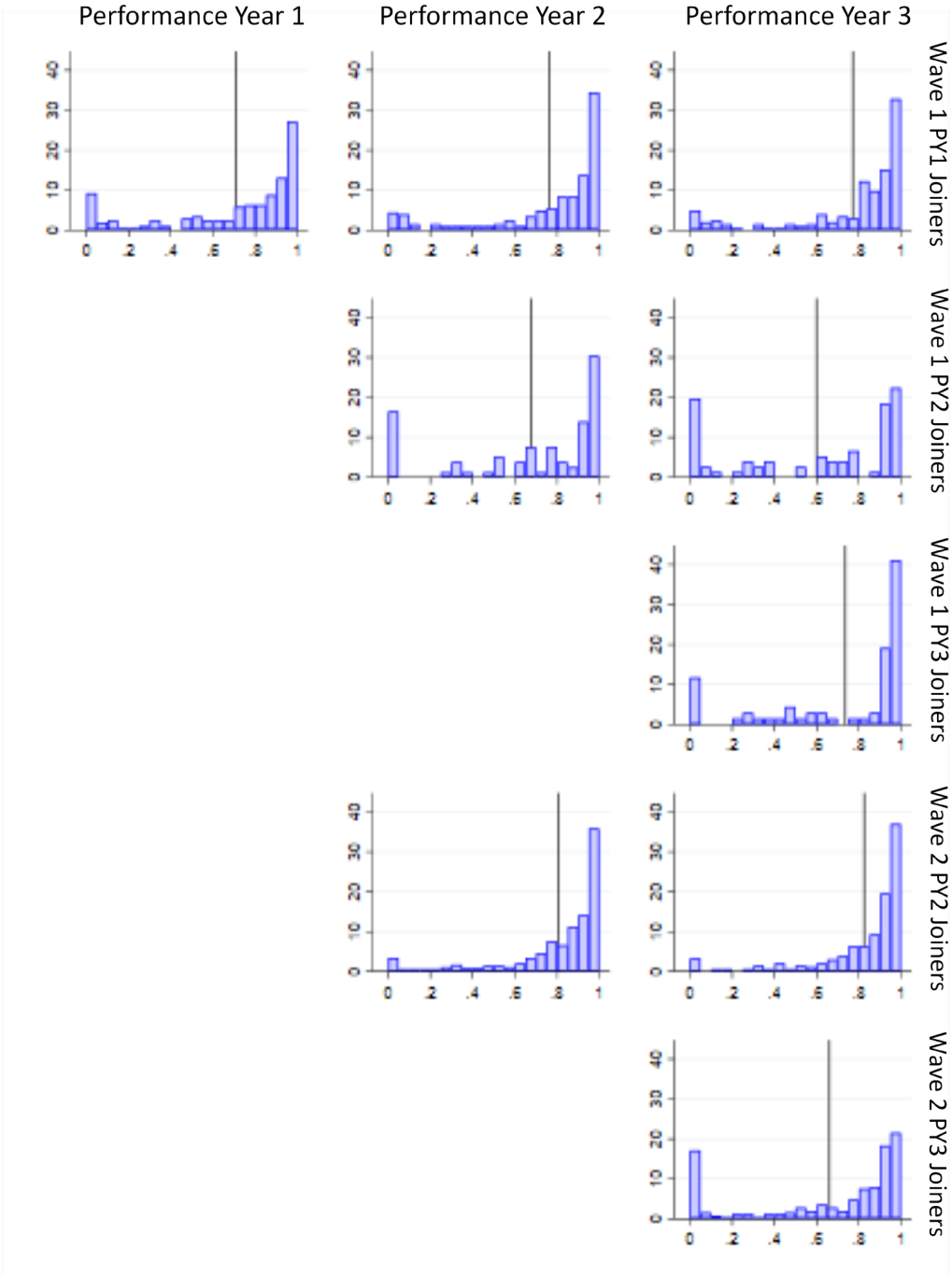
On average, between 60 to 77% of beneficiaries aligned to Wave 1 ESCO facilities were treated by an owner nephrologist at least once in a performance year. Overall, the percent of aligned beneficiaries treated by owner nephrologists was similar across the three facility cohorts and over time. Beneficiaries aligned to Wave 1 PY1 joiners experienced a slight increase in the percent of patients who were seen by owner nephrologists over the three performance years (from 71% in PY1 to 77% in PY3). In PY1, about 27% of Wave 1 PY1 facility joiners had more than 95% of their aligned beneficiaries treated by an owner nephrologist at the facility at least once during the year. Conversely, in just under 10% of Wave 1 PY1 facility joiners, fewer than 5% of aligned beneficiaries were treated by owner nephrologists during that performance year. At Wave 1 PY2 joiner facilities, nearly 68% of patients in PY2 and 60% of patients in PY3 were treated by an owner nephrologist at least once in the year. The 68 facilities which joined in Wave 1 PY3 had a similar mean (74%) to the facilities which joined in Wave 1 PY1, but had a larger percentage of facilities where at least 95% of beneficiaries were treated by an owner nephrologist. Therefore, for Wave 1 ESCOs we did not find that the later joining cohorts had a lower proportion of CEC beneficiaries being treated by owner-nephrologists.

The Wave 2 ESCO facilities which joined in PY2 and PY3 differ in the percentage of beneficiaries who were treated by an owner nephrologist. Beneficiaries aligned to Wave 1 PY1 facility joiners were overall the most likely, to be treated by an owner nephrologist (an average of 81% in PY2 and 83% in PY3). Conversely, at Wave 2 PY3 facility joiners, around 66% of beneficiaries in these facilities were treated by an owner nephrologist. While Wave 2 PY3 facility joiners are in contrast to the high treatment by owner nephrologist rates in Wave 2 PY2 joiners, these facilities appear similar to both performance years for the Wave 1 PY2 joiners in mean and distribution.

[22] The measure presented is based on the beneficiary receiving treatment from an owner nephrologist at least once in a year. We developed another measure to describe the percent of beneficiaries who received at least half of their treatments from owner nephrologists. The conclusions using both measures are the same.

[23] The changes to the histograms display how the reach of owner nephrologists evolved with the growth of the ESCO. The x-axis on each subplot shows the percentage of beneficiaries in the facility that are treated by owner nephrologists, where each histogram contains twenty "bins," each representing a mutually exclusive segment of the overall range. Each subplot's y-axis denotes the percentage of facilities within a cohort-PY which are contained in one of the x-axis bins. The black vertical line in each plot denotes the mean.

Exhibit 8. Percent of Beneficiaries Who Receive Treatment from an Owner Nephrologist



Note: Columns denote performance years and rows denote the wave and performance year during which the facilities joined. The x-axis in each subplot shows the fraction of individuals aligned to a CEC facility that are treated by an owner nephrologist at least once in a performance year. The y-axis denotes the percent of facilities.

D. Discussion

Overall, CEC facilities accounted for 15% of dialysis facilities nationally. Participating facilities were different than non-participating facilities in that they tended to be somewhat larger in terms of number of dialysis stations and number of Medicare beneficiaries treated, but they were

similar on other key standardized outcome-related measures. The markets served by ESCOs tended to be larger than those without an ESCO. The addition of new participants in PY3 increased the representation of markets participating in CEC to include more rural and lower income areas. As these ESCOs expanded, so did their presence of owner nephrologists, leading to a relatively stable rate of treatment by owner nephrologist across joining facilities for Wave 1 ESCOs and a slight decrease for Wave 2 ESCOs.

Most Wave 1 ESCOs expanded the number of participating dialysis facilities and nephrologists beyond their initial set of participants. The key motivations for this expansion included strong existing relationships between the nephrologists and facilities who did not already participate, presence of providers with a potential good fit/alignment with ESCO goals, and MACRA incentives. Specifically, beginning in PY2 MACRA offered a monetary bonus for joining the model and exemption from MIPS reporting. These incentives were not available to facilities when they joined in PY1.

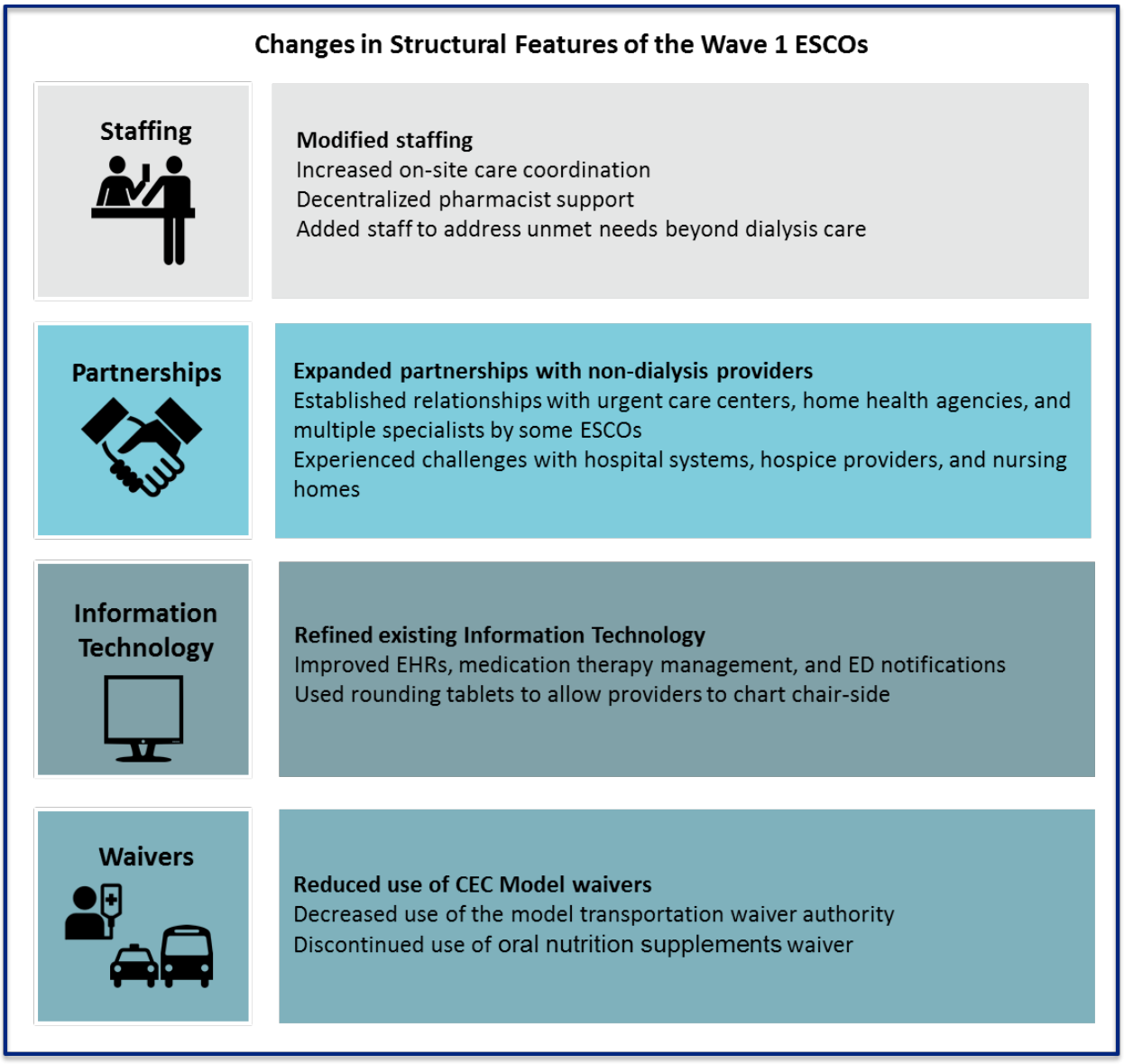
In PY3, existing ESCOs enrolled 319 facilities to the CEC Model for a total of 1,065 dialysis facilities. Fresenius, an LDO, dominated participation in the model in Wave 2. Wave 1 and Wave 2 facilities had similar characteristics, although relative share of facilities under each LDO varied from Wave 1 to Wave 2. Additionally, the CBSAs represented by Wave 1 and Wave 2 facilities differed slightly in terms of population and access to SNFs.

There were differences in facilities and beneficiary characteristics new to the CEC Model in PY3. In particular, PY3 joiner facilities were less metropolitan, had fewer dialysis stations, and had less availability of late shift dialysis than their predecessors. Beneficiaries aligned with PY3 joiners were also more complex than their predecessors with higher historical rates of service utilization and Medicare payments and more comorbid conditions.

III. How Have Structural Features of the Wave 1 ESCOs Changed Over Time?

During PY1, we collected information about early model investments by Wave 1 ESCOs. These findings were provided in the Performance Year 1 Annual Evaluation Report.[24] To monitor these features over time, we conducted a second set of site visits at Wave 1 ESCOs in PY3. This chapter summarizes changes in staffing, partnerships with other providers, information technology (IT), and use of CEC Model waivers among Wave 1 ESCOs.

A. Key Findings



[24] https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf

B. Methods

We used the methods described in **Section II.B** and **Appendix C** to analyze the qualitative data derived from the site visits**.**

C. Results

1. To What Extent Have Wave 1 ESCOs Modified Staffing?

In PY3, some Wave 1 ESCOs made changes to care coordination and pharmacist staffing and added behavioral health, palliative care, and peer mentoring to address unmet beneficiary needs.

On-site and Telephonic Care Coordinators. On-site care coordination was the most significant change in staff investments and structure. In PY1, Fresenius used a centralized, remote telephonic care coordination model called the Care Navigation Unit (CNU). Since then, the CNU has evolved into a hybrid model, retaining remote telephonic support while adding an on-site care coordinator at ESCO facilities. Fresenius incorporated the on-site presence to help build relationships with beneficiaries and staff and facilitate cultural change. Remote telephonic support continued to play an important role, particularly in scheduling appointments and arranging transportation. The on-site care coordinator covers multiple (up to 10-15) facilities and generally does not have a daily presence at each facility. The on-site coordinator's presence was generally well received by other facility staff and frequently referred to as "the face of the ESCO." DaVita ESCOs used a care coordination service (VillageHealth), which was initially remote, but over time the service increased the on-site presence of its care coordinators.

> *"… [on-site care coordination is] something that I've pushed for since the inception of the [CEC]… I think having the call centers was great, and that's a 24/7, 365-day availability for providers and patients. But having that local piece is huge and having that chairside person that can talk with those high risk patients and really target locally is huge."*
> – ESCO Site Visit Participant

Pharmacist Support. Because medication management continued to be a major area of emphasis across all Wave 1 ESCOs in PY3, care coordinators or dialysis facility nurses conducted regular medication management, with a focus on the time period immediately following patient discharge from the hospital. DaVita and DCI reported providing centralized pharmacy support in PY1, but both organizations reduced that resource in PY3, citing the expense of staffing pharmacists and local issues, such as poor wireless connectivity for some remote consults.

Additional Staff. A small number of facilities reported other staffing changes to address unmet patient needs beyond dialysis. Examples included adding a psychologist; piloting new programs in behavioral health, palliative care, and patient-to-patient mentoring; and changing care coordination from registered nurses to nurse practitioners (or vice versa). Since initial model implementation, one ESCO also launched a pilot palliative care program jointly managed with the participating health system partner. This program allows the ESCO to leverage the hospital's existing palliative care resources to deliver better end-of-life care to patients.

2. How Have Partnerships with Non-Dialysis Providers Changed?

Wave 1 ESCOs continued to explore ways to partner with other providers, because targeting reductions in the total cost of patient care demands attention to the full range of patient needs. However, the types of providers targeted and the success of the partnerships varied by ESCO. Behavioral health and transportation provider shortages and partnerships with hospital systems continued to be challenging in PY3. Several ESCOs anticipated implementing telehealth options because of the new model waiver for telehealth that began in January 2019.

Early in the CEC Model implementation, several ESCOs attempted to partner with hospital systems, hospice providers, and nursing homes. But some ESCOs (e.g., one from each LDO) abandoned or scaled back these efforts by PY3 due to lack of interest or sustained engagement by these providers.

The range of new provider partnerships expanded in a few ESCOs in PY3 to include:

- Urgent care centers to support beneficiaries in avoiding the ED by making urgent care options more accessible;
- Home health agencies that function as the ESCO's "eyes in the home" by providing information about patients' home environments and patient support in the post-hospital discharge period; and
- Multiple specialists (e.g., vascular surgeons, orthopedic surgeons, endocrinologists, and palliative care providers) who were directly incorporated into broader discussions about value and beneficiary outcomes.

Other partnerships involved the incorporation of specialist care into the dialysis facility to improve beneficiary access to services. These examples included an upcoming partnership with an ophthalmologist group to provide diabetic eye exams in the facility, chairside counseling by a behavioral healthcare specialist during dialysis, and a staff psychologist.

3. What Investments Were Made in Information Technology?

Initial IT investments by Wave 1 ESCOs were reported in the Performance Year 1 Annual Evaluation Report.[25] In PY3, some ESCOs identified changes in IT, but most involved refinements of existing systems/software rather than adoption of new systems/software. ESCOs added systems to alert the ESCO when its beneficiaries presented in the ED, increased facility staff's access to care coordinators' notes in electronic health records (EHRs), and began using "rounding tablets" to allow providers to chart chair-side. One ESCO made facility-wide improvements in its case management software, refining the clinical pathways used to guide nursing interventions and decreasing the amount of required documentation to allow nurses to spend more time with the patient. DCI reported moving away from an external platform to a new software aligned with its EHR system for better medication management documentation and integration across clinical staff, providers, pharmacists, and care coordinators.

[25] https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf

4. What is the Status of CEC Model Waiver Use among Wave 1 ESCOs?

Use of the CEC waivers—transportation, oral nutritional supplements (ONS), and other financial arrangements—declined across ESCOs between PY1 and PY3. More information about these waivers is provided in **Appendix A.**

Transportation. ESCOs continued to provide transportation to prevent missed dialysis treatments directly (by providing transportation when caregivers were not available or weather conditions made beneficiaries/caregivers hesitant to drive) and indirectly (by getting patients prompt vascular access procedures). However, some of the concerns raised about the transportation waiver by Wave 1 ESCOs in prior performance years remained in PY3 (e.g., the $500 per patient annual limit and restriction to transportation to directly dialysis-related services). Some DCI Wave 1 ESCOs discontinued use of the transportation waiver by PY3. Alternatively, several DCI ESCOs provided transportation under the authority provided by the Department of Health and Human Services Office of Inspector General final rule (or "safe harbor" rule)[26] that allows providers to offer free or reduced price transportation under certain conditions.

Oral Nutritional Supplements Waiver. During PY1, the ONS waiver was only used by Wave 1 Fresenius ESCOs.[27] By PY3, Fresenius discontinued its use due to lack of evidence that it changed outcomes, concerns about whether patients actually took the supplements and the overall cost, and the existence of other supplement options within Fresenius.

Other Financial Arrangements. As was the case in PY1,[28] few Wave 1 ESCOs reported use of pay-for-performance (P4P) payments in PY3, and use of these payments was not uniform within dialysis organizations. Fresenius continued to provide an incentive (established in PY2) to nephrologists for more timely completion of a Transition of Care form. [29]

D. Discussion

While many structural features of the Wave 1 ESCOs have not changed significantly since PY1, there were several notable changes. For example, Fresenius added on-site care coordinators to its existing telephonic care coordination in PY3. This key staffing modification acknowledged the importance of face-to-face care coordination of some tasks while leveraging centralized telephonic care coordination for other tasks. ESCOs also established new relationships with urgent care centers and home health agencies in PY3 to decrease ED use for dialysis-related beneficiary needs. Three organizations reported new pilots providing diabetic eye exams in the clinic or bringing in behavioral healthcare specialists to provide counseling to patients. In addition, ESCOs refined their EHR, medication management, and ED notification systems to

[26] Department of Health and Human Services. Medicare and State Health Care Programs: Fraud and Abuse; Revisions to the Safe Harbors under the Anti-Kickback Statute and Civil Monetary Penalty Rules Regarding Beneficiary Inducements. Federal Register Vol. 81, No. 235, December 7, 2017. Available from https://www.gpo.gov/fdsys/pkg/FR-2016-12-07/pdf/2016-28297.pdf.

[27] For findings from PY1 site visits with Wave 1 ESCOs, please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf).

[28] Ibid

[29] For findings from PY2 site visits with Wave 2 ESCOs, please see the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

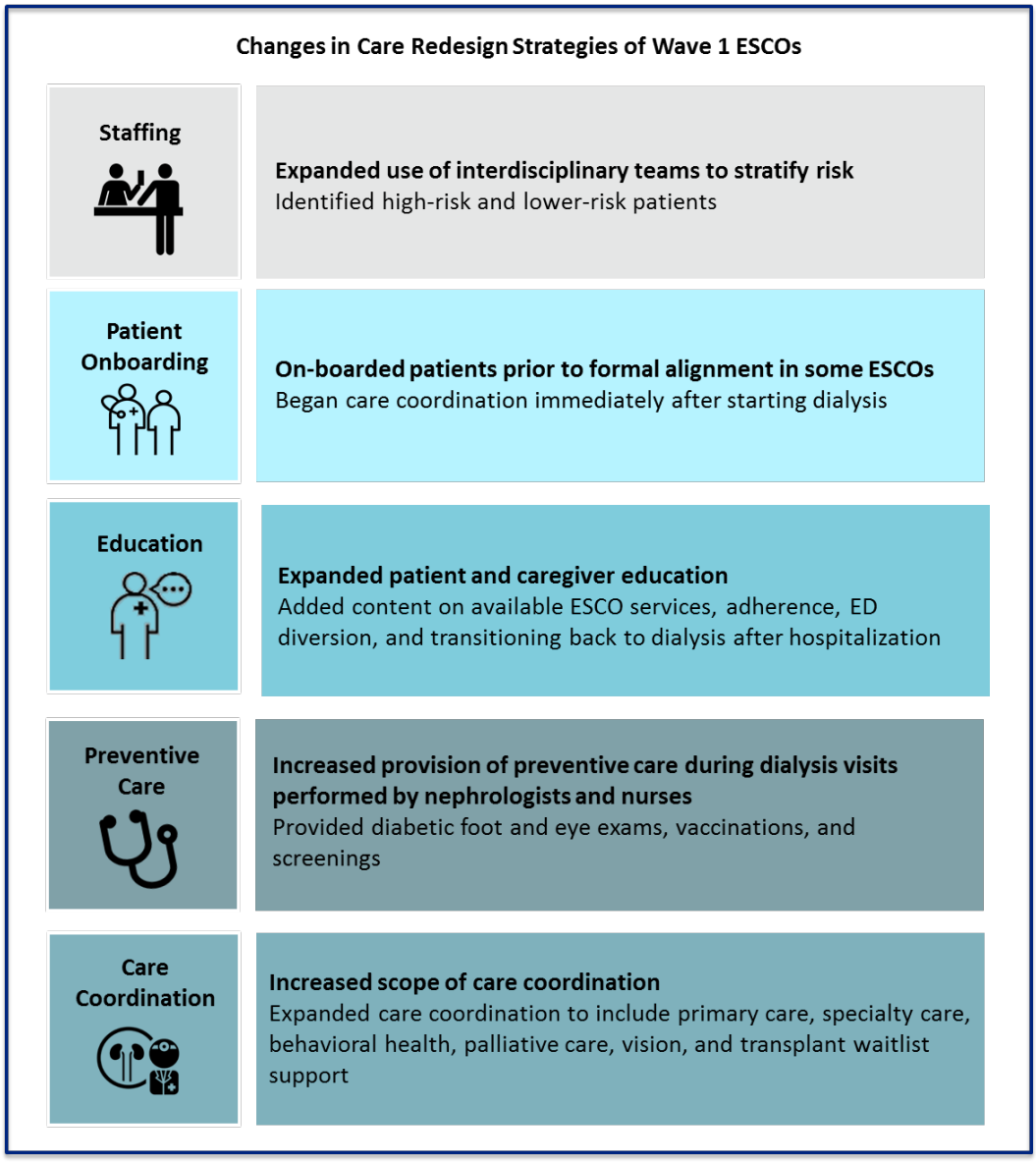
better support model operations in PY3. Another key structural change was the decline in use of CEC waivers in PY3. Use of the transportation waiver decreased in PY3 as some ESCOs began providing transportation under the safe harbor provision to avoid the costs imposed by the CEC waiver.[30] In addition, the only organizations previously using the ONS waiver determined that it was not cost effective and discontinued use.

[30] Department of Health and Human Services. Medicare and State Health Care Programs: Fraud and Abuse; Revisions to the Safe Harbors under the Anti-Kickback Statute and Civil Monetary Penalty Rules Regarding Beneficiary Inducements. Federal Register Vol. 81, No. 235, December 7, 2017. Available from https://www.gpo.gov/fdsys/pkg/FR-2016-12-07/pdf/2016-28297.pdf.

IV. How Has Care Redesign Evolved Under Wave 1 ESCOs?

The CEC Model focuses on improving quality of care and health outcomes in addition to reducing unnecessary healthcare utilization and spending through the coordination of care. In care redesign, ESCOs are encouraged to implement beneficiary-centered approaches that promote comprehensive and coordinated care delivery and improve access to services. Initial information about Wave 1 ESCOs' strategies to improve patient care under the CEC Model were reported in the Performance Year 1 Annual Evaluation Report.[31] In PY3, we asked Wave 1 ESCOs about how their care redesign strategies had evolved over time.

A. Key Findings



[31] https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf

B. Methods

We used the methods described in **Section II.B** and **Appendix C** to analyze the qualitative data derived from the site visits**.**

C. Results

All Wave 1 ESCOs continued to embrace the principles of the CEC Model with its focus on care coordination and providing holistic care to the beneficiary. While most ESCOs did not report any fundamental changes to their care design in PY3, all expressed strong emphasis on continuing and refining the specific approaches implemented in PY1. In particular, ESCOs continued to improve access to dialysis care to avoid hospitalizations by more consistently rescheduling missed appointments, providing extra treatments, arranging transportation, and transferring patients when chairs were not available to nearby facilities with chair availability. (See Patient Adherence discussion in Dialysis Care section.)

1. Expanded use of interdisciplinary teams to stratify patients by risk

ESCOs identify high-risk patients because effective management of these patients is more likely to yield improved outcomes and lower health care spending due to efficient utilization. Some ESCOs acknowledged needing facility staff input, in addition to the computer-generated list, to identify patients in need of additional care, and they expanded use of interdisciplinary teams to identify patients at risk or who may become high-risk. This informal risk identification captures sudden changes in patient behavior or life events that an algorithm does not take into account, such as the death of a family caregiver or when a patient "doesn't look too good." Regular "huddles" and interdisciplinary team meetings were used to identify and review high-risk patients, create care plans, and assign staff for follow-up. Communication about ESCO beneficiaries, regardless of their formal risk level, also increased.

ESCO Example

Lower-Risk Patient Care Coordination

A DaVita ESCO piloted more frequent care coordinator contact with lower-risk patients and experienced a decrease in hospital admission rates.

All Wave 1 ESCOs continued to use computer algorithms to identify high-risk patients. The range of risk factors assessed included laboratory tests, ED visits, hospitalizations, fluid levels between dialysis treatments, dry weight following dialysis, missed treatments, treatment compliance, medication changes, blood pressure, fall risk, low albumin, high phosphorous, catheter use, and weather reports. One ESCO was also considering adding artificial intelligence-based predictive risk modeling.

2. On-boarded patients prior to formal alignment

Alignment of beneficiaries to the CEC Model typically occurs a few months after the start of dialysis. Yet all four Wave 1 organizations emphasized the importance of providing targeted care to patients during the first 90-120 days of dialysis when patients new to dialysis are particularly vulnerable to vascular access complications and other sources of clinical instability. This time frame is also the key period to establish patient treatment adherence. Fresenius identified incident patients who *may* become aligned to the ESCO and had CNU nurses reach out to "pre-ESCO" patients for education and ESCO onboarding before formal alignment to the model.

3. Expanded patient and caregiver education

In PY1, Wave 1 ESCOs emphasized the role of patient and caregiver education in optimizing patients' dialysis experience and outcomes. In PY3, ESCOs identified new areas of patient education and increasing focus on existing topics. The patient education topics they highlighted included:

- Available ESCO services;
- Importance of dialysis adherence (e.g., attending or rescheduling appointments or receiving extra treatments);
- Use of urgent care to avoid ED visits and hospitalizations;
- Transition back to dialysis care following hospitalization; and
- Maintenance of transplant eligibility.

Interviewees emphasized education for family members or caregivers on catheter removal, dialysis adherence/schedule, preventive care, diabetes, patient environment, and gastrointestinal issues, as well as palliative care and hospice.

ESCOs used many of the same education methods and tools previously reported in PY1 and continued to struggle with engagement of patients in care and patient adherence with care plans. Lack of compliance, such as skipping treatments and not adhering to dietary restrictions, can result in poorer outcomes, including greater risk of hospitalization (e.g., due to fluid overload).[32] ESCOs supported patient education by all staff and nephrologists, and they emphasized the importance of having multiple providers reiterate and reinforce the educational messages and materials to help patients remember and adopt the guidance provided.

> *"Well, you lay it out there, this is what you should be doing, this is why, and [patients] still choose not to come or they still choose to get off [dialysis] after two hours. They still get to choose. And no matter how much education … they still choose to do what they want to do."*
> – ESCO Site Visit Participant

4. Increased provision of preventive care during dialysis visits

The CEC Model's emphasis on total cost of care creates an incentive for facilities to provide preventive care to avoid complications. Nearly all ESCOs provided preventive care, such as diabetic foot and eye exams, flu vaccinations, tobacco screening and referral to cessation services, and fall risk and depression screening. These efforts had been in place before the CEC Model, but the model and its inclusion of these screenings/prevention activities in the CEC Quality Measure Set heightened awareness of their importance.[33] The inclusion of transplant waitlist measures in PY3 may also have improved attention to the annual screenings

[32] Salmi, A., Larina, M., Wang, M., Subramanian, L., Morgenstern, H., Jacobson, S.H., Hakim, R., Tentori, F., Saran, R., Akiba, T,, Tomilina, N.A., Port, F.K., Robinson, B.M., Pisoni, R.L. (2018). Missed Hemodialysis Treatments: International Variation, Predictors, and Outcomes in the Dialysis Outcomes and Practice Patterns Study (DOPPS). *American Journal of Kidney Diseases*, 2(5):634-643. doi: 0.1053/j.ajkd.2018.04.019. Epub 2018 Aug 23.

[33] The PY3 (2018) CEC Quality Measure Set is available at: https://innovation.cms.gov/Files/x/cec-2018qualmeasureset.pdf.

(e.g., colonoscopies and dental exams) needed to remain active on the transplant waitlist. However, some nephrologists were less interested in providing more primary care.

5. Increased scope of care coordination

ESCOs continued to identify and refer beneficiaries to primary care and specialty providers, as well as make these appointments for them. In PY3, the providers we spoke with expanded their scope of care coordination to include behavioral health, home health, palliative care, vision, and transplant waitlist support. In addition to coordinating non-dialysis appointments, care coordinators arranged durable medical equipment, scheduled transportation to appointments, and followed up to ensure patients attended appointments and obtain records.

ESCO Example
Preventive Care Provision

To overcome barriers to timely receipt of primary care, nephrologists and dialysis staff increasingly and more consistently provided primary care during dialysis treatment. When a beneficiary came in with a cough, for example, the nephrologist listened to the patient's lungs and diagnosed pneumonia. The nephrologist then prescribed an antibiotic right away, preventing a delay in treatment as well as reducing the time and cost associated with the alternative referral to a primary care physician.

In PY3, all four Wave 1 dialysis organizations described staff training and limited discussion of palliative care and hospice with patients and families, suggesting modest improvement in staff and nephrologist level of comfort discussing end-of-life care. Several facilities also discussed advanced care directives with patients.

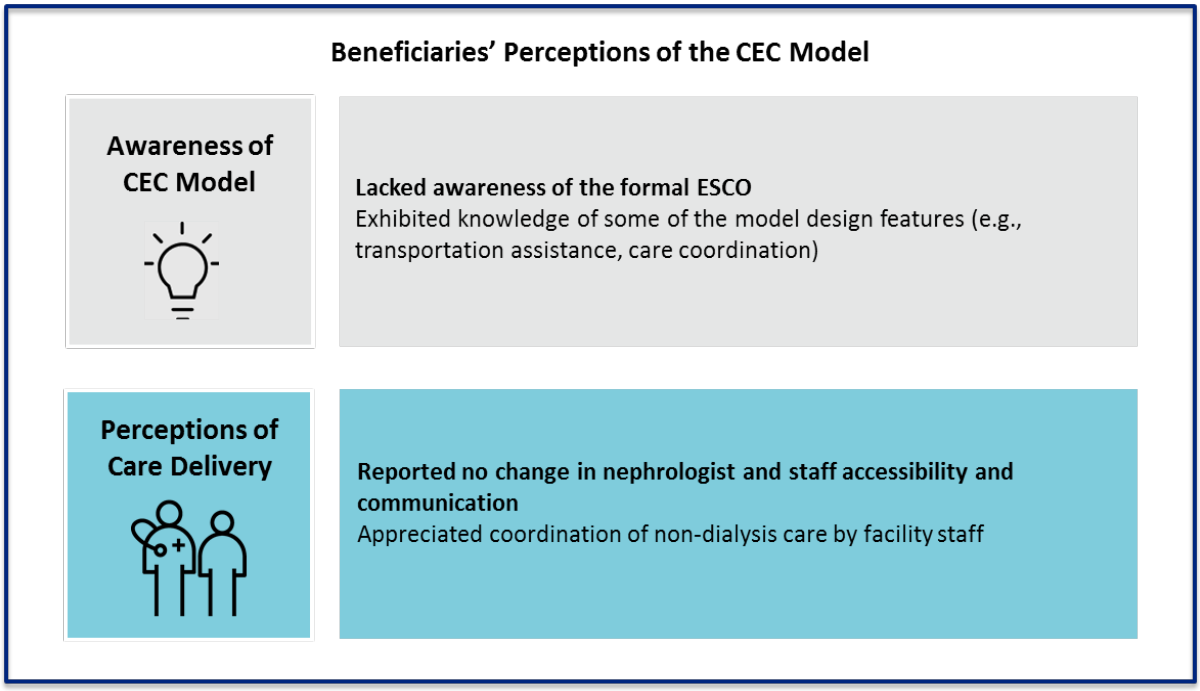
D. Discussion

In PY3, all Wave 1 ESCOs continued specific approaches implemented in PY1 and expanded patient-centered care coordination. Use of interdisciplinary teams was expanded to leverage knowledge of patient behavior and life events to help target care coordination to high-risk individuals not identified by computer algorithms, as well as other patients that could benefit from intervention. Interdisciplinary teams also began identifying and providing care coordination to patients at risk of complications. DaVita suggested that these preventive efforts led to decreases in hospitalization. Fresenius began on-boarding patients prior to formal alignment to the model and initiated care coordination closer to the start of dialysis. Several ESCOs placed greater emphasis on patient and caregiver education and expanded the range of topics to include encouragement for the use of urgent care centers as an alternative to the ED. Since the CEC Model began, ESCOs provided more preventive care during dialysis visits. The scope of care coordination also increased in PY3 to include a wider range of patient needs, including transplant waitlist support and complementing the expanded emphasis of patient and caregiver education.

V. What Were Beneficiaries' Perceptions of the CEC Model?

We conducted focus groups with beneficiaries aligned to Wave 1 ESCOs to determine if they noticed changes in the delivery and quality of their care and to assess their perceptions of their care (e.g., communication with facility staff and nephrologists)[34] since their facility joined the CEC Model. These focus groups provided contextual information about changes in quality of care and beneficiary experience, complementing what we learned from quantitative data analyses.

A. Key Findings



B. Methods

Between October 17, 2018, and December 6, 2018, we conducted focus groups with beneficiaries at four Wave 1 ESCOs, one from each of the four dialysis organizations: Fresenius, DaVita, DCI, and Rogosin. Each focus group was held on-site at a dialysis facility associated with the ESCO, but participants may have been from any of that ESCO's participating facilities. A total of 32 beneficiaries participated across the four focus groups. Each focus group session lasted approximately 90 minutes. The focus group methodology is described in **Appendix D**.

[34] For findings from PY1 focus groups with Wave 1 ESCO beneficiaries, please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf). For findings from the PY2 focus groups with Wave 2 ESCO beneficiaries, please see the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

C. Results

Beneficiaries were not aware of the ESCO by name but were familiar with some of the model design features. Overall, beneficiary experience varied by facility. Their perceptions of nephrologists ranged from feeling rushed to being active participants in their care. Beneficiaries also reported being more engaged than before the model in their conversations with staff. Beneficiary perceptions were consistent with the model design features described by ESCOs.

1. What Did Beneficiaries Know about the CEC Model?

Similar to the beneficiaries who participated in focus groups in PY1 and PY2, most focus group participants in PY3 did not have knowledge of the ESCO. The term sounded familiar to a few participants, but they could not provide specific information about what the ESCO encompassed. Some Fresenius patients were an exception (that is, they knew about the ESCO) because they received CNU assistance with their medications. When prompted, most focus group participants were familiar with specific services, such as transportation or special assistance offered by the care coordinator, although the services were not considered new. Many of the staff members performing ESCO services had worked in the dialysis facilities prior to the ESCO.

> *"Care Navigation help[s] me with my transportation; help[s] me with my medication. They'll call every month or two to see how I'm doing."*
> – Beneficiary Focus Group Participant

2. What Changes Did Beneficiaries Notice Since their Facility's Participation in the ESCO Began?

Focus group participants identified a few changes in their dialysis care in recent years, but like focus group participants in PY1 and PY2, they did not attribute these changes to the ESCO.[35]

Staffing. Participants in all four focus groups described staff turnover and the introduction of new inexperienced technicians. Beneficiaries from one focus group also suggested that staff shortages negatively affected dialysis treatment time because dialysis treatment time decreased or overall time spent at the dialysis facility increased due to longer wait times.

Accessibility of Nephrologist. Most participants indicated there were no notable changes in the accessibility of their nephrologist or in the way their nephrologist communicated with them. Some experienced being active participants in the conversations; others felt like their nephrologist often made changes to their care without discussing these changes with them first.

The majority of the participants saw their nephrologist infrequently. For some participants, regular visits with their nephrologist had been replaced by visits with a nurse practitioner. A few beneficiaries wanted more access to their nephrologist. Some wished that their nephrologist was more helpful in assisting with general medical care, such as writing a prescription for medicine to treat a cold instead of directing them to see their primary care physician.

[35] For findings from PY1 focus groups with Wave 1 ESCO beneficiaries, please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf). For findings from the PY2 focus groups with Wave 2 ESCO beneficiaries, please see the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

Communication with Dialysis Staff. Focus group participants did not report any noticeable changes in dialysis staff communications over recent years. None of the participants mentioned having conversations with dialysis facility staff about treatment options. However, overall, beneficiaries felt they were active participants in their conversations with staff and not just listeners. They reported being able to understand what staff were explaining and were comfortable talking with staff. They also were pleased with the assistance staff provided for rescheduling appointments, reporting that staff actively reached out to reschedule. A few participants expressed dissatisfaction with their interactions with facility staff in situations where staff did not follow their wishes regarding the process of being hooked up to the dialysis machine.

Overall, focus group participants indicated that dialysis staff were willing to help in the coordination of non-dialysis care, including making referrals and appointments, assisting with medication management, and arranging transportation. Participants appreciated this additional support provided by care coordinators. They provided several examples of the care coordination they received, including receiving identification cards and paperwork for use in emergencies or for getting other non-dialysis care; talking with staff while they were hospitalized; and getting help with transitioning back to the dialysis clinic after a hospitalization by their nurse or technician. However, support for transition following a hospitalization was inconsistent. For some beneficiaries, transition steps were put in place, but other patients were simply told to bring the discharge papers from the hospital to their next dialysis appointment.

> *"They make sure you are transitioning back… monitor your vitals to ease transition back to the dialysis center."*
>
> *"I've left [the facility] not feeling well, and they've called my home to make sure I was okay. And when I was in the hospital, they called me in the hospital."*
>
> – Beneficiary Focus Group Participants

In terms of areas of improvement, beneficiaries would like:

- More consideration of their input by staff when the facility was considering changes in their care;
- Advance notice prior to changes to their care (e.g., medications);
- Greater reliance on their input when interpreting dialysis machine readings; and
- Reliable and reasonably priced transportation to and from dialysis.

A few participants also reported needing assistance with housing but were not sure that the dialysis facility could help.

D. Discussion

Although focus group participants in PY3 were not acutely aware of the ESCO, most participants were knowledgeable about at least some of the services offered through the ESCO (e.g., care coordination, transportation) and the presence of a staff member who provided additional assistance, although they did not directly associate that person with the ESCO. Participants reported no significant changes in nephrologist and dialysis facility staff accessibility and communications. Care coordinators were praised for their assistance with helping beneficiaries coordinate non-dialysis care.

VI. What Was the Association between Alignment in the CEC Model and Beneficiary Quality of Life?

Because the CEC Model requires that performance thresholds be met, it provides an incentive to ESCOs to maintain and improve quality. In PY2, ESCOs were only eligible for shared savings if they also achieved a set of quality standards.[36] Shared savings and losses also depend on an ESCO's total quality score (TQS).[37] The broader accountability for both quality outcomes and costs further induces ESCOs to improve these measures using patient-centered approaches (for example, enhanced communication and education). We monitor Kidney Disease Quality of Life (KDQOL) because quality of life is a key outcome in a patient-centered care model. We assessed health-related quality of life (HRQOL) using the KDQOL-36™ survey to ensure there were no unintended adverse consequences of CEC's incentives to achieve costs savings.

This section presents findings on the association between participation in the CEC Model and HRQOL during PY3.[38] The analysis used survey data collected using the KDQOL-36™ questionnaire from both CEC participants and a matched comparison group of beneficiaries.[39] We assessed self-reported quality of life for CEC beneficiaries relative to what would be expected had they not been aligned to a participating ESCO.

[36] The list of quality measures included in the CEC Model can be found here: https://innovation.cms.gov/Files/x/cec-qualityperformance-ldo.pdf.

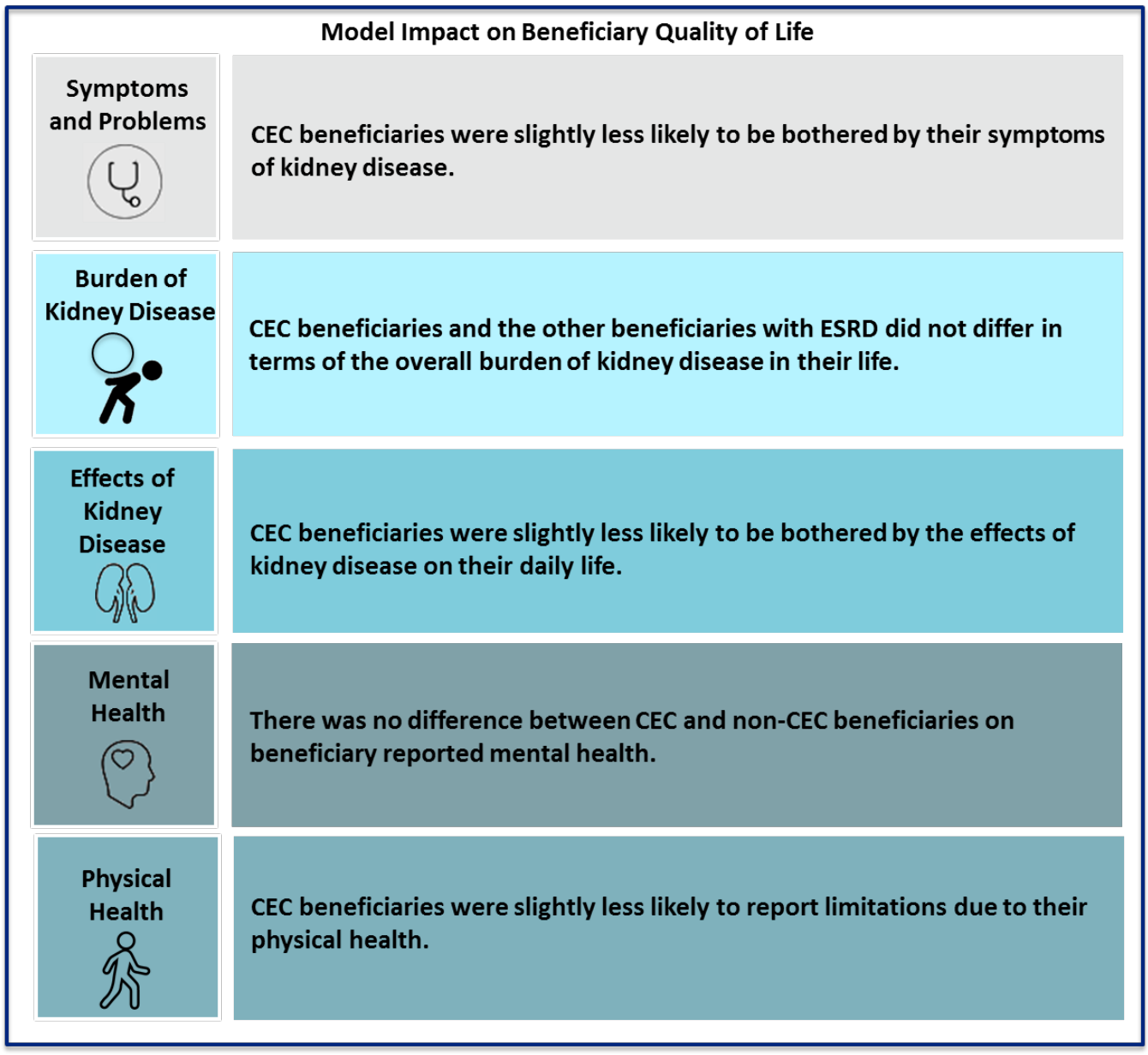
[37] The TQS rates the ESCO's overall performance based on the CEC Quality Measure Set, which is a set of standardized quality performance measures used to determine eligibility for shared savings.

[38] We also conducted quality of life surveys in PY1 and PY2. The PY1 survey results are included in the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf). The PY2 survey results are included in the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

[39] The KDQOL-Short Form underwent extensive psychometric testing (e.g., Joshi, V.D., Mooppil, N., Lim, J.F. (2010). Validation of the Kidney Disease Quality of Life-Short Form: A cross-sectional study of a dialysis-targeted health measure in Singapore. *BMC Nephrology*, 11(36). doi:10.1186/1471-2369-11-36.)

A. Key Findings

Overall, there was little evidence that self-reported quality of life differed for CEC beneficiaries compared to comparison group beneficiaries not aligned to the CEC. Beneficiaries in the CEC Model had higher HRQOL scores in the areas of the effects of kidney disease, kidney disease symptoms and problems, and physical health, but these differences were small in magnitude.



B. Methods

The KDQOL-36™ is a validated 36-item patient self-report survey that has been administered to thousands of patients since 2002.[40,41,42] It consists of the Short Form 12 (SF-12) generic core of health-related quality of life questions, four questions related to the perceived burden of kidney disease, twelve questions addressing kidney disease symptoms or problems, and eight questions addressing effects of kidney disease. These items are used to compute the following five composite scores according to established methods:[43] (1) Physical Component Summary (PCS), (2) Mental Component Summary (MCS), (3) Burden of Kidney Disease, (4) Symptoms and Problems, and (5) Effects of Kidney Disease. Composite scores with higher values represent better self-reported quality of life. Individual questions included in each composite score are shown in **Appendix E**, **Exhibits E-4** and **E-5**.

We used multivariable regression methods to estimate the association between participation in the CEC Model and quality of life was estimated for CEC beneficiaries, relative to the matched comparison group of beneficiaries with ESRD. Because there was no pre-CEC data collected, we selected a cross-sectional study design. The 18,122 CEC beneficiaries who were sampled for the KDQOL-36™ survey were aligned to a CEC facility by the end of March 2018 and were surveyed from May through the end of August 2018. We constructed a sample of 18,122 comparison beneficiaries who meet the eligibility and alignment criteria as of March 2018. To this end, we used propensity score and Mahalanobis distance methods to select beneficiaries who were similar to CEC beneficiaries in terms of beneficiary characteristics like demographics and comorbid conditions, facility characteristics, and market characteristics. Among similar beneficiaries, the sample selection prioritized beneficiaries with a valid address. The comparison sample was surveyed from June through August 2018. The survey administration, methods for selecting beneficiaries in the comparison group, and methods for estimating regression models are described in detail in **Appendix E**.

Among CEC beneficiaries, the response rate for the KDQOL-36™ survey was 39%, while the response rate was lower for the comparison group, at 37%. Response rates stratified by select characteristics, such as demographics, are available in **Exhibit E-6** in **Appendix E**. A sufficient sample size was achieved for estimating the association of the CEC Model with each of the five composite scores. Based on standards used in the literature, a greater than five-point difference/change is typically considered clinically meaningful, whereas smaller differences/changes might not be considered clinically meaningful, even if they are statistically significant. For example, for the KDQOL-36™ measures that range from 0-100, a five-point difference essentially represents a five percentage point change in the fraction of the maximum

[40] Yang, F., Wang, V.W., Joshi, V.D., Lau, T.W., Luo, N. (2013). Validation of the English version of the Kidney Disease Quality of Life questionnaire (KDQOL-36) in hemodialysis patients in Singapore. *Patient*, 6(2):135-41.

[41] Ricardo, A.C., Hacker, E., Lora, C.M., Ackerson, L., DeSalvo, K.B., Go, A., Kusek, J.W., Nessel, L., Ojo, A., Townsend, R.R., Xie, D., Ferrans, C.E., Lash, J.P., and CRIC Investigators. (2013). Validation of the Kidney Disease Quality of Life Short Form 36 (KDQOL-36) US Spanish and English versions in a cohort of Hispanics with chronic kidney disease. *Ethnicity & Disease*, 23(2):202-9.

[42] Peipert, J.D., Bentler, P.M., Klicko, K., Hays, R.D. (2018). Psychometric properties of the Kidney Disease Quality of Life 36-item short-form survey (KDQOL-36) in the United States. *American Journal of Kidney Diseases*, 71(4):461-468.

[43] https://www.rand.org/health/surveys_tools/kdqol.html

possible points that were attained. A one-half standard deviation difference/change has also been noted as being clinically meaningful, but literature in this area cautions against adopting one value given that this may vary across different types of patient populations.[44]

The distribution of select characteristics across CEC and comparison group respondents are shown in **Exhibits 9a** and **9b**. CEC beneficiaries who responded to the survey were slightly older and more likely to be White relative to all CEC beneficiaries surveyed (i.e., all respondents and non-respondents). Similarly, the comparison group respondents were older and more likely to be White than the entire comparison group of beneficiaries who were surveyed (i.e., all respondents and non-respondents). The impact of these differences on the results were minimized by using sample-balancing weights to match the distribution by age, sex, and race/ethnicity for the total surveyed and respondent groups (see **Appendix E, Exhibits E-7** and **E-8**). Finally, respondents across the CEC and matched comparison groups exhibited similar distributions for sex and similar average hierarchical condition category (HCC) scores. However, CEC respondents were more likely to be younger than 65 and included a greater percent of Black beneficiaries relative to comparison respondents.

Exhibits 9a. Characteristics by Respondent Group

Characteristics		CEC Beneficiaries				Matched Comparison Beneficiaries			
		All Surveyed		Respondents		All Surveyed		Respondents	
		N	%	N	%	N	%	N	%
Age	<65	9,067	50.0	3,154	44.2	9,142	50.4	2,730	40.4
	65 to 85	8,008	44.2	3,537	49.6	7,922	43.7	3,528	52.2
	85 +	1,029	5.7	442	6.2	1,052	5.8	497	7.4
Sex	Female	10,141	56.0	3,981	55.8	10,068	55.6	3,686	54.6
	Male	7,963	43.9	3,152	44.2	8,048	44.4	3,069	45.4
Race/Ethnicity	Black	7,855	43.3	2,795	39.2	7,392	40.8	2,299	34.0
	White	7,574	41.8	3,399	47.6	8,068	44.5	3,630	53.7
	Hispanic	1,164	6.4	454	6.4	1,158	6.4	326	4.8
	Other	1,511	8.3	485	6.8	1,498	8.3	500	7.4

[44] Dwyer, J.T., Larive, B., Leung, J., Rocco, M., Burrowes, J.D., Chumlea, W.C., Frydrych, A., Kusek, J.W., Uhlin, L. (2002). Nutritional status affects quality of life in Hemodialysis (HEMO) Study patients at baseline. *Journal of Renal Nutrition,* 12(4):213-23.

Unruh, M., Benz, R., Greene, T., Yan, G., Beddhu, S., DeVita, M., Dwyer, J.T., Kimmel, P.L., Kusek, J.W. (2004). Effects of hemodialysis dose and membrane flux on health-related quality of life in the HEMO Study. *Kidney International*, 66(1):355-66.

Garg, A.X., Suri, R.S., Eggers, P., Finkelstein, F.O., Greene, T., Kimmel, P.L., Kliger, A.S., Larive, B., Lindsay, R.M., Pierratos, A., Unruh, M., Chertow, G.M.. (2017). Patients receiving frequent hemodialysis have better health-related quality of life compared to patients receiving conventional hemodialysis. *Kidney International*, 91:746–754.

Finkelstein, F., Schiller, B., Daoui, R., Gehr, T.W., Kraus, M.A., Lea, J., Lee, Y., Miller, B.W. (2012). At-home short daily hemodialysis improves the long-term health-related quality of life. *Kidney International,* 82(5):561-9.

Exhibit 9b. HCC Score by Respondent Group

	CEC Beneficiaries				Matched Comparison Beneficiaries			
	All Surveyed		Respondents		All Surveyed		Respondents	
	N	Mean	N	Mean	N	Mean	N	Mean
HCC Score	17,647	1.1	6,942	1.1	18,114	1.1	6,754	1.1

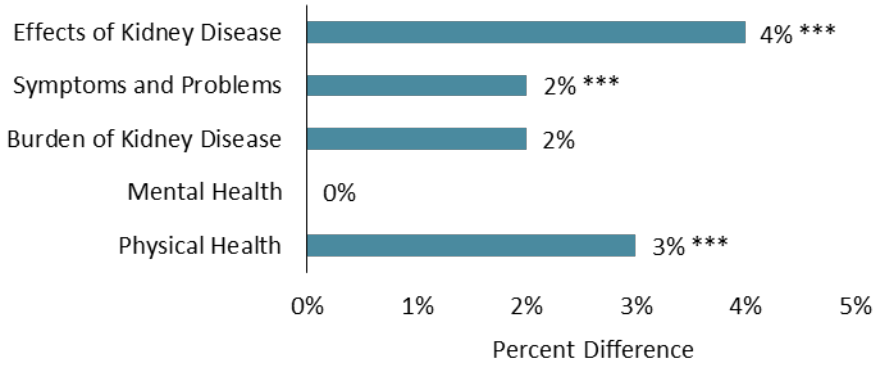
Note: Ns do not always add to total due to missing values. HCC scores were derived based on version 21 of the CMS ESRD risk adjustment model.

C. Results

In PY3 of the CEC Model, although there were statistically significant differences in HRQOL between participants in the CEC Model and the comparison group, none of the estimates met the five-percent threshold of clinically meaningful significance.

The differences between CEC Model beneficiaries and the comparison group in quality of life, as measured by KDQOL-36™ composite scores, are summarized in **Exhibit 10**. CEC beneficiaries had, on average, scores that were 4% higher on self-reported effects of kidney disease on quality of life, 3% higher on physical health, and 2% higher on symptoms and problems relative to the comparison group. While statistically significant ($p \leq 0.01$), these differences were small and not likely to be clinically meaningful.[45] The regression results for all covariates included in the models, including clinical conditions, are displayed in **Appendix E**, **Exhibit E-10**.

Exhibit 10. Differences in Health-Related Quality of Life between CEC and Comparison Group Beneficiaries



Notes: Values show the percent difference in scores between CEC beneficiaries and the comparison group. Significance of the CEC estimated association is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. All of these measures are scaled so that higher values represent better self-reported quality of life.

D. Discussion

The results suggest that beneficiaries in the CEC Model had, on average, slightly higher HRQOL scores relative to the comparison group in self-reported effects of kidney disease, symptoms and problems, and physical quality of life. This finding is consistent with reported efforts by ESCOs to enhance patient-centered approaches, including improved communication, education, and

[45] The mean PCS is 33.8; thus, a 0.88 increase is equivalent to a 2.6% increase relative to the mean in the sample. See **Appendix E, Exhibit E-9**.

access to care. For example, improved communication with patients, or enhanced patient education might involve facilities helping patients better manage bothersome symptoms, or the effects that kidney disease has on patients' day-to-day life. This finding also suggests that the CEC Model did not negatively affect patient quality of life, a concern for models like CEC that are focused on saving costs.

There are a few limitations to consider when interpreting these results. To begin, response rates were generally low in both groups and, consequently, may not be representative of the population of CEC aligned beneficiaries or the general ESRD population. In addition, this study uses cross-sectional differences in risk-adjusted scores to infer associations with the CEC Model. Since survey results prior to CEC Model implementation were unavailable, we were unable to assess changes over time before and after implementation of the model. The strength of these results, therefore, is dependent on how well self-reported quality of life among the non-CEC comparison group represents what would have happened absent the CEC Model. Additionally, the characteristics we selected for matching and the regression analysis may not adequately account for all differences between CEC and comparison beneficiaries. Therefore, any observed associations should not be interpreted as causal.

VII. What Were the Impacts of the CEC Model?

This section presents quantitative findings of the impact of the CEC Model on dialysis care, coordination of care beyond dialysis, hospitalizations, ED visits, Medicare payments, and standardized measures over the first three performance years.

A. Key Findings

CEC Model Impact

Dialysis Care 	**Vascular access placement and dialysis treatment adherence improved modestly for CEC beneficiaries but there was no evidence of changes in their experience with care** Catheter use declined (by 7%) Number of dialysis sessions per month increased (by 0.4%) Emergency (unscheduled) dialysis sessions declined (by 7%)
Coordination of Care Beyond Dialysis 	**There is some evidence the CEC Model improved coordination of care beyond dialysis** CEC beneficiaries had increased use of preventive care (e.g., cholesterol and diabetes tests, eye exams) and an increase (4%) in primary care office visits The model had a favorable impact on medication utilization with 5% fewer CEC beneficiaries over-utilizing opioid prescriptions and 4% greater adherence to phosphate binder medication. No impact was estimated on the use of medications that could be contraindicated for beneficiaries with ESRD
Hospitalizations 	**Hospitalizations declined under the model by 4%** The number of hospitalizations in a given month declined for infectious (by 6%), circulatory (by 6%), Congestive Heart Failure (by 8%), and ESRD complication (by 7%) related causes The CEC Model reduced the likelihood of a hospitalization for sepsis related infections (by 8%) ($p<0.01$)
Medicare Payments 	**Total Medicare Part A and Part B payments for CEC beneficiaries declined by 1.5%, suggesting aggregate gross savings of $122 million during the first 3 PYs** Savings were accomplished by decreases in spending for acute inpatient service ($59 PBPM), institutional post-acute care ($30 PBPM) and readmissions ($33 PBPM) Spending in PY3 declined less than in prior years due to lower performance by facilities who joined in PY3 and decreased impacts among established facilities who joined in PY1 and PY2
Survival 	**The CEC Model showed a modest association with improved survival** The association was stronger among beneficiaries aligned to CEC during their first year of dialysis

B. Methods

Our evaluation used a difference-in-differences (DiD) approach to estimate impacts of the CEC Model on key outcomes depicted in **Exhibit 11**, relative to the comparison group. DiD is a statistical method that quantifies the impact of the model by comparing changes in risk-adjusted outcomes for CEC beneficiaries, before and after implementation of the CEC Model, to changes in outcomes for similar beneficiaries in the comparison group, before and after CEC implementation. This approach controls for beneficiary-, market-, and facility-level differences between the CEC and comparison populations. It also minimizes biases from time-invariant differences between the CEC and comparison populations and controls for secular trends. The comparison group consisted of beneficiaries from non-participating dialysis facilities matched to CEC facilities based on key market and facility characteristics as well as the sociodemographic and clinical composition of beneficiaries served.

The DiD analysis used Medicare Part A and Part B enrollment and claims data from January 2014 to December 2018 in combination with other program, provider, and market data sources. We estimated a DiD model, that produced wave- and PY-specific effects for the original 13 ESCOs (Wave 1) and the additional 24 ESCOs (Wave 2). We used these by-wave, by-PY estimates to generate the estimate of the cumulative impact of the CEC Model for all 37 ESCOs.

We divided the period of analysis into pre-CEC, transition, and post-CEC periods for each of the waves of the ESCO facilities. The pre-CEC period for facilities that joined CEC in October 2015 ran from January 2014 through March 2015, and was followed by a six-month transition period from April 2015 through September 2015 to account for the delayed start of the model. The pre-CEC period for facilities that joined CEC in January 2017 ran from January 2014 through June 2016 and was followed by a six-month transition period from July 2016 through December 2016. The pre-CEC period for facilities that joined CEC in January 2018 ran from January 2014 through June 2017, and was followed by a six-month transition period from July 2017 through December 2017. The last intervention quarter for all waves concluded in December 2018. Due to the different intervention start times and multiple groups of Wave 1 facilities, Wave 1 ESCOs contribute nearly two times as many intervention quarters as Wave 2 ESCOs to the aggregate CEC Model DiD impact estimate. The DiD methodology, including data sources, outcomes definitions, methods for identifying comparison populations and any applied exclusion criteria, and statistical models, is described in **Appendix F**. The evaluation's statistical power to detect impacts are discussed in **Appendix G**.

Exhibit 11. CEC Model Evaluation Difference-in-Differences Measures

Category	Evaluation Measure
Dialysis Care	▪ Number of outpatient dialysis sessions per 1,000 beneficiaries per month ▪ Percent of beneficiaries with at least one unscheduled or emergency dialysis session in a given month ▪ Dialysis modality • Percent of beneficiaries receiving hemodialysis in a given month • Percent of beneficiaries receiving peritoneal dialysis in a given month ▪ Percent of beneficiaries receiving home hemodialysis in a given month ▪ Percent of beneficiaries receiving home dialysis in a given month ▪ Percent of beneficiaries starting dialysis with no prior nephrology care – beneficiary had no previous nephrology care ▪ Vascular access • Fistula use: percent of adult patients in a given month who had a fistula and had 90 days or longer of dialysis • Catheter use: percent of adult patients in a given month who had a catheter for 90 days or longer ▪ Patients' experience with care (ICH CAHPS®Survey) • Rating of kidney doctors (global ratings)^ • Rating of dialysis center staff (global ratings)^ • Rating of dialysis center (global ratings)^ • Beneficiary was seen within 15 minutes of appointment time (individual survey item) • Beneficiary received an explanation for why they were not eligible for a kidney transplant (individual survey item) • Nephrologists' communication and caring (composite score)^ • Quality of dialysis center care and operations (composite score)^ • Providing information to patients (composite score)^
Coordination of Care beyond Dialysis	▪ Preventive care indicators (percent of beneficiaries) • Low-density lipoprotein (LDL) cholesterol testing • HbA1c testing • Dilated eye exam (diabetic beneficiaries) • Flu vaccinations ▪ Number of Primary Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month ▪ Number of Specialty Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month ▪ Percent of beneficiaries receiving hospice services in a given month ▪ Medication management indicators (percent of beneficiaries) • Indicator of opioid overutilization, average daily morphine milligram equivalent (MME) dose greater than 50 mg in a given month • Indicator of phosphate binder adherence, proportion of days covered by phosphate binder over 80% in a given month • Indicator of contraindicated medication prescription fill in a given month

Category	Evaluation Measure
Hospitalizations and Emergency Department Visits	▪ Number of hospitalizations per 1,000 beneficiaries per month ▪ Number of ED visits per 1,000 beneficiaries per month ▪ Number of Observation Stays per 1,000 Beneficiaries per Month ▪ Inpatient Hospitalizations • Number of Endocrine/Metabolic Inpatient Hospitalizations per 1,000 Beneficiaries per Month • Number of Circulatory Inpatient Hospitalizations per 1,000 Beneficiaries per Month • Number of Infectious Inpatient Hospitalizations per 1,000 Beneficiaries per Month ▪ Percent of beneficiaries with at least one hospitalization for vascular access complications in a given month ▪ Percent of beneficiaries with at least one hospitalization for ESRD complications (i.e., volume depletion, hyperpotassemia, fluid overload, heart failure, and pulmonary edema) in a given month ▪ Infections • Percent of beneficiaries with at least one hospitalization for a Venous Catheter Bloodstream Infection in a given month • Percent of Beneficiaries with at least one hospitalization for Peritonitis in a given month • Percent of beneficiaries with at least one hospitalization for a Percent of Sepsis Infections in a given month ▪ Percent of beneficiaries with at least one admission for Ambulatory Care Sensitive Conditions (ACSC) in a given month • Admissions for diabetes short-term complications (National Quality Forum [NQF]#0272) • Admissions for diabetes long-term complications (NQF#0274) • Admissions for Congestive Heart Failure (CHF) (NQF#0277) ▪ Percent of beneficiaries with at least one readmission in a given month ▪ Percent of beneficiaries with at least one ED visit within 30-days of an acute hospitalization in a given month ▪ Standardized hospitalization ratio (NQF#1463) ▪ Standardized readmission ratio (NQF#2496) ▪ Standardized mortality ratio (NQF#0369)^
Medicare Payments across the Continuum of Care	▪ Average Part A and Part B Medicare payments PBPM ▪ Average payments PBPM for the following services: inpatient, readmissions, institutional post-acute care (PAC), home health, hospice, outpatient, office visits, total Part B, dialysis care, hospitalizations for ESRD complications, and Part B drug[46]
Unintended Consequences	▪ Total Part D Drug Cost PBPM

Notes: Medicare payments were standardized to remove the effects of Medicare's geographic wage, teaching and other payment adjustments. (^) Denotes measures included in the CEC Quality Model Measures Set.

ICH CAHPS® Instrument and Measures. The ICH CAHPS® survey was developed through a collaboration between CMS and the Agency for Healthcare Research and Quality and was designed to measure adult hemodialysis patients' experience with in-center hemodialysis care

[46] Medicare Part A and B payment categories include all beneficiary months and are not conditioned to whether a beneficiary received that specific service, hence payments can be zero in a given beneficiary month.

from Medicare-certified dialysis facilities.[47] We used this survey to assess the impact of CEC on the quality of dialysis care. We also use the survey to explore potential unintended consequences of the model, such as ESCOs investing only in quality measures included in the model and/or reducing quality of care on other dimensions not captured in the CEC quality set. To this end, we selected eight ICH CAHPS® measures (see **Exhibit 11** above): three global rating measures (rating of kidney doctors, dialysis center staff, and dialysis center); three composite measures currently used in the CEC Model Quality Measures Set (nephrologists' communication and caring, quality of dialysis center care and operations, and providing information to patients); and two additional measures based on individual survey responses that address other components of quality (beneficiary was seen within 15 minutes of appointment time and beneficiary received an explanation for why they were not eligible for a kidney transplant). The calculation of the global and composite measures uses the same methods CMS uses for the publicly reported ICH CAHPS® measures published on Dialysis Facility Compare.[48] Individual questions are shown in **Appendix H**, **Exhibits H-2** and **H-3**.

For each measure, we used a DiD approach to estimate the change, from the pre-CEC to the post-CEC periods, of the percent of beneficiaries reporting quality in the "top box" category (i.e., what would best demonstrate improvement)[49] among beneficiaries receiving care from CEC facilities relative to beneficiaries receiving care from facilities in the comparison group. Among 951 matched pairs of CEC and comparison group facilities, 653 (69%) had sufficient[50] ICH CAHPS® survey responses for inclusion in the analysis. Surveys collected between the fall 2014 and fall 2018 waves of the ICH CAHPS® were included in the analysis. The data, study population, and DiD analytic methods are described in detail in **Appendix H**.

C. Results

The final sample consisted of 117,186 CEC beneficiaries (48,622 in Wave 1 and 68,564 in Wave 2 CEC facilities), and 103,581 comparison beneficiaries. The analytic sample included all the eligible and aligned monthly beneficiary observations between January 2014 and December 2018. Across ESCO waves and comparison groups, beneficiaries were similar. Both of the CEC waves and comparison beneficiaries were around 44% female, averaged 63 years in age, and had been on dialysis for an average of over 42 months. More than 90% of beneficiaries in all three groups used hemodialysis. Wave 2 CEC facilities and the comparison group had larger proportions of White (47% and 50%) and had fewer Black beneficiaries (40% and 37%) compared to Wave 1, which had 42% of its beneficiaries White and 42% Black (see **Appendix F**, **Exhibit F-13**).

DiD impact estimates are reported as the absolute change in the value of the outcome measure among CEC beneficiaries, relative to the comparison group, and also in terms of the relative percent change of the outcome measures, compared to the pre-CEC period. We report the statistical significance of all results. We present estimates for all ESCOs and each wave,

[47] In-Center Hemodialysis CAHPS Survey official website (https://ichcahps.org/).
[48] https://www.medicare.gov/dialysisfacilitycompare/#about/dialysisfacility-info
[49] "Top box" is a label used in ICH CAHPS® research to describe the most positive responses. For example, responses categorized as top box include responses of 9 or 10 on a scale of 0 (worst) to 10 (best) on the Global Ratings Measures and responses of 'Always' or 'Yes' on the Composite Scores and individual survey items.
[50] To ensure beneficiary confidentiality, the ICH CAHPS® data received for this analysis had already applied rules suppressing facility results when there were 10 or fewer respondents in a given period.

cumulatively and by performance year. Detailed results, pre-CEC and post-CEC descriptive statistics, and sample sizes are located in **Appendix F**, **Exhibits F-18** through **F-29**.

1. What Was the Impact of CEC on Dialysis Care?

We investigated how the CEC Model may have impacted the delivery and quality of dialysis-related care delivered by dialysis facilities and nephrologists, the focal points of care within an ESCO. To assess care delivery and quality, we used available evidence-based clinical metrics to capture dialysis treatment adherence, nephrology care before dialysis, vascular access, and beneficiaries' experience with care. We highlighted these measures in the logic model as dialysis best practices under the sections for new behaviors and investments/drivers of change, as well as outputs and, ultimately, patient outcomes (see **Appendix B**).

At present, there is an established P4P program, the ESRD Quality Incentive Program (QIP), which provides financial incentives for all dialysis facilities, regardless of CEC participation, to improve many of these measures. Likewise, public quality reporting through Dialysis Facility Compare also applies to all facilities and may provide indirect incentives (e.g., through influencing patient choice of facility) to maintain or improve quality. Therefore, we did not anticipate that the CEC Model would result in dramatic changes in these measures, with the possible exception of a shift in vascular access initiation or adherence to dialysis, as improvements in those metrics could result in savings in other areas (e.g., procedures, hospitalizations). Moreover, efforts to improve vascular access and dialysis adherence were often noted at the ESCO site visits.

Overall, our analyses revealed that dialysis treatment adherence and vascular access practices improved modestly for CEC beneficiaries, but there was no evidence of any change in the percent of beneficiaries that received prior nephrology care or in their experience with care. Results differed across waves; CEC beneficiaries in Wave 1 ESCOs had stronger results, likely due to greater motivation by Wave 1 ESCOs to participate in the model and more lead-in time for Wave 1 ESCOs before model start, compared to Wave 2 ESCOs.

a. Dialysis Treatment Adherence and Modality

ESCO strategies to increase patients' adherence to dialysis treatment and minimize the occurrence of dialysis treatment in EDs when an outpatient dialysis session was a viable alternative evolved between PY1 and PY3. Examples of these ESCO strategies include the following:

- Updating EHRs to support transfer of patients from facilities without available chairs to nearby facilities, as well as offering expanded facility hours and reserving chairs for emergencies.
- Conducting more consistent proactive outreach to patients who missed treatments, with greater emphasis on coordination of and payment for transportation to dialysis.
- Increasing consistent emphasis on the importance of adherence to dialysis and non-dialysis treatment in patient and caregiver education sessions.

ESCOs attributed improved patient adherence to their dialysis treatments (including fewer patients ending their dialysis sessions early) to these care redesign strategies implemented under the CEC Model. As the model matured, ESCOs reported a widespread change in staff culture emerged (e.g., forming relationships with patients, addressing underlying social determinant of health, and increasing collaboration across staff), which also likely contributed to improved patient adherence.

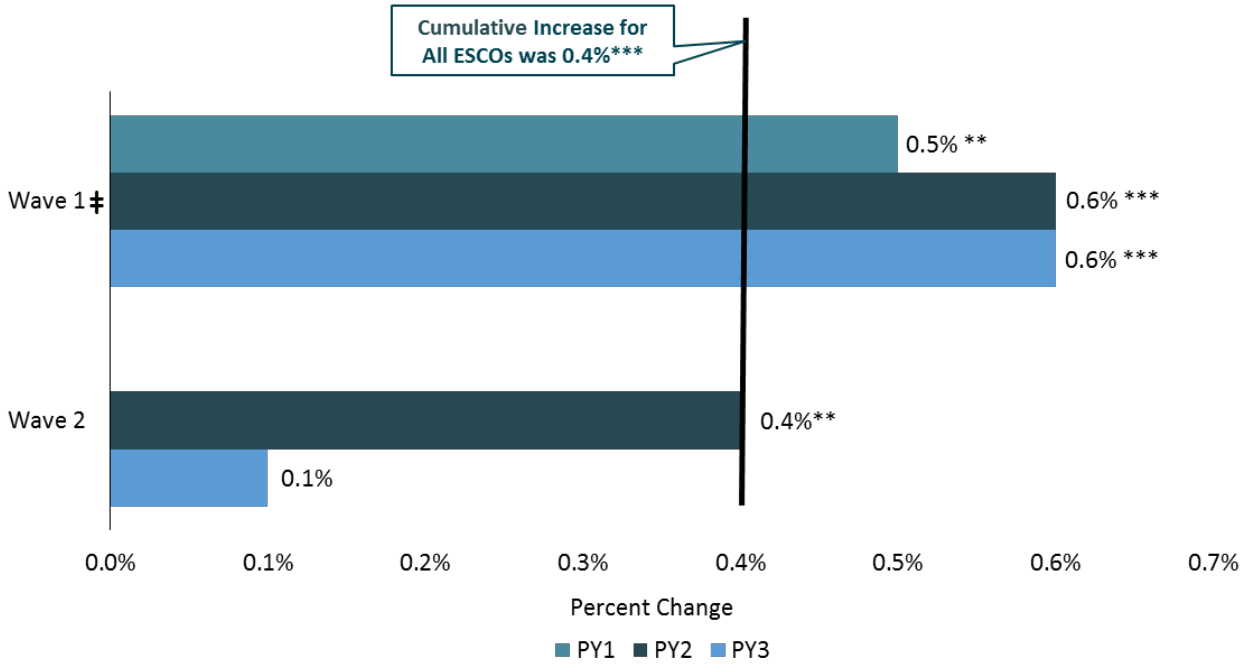
> *"We have seen an improvement in patients coming to treatment, stay on for the duration, because [the care coordinator] is helping us educate, and helping us push the education, staying for their appointments, their treatments."*
> – ESCO Site Visit Participant

To assess the success of these strategies, we evaluated whether the model positively impacted the frequency of dialysis sessions and decreased the use of emergency dialysis sessions. We found modest evidence that supports improvement in these measures. Overall outpatient dialysis sessions increased by 0.4%, ($p \leq 0.01$), which translates into an increase of 52 outpatient sessions per 1,000 beneficiaries per month among CEC beneficiaries.[51] Results were mainly driven by Wave 1 CEC beneficiaries, who increased 0.5% ($p \leq 0.05$) in PY1, 0.6% ($p \leq 0.01$) in PY2, and 0.6% ($p \leq 0.01$) in PY3 (see **Exhibit 12**).[52] The corresponding increase for Wave 2 CEC beneficiaries was 0.4% ($p \leq 0.05$) in PY2. The results for Wave 2 PY3 were not statistically significant.

[51] DiD values are estimated at the PBPM level and transformed post estimation to per 1,000 beneficiaries per month values. Since the per 1,000 beneficiaries per month values are linear transformations of the PBPM DiD estimates, the percent change values are identical for both levels.

[52] Outpatient Dialysis sessions did not pass statistical testing of the parallel trends assumption for Wave 1. However, visual inspection of the trend graph which compared trends between the treatment (CEC) and comparison group yielded no obvious differences. Additionally, the trend coefficient, although significant, equals 0.047. See **Appendix F**, **Exhibit F-17.**

Exhibit 12. Impact of the CEC Model on the Number of Outpatient Dialysis Sessions PBPM



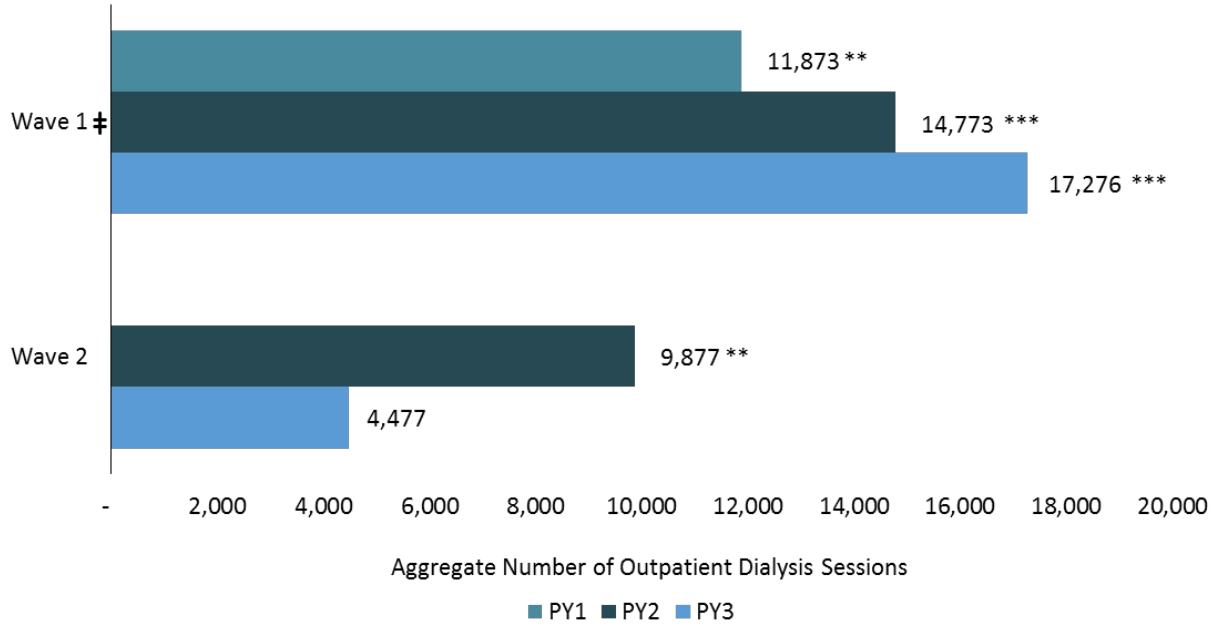
Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the baseline period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate. See **Appendix F** for detailed results: **Exhibits F-18** (All ESCOs), **F-19** (Wave 1), and **F-20** (Wave 2).

Overall, the results are consistent with the expectation that the CEC Model would create incentives to avoid or reschedule missed treatments in the outpatient setting and with the efforts reported by Wave 1 ESCOs.

> *"…if we have to spend a few hundred dollars on labor to run longer and prevent the $15,000 hospitalization, do it. It is the right thing to do for the patient."*
> – ESCO Site Visit Participant

In aggregate, the CEC Model increased the number of outpatient dialysis sessions by about 11,900, 24,700, and 21,800 total additional dialysis sessions in PY1, PY2, and PY3 respectively (see **Exhibit 13**).

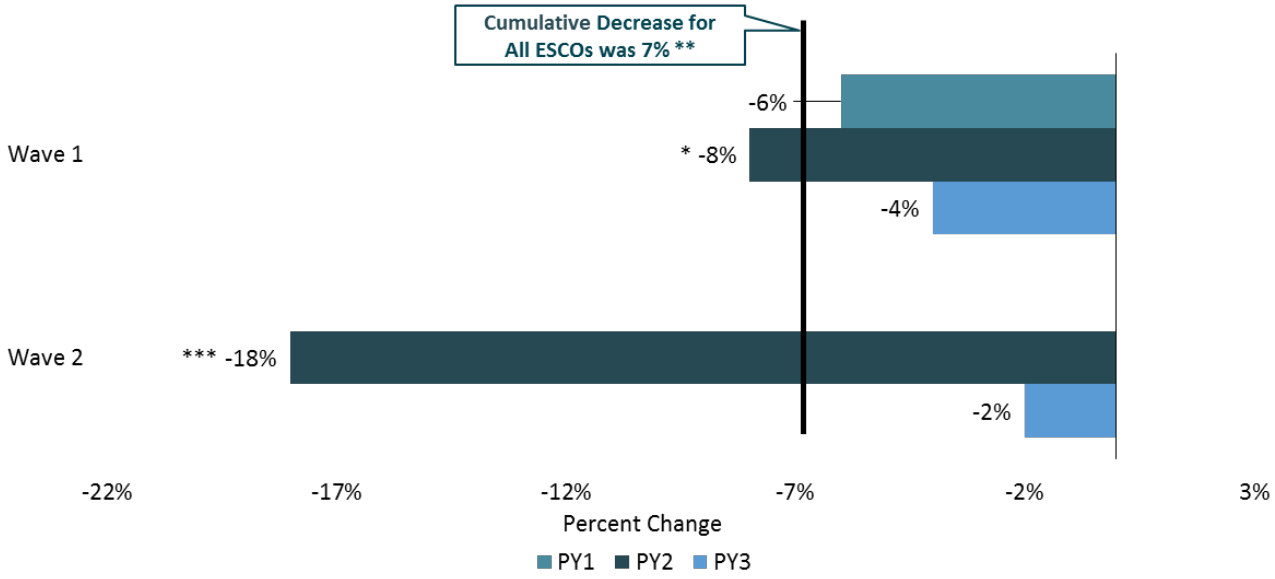
Exhibit 13. Impact of the CEC Model on the Aggregate Number of Outpatient Dialysis Sessions



Notes: Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. Aggregate estimates are based on the estimated total number of aligned intervention member months for the 685 CEC facilities participating in the CEC Model. ‡ Data from the baseline period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Emergency dialysis sessions (i.e., dialysis sessions that are unscheduled and occur in a non-dialysis facility setting) declined by 7% overall ($p \leq 0.05$) relative to the pre-CEC period, as shown in **Exhibit 14**. This decline is expected as the increase in outpatient sessions should lead to a reduced need for emergency dialysis sessions. This shift from emergency to outpatient sessions is also consistent with ESCOs' emphasis on strategies to improve patient adherence, as described above. The CEC Model also increased the coordination of and payment for transportation to ESRD-related appointments, a significant barrier to access to dialysis care, which may have contributed to the decline in use of emergency dialysis sessions. Although emergency dialysis sessions declined in all performance years, only the PY2 results were statistically significant. In PY2, the percent of Wave 1 and Wave 2 CEC beneficiaries with at least one emergency dialysis session decreased by 8% and 18%, respectively.

Exhibit 14. Impact of the CEC Model on the Likelihood of Receiving Emergency Dialysis in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See Appendix F for detailed results: **Exhibits F-18** (All ESCOs), **F-19** (Wave 1), and **F-20** (Wave 2).

We found no evidence that the CEC Model impacted the modality of dialysis treatment. Changes in the modality of treatment pre- and post-CEC were very modest and not statistically significant (see **Appendix F**, **Exhibits F-18** (All ESCOs), **F-19** (Wave 1), and **F-20** (Wave 2)). The vast majority of dialysis patients in the United States receive in-center hemodialysis treatments three times a week with a typical duration of three to four hours each. (Among the beneficiaries in our analytic sample, 91% had hemodialysis and 7% had peritoneal dialysis.) The percent of patients treated with home therapies is relatively low, although home therapies may provide the flexibility to help individual patients maintain their lifestyle, and some research has shown that home hemodialysis patients report a higher quality of life relative to patients receiving in-center hemodialysis.[53]

The DiD results align with the qualitative data collected at the site visits. All Wave 1 ESCOs reported that the CEC Model had little-to-no impact on home dialysis utilization. Many ESCOs cited an increase in home dialysis due to the focus on this treatment through chronic kidney disease (CKD) education programs unrelated to the CEC Model and conducted prior to initiation of dialysis.

[53] https://www.hsrd.research.va.gov/publications/esp/kidney-dialysis-REPORT.pdf

b. Prior Nephrology Care

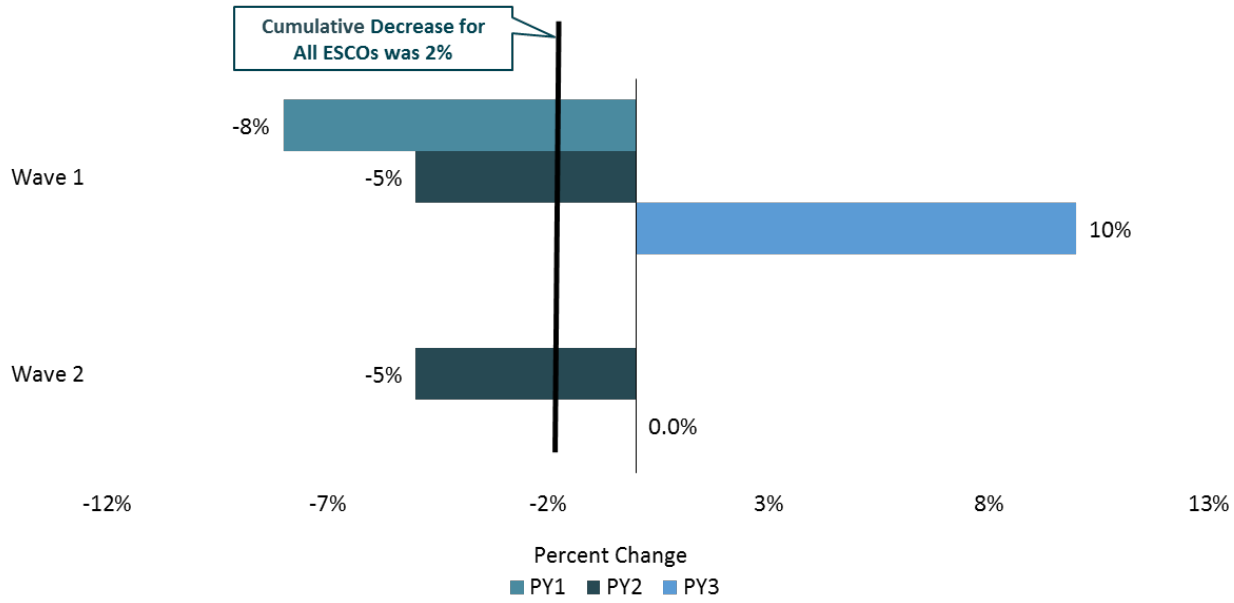
Although financial accountability under the CEC Model begins with initiation of dialysis, ESCOs have an incentive to provide additional care to late-stage CKD beneficiaries to improve outcomes once dialysis and model alignment begin. Unplanned dialysis starts or inadequate preparation for starting dialysis are associated with adverse outcomes.[54] Several ESCOs indicated that they were attempting to improve pre-dialysis care for this reason, unrelated to the model.

To assess the extent ESCOs focused on improving pre-dialysis care, we investigated the impact of the model on the percent of beneficiaries who receive nephrology care before the start of dialysis.[55] Education programs designed to prepare CKD patients for dialysis are important for avoiding early complications and reducing costs. These programs are available to all patients not yet on dialysis. Although pre-dialysis patients are not yet aligned to an ESCO, the potential to avoid early post-dialysis complications might motivate ESCOs to try to identify CKD patients who might become aligned to ESCOs after starting dialysis. However, there were no statistically significant changes in the percent of beneficiaries who started dialysis with no prior nephrology care (see **Exhibit 15)**.

[54] Molnar, A.O., Hiremath, S., Brown, P.A., Akbaricorresponding, A. (2016). Risk factors for unplanned and crash dialysis starts: A protocol for a systematic review and meta-analysis. *Systematic Reviews,* (5):117. PMC. Web. 18 Sept. 2018.

[55] A beneficiary was considered to have no prior dialysis care if their first vascular access type was not a graft or fistula and if they did not have select services such as treatment by a nephrologist, kidney dietician, or receive erythropoietin before the start of dialysis.

Exhibit 15. Impact of the CEC Model on the Likelihood of Not Receiving Nephrology Care Prior to Dialysis



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See Appendix F for detailed results: **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

c. Vascular Access Type

Because infections and infection-related hospitalizations often occur in chronic dialysis patients with tunneled catheters for vascular access, we anticipated that ESCOs may focus additional resources on successful creation of arteriovenous (AV) fistula, which is the most preferred access type, and AV graft which have lower risk of infections and other complications compared to long term catheters.

ESCOs indicated in PY1 that partnerships with vascular surgeons were an important strategy to reduce vascular access complications.[56]

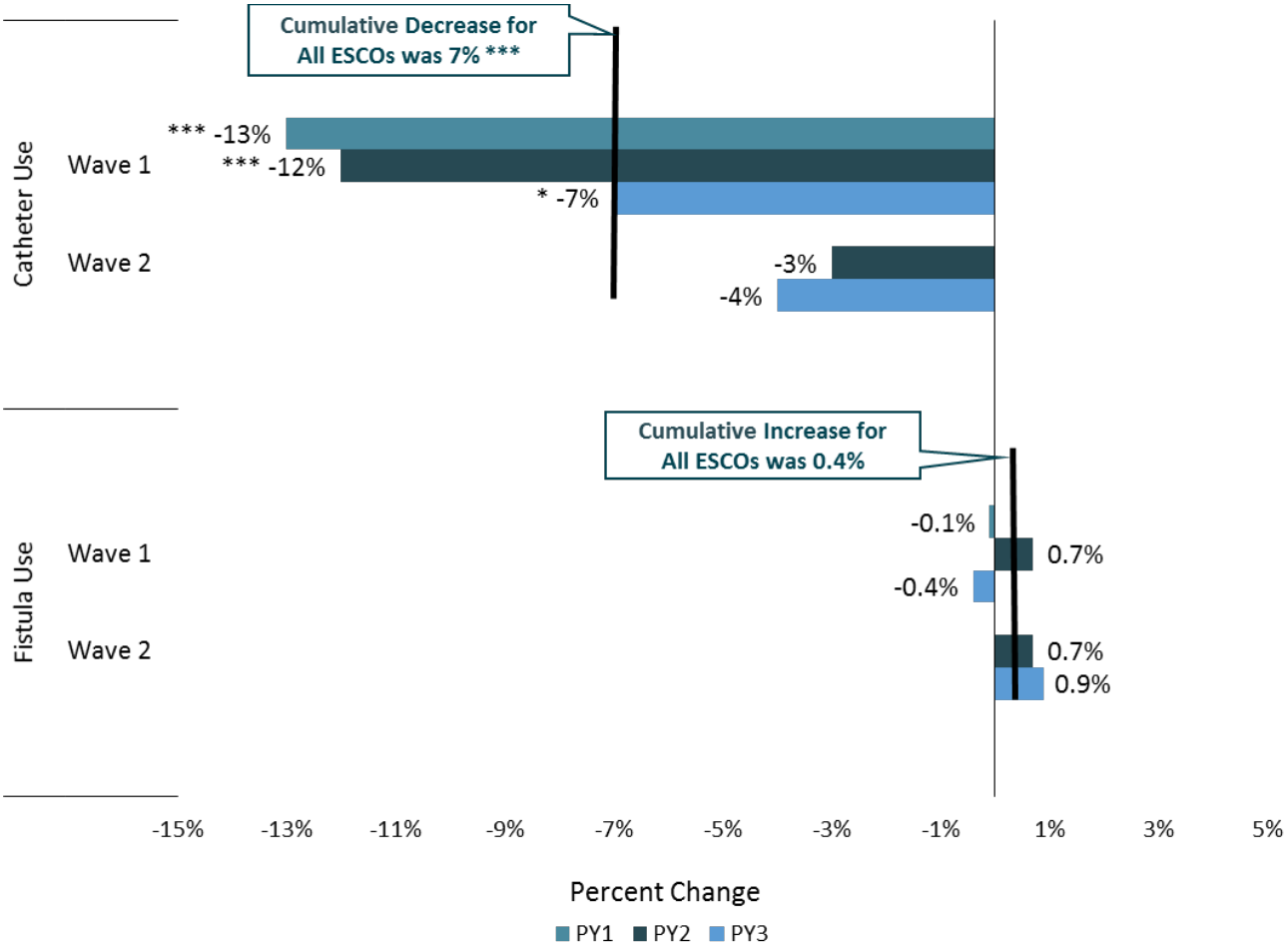
ESCO Strategies for Reducing Vascular Access Complications

Some ESCOs made appointments and coordinated transportation when beneficiaries had issues with their vascular access site to reduce the risk of further complications. One ESCO shared quality data on vascular access surgeons with its nephrologists so they can refer patients to surgeons with the best outcomes.

[56] Tunneled catheters are tubes surgically placed under the skin and underlying tissues 'tunneled' into a large vein, usually in a patient's neck or chest, to allow access to the patient's bloodstream for dialysis treatments.

During the first three performance years, the CEC Model resulted in a decline in the percent of beneficiaries who used catheters as their vascular access for 90 days or more by 7% ($p \leq 0.01$), relative to the pre-CEC period (see **Exhibit 16)**. This result was driven by Wave 1 ESCOs, with no statistically significant change among Wave 2 ESCOs. There was no statistically significant impact on fistula use over the three year period. For both waves, the impact of the model was lower in PY3. The CEC Model resulted in a modest increase in the percent of beneficiaries using fistula as their vascular access, with more consistent results for Wave 2 ESCOs. However, the estimate did not reach statistical significance. Therefore, it appears that the decrease in catheter use corresponds to an increase in AV grafts.

Exhibit 16. Impact of the CEC Model on the Likelihood of Vascular Access Type in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-18** (All ESCOs), **F-19** (Wave 1), and **F-20** (Wave 2).

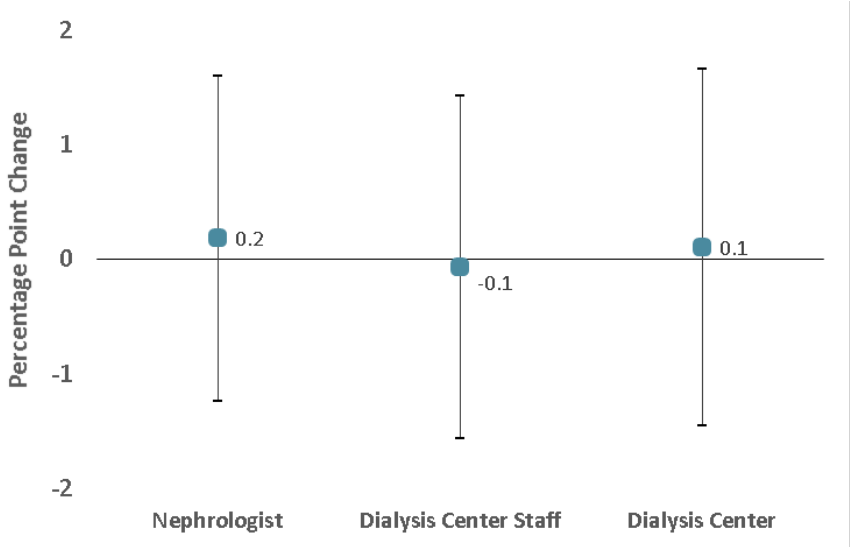
d. CEC Patients' Experience with Dialysis Care

Overall, there was no change in patients' experience of care as measured by the In-Center Hemodialysis Consumer Assessment of Healthcare Providers and Systems (ICH CAHPS®) survey measures. Although reduced quality is a potential concern in any model intended to drive down total cost of care in a vulnerable population, we did not anticipate such an effect given the existing P4P and quality reporting initiatives to maintain and improve quality applying to all dialysis facilities.

To assess changes in patient's experience of care, we estimated the impact of the CEC Model on the percent of beneficiaries who reported the highest level of satisfaction with care (i.e., top-box level) across all ESCOs for the ICH CAHPS® measures examined.[57] The eight ICH CAHPS® measures evaluated included three global ratings measures (see **Exhibit 17**), two individual survey items (see **Exhibit 18**), and three composite score measures (see **Exhibit 19**). Additional descriptive statistics for each measure by wave and performance year in are shown in **Appendix H**.

Survey response rates may affect our interpretation of these results. The response rates for CEC and comparison facilities were roughly 29% in both groups. Consequently, we cannot assess if the observed results are representative of the larger proportion of beneficiaries who did not respond.

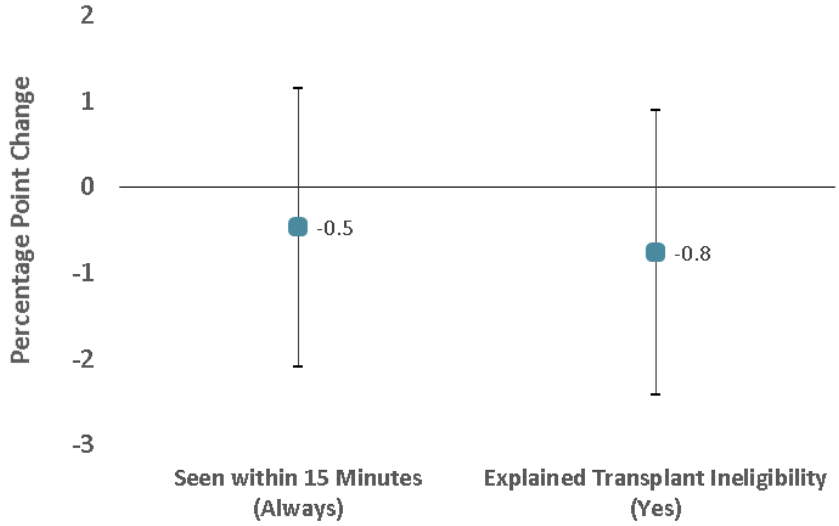
Exhibit 17. Impact of CEC on ICH CAHPS® Global Ratings Measures
Percent of Beneficiaries Reporting Highest Level of Satisfaction



Notes: This analysis included results from the fall 2014 through the fall 2018 ICH CAHPS® surveys, which encompass the pre-period, PY1, PY2, and PY3. Plotted values are the DiD estimates and 90% confidence intervals. The responses categorized as top-box include responses of 9 or 10 on a scale of 0 (worst) to 10 (best). Individual questions are available in **Appendix H**.

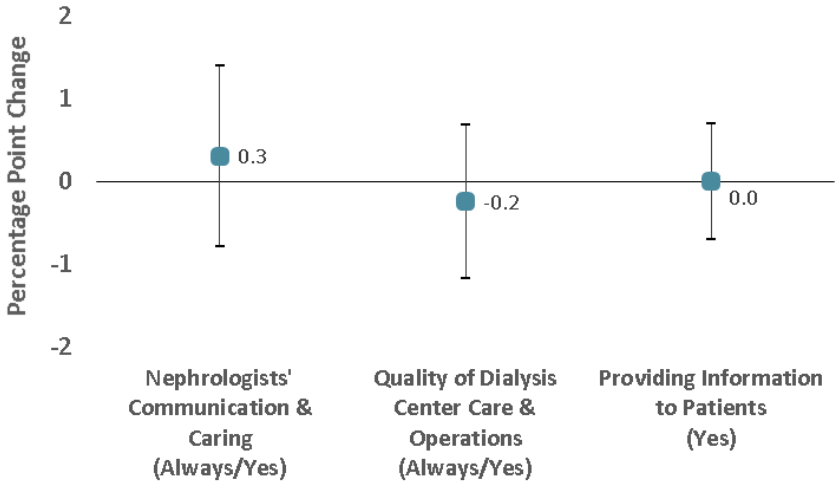
[57] We do find statistically significant improvements for Wave 1 in PY3 for the Nephrologist measure and a decrease for Wave 2 in PY3 for the "Explained Transplant Ineligibility" individual question. However, these changes are very small and not clinically meaningful.

Exhibit 18. Impact of CEC on ICH CAHPS® Individual Survey Items
Percent of Beneficiaries Reporting Highest Level of Satisfaction



Notes: This analysis included results from the fall 2014 through the fall 2018 ICH CAHPS® surveys, which encompass the pre-period, PY1, PY2, and PY3. Plotted values are the DiD estimates and 90% confidence intervals. Individual questions are available in **Appendix H**.

Exhibit 19. Impact of CEC on ICH CAHPS® Composite Score Measures
Percent of Beneficiaries Reporting Highest Level of Satisfaction



Notes: This analysis included results from the fall 2014 through the fall 2018 ICH CAHPS® surveys, which encompass the pre-period, PY1, PY2, and PY3. Plotted values are the DiD estimates and 90% confidence intervals. Individual questions are available in **Appendix H.**

2. What Was the Impact of CEC on the Coordination of Care beyond Dialysis?

Because ESCOs are accountable for all the Medicare Part A and B costs of their beneficiaries, providers have an incentive to invest in preventive services and chronic disease management activities beyond standard dialysis care. ESCOs reported various efforts to coordinate non-dialysis care for aligned beneficiaries, such as promoting preventive health, chronic disease

management, and the use of other services (e.g., hospice). Some noted that the model brought about an increased focus on efforts that had been in place prior to the CEC Model, resulting in these services being provided (or patients being referred to other providers) more efficiently and with greater follow-up to ensure their completion.

All Wave 1 ESCOs described a "culture change" since the start of the model, in which care moved from providing dialysis to treating the whole patient. The model's emphasis on quality metrics and the associated accountability for the total cost of health care for the patient influenced the willingness of some nephrologists to address primary care needs directly, as well as motivated staff and nephrologists to work together to encourage beneficiaries to become more invested in their care and address behavioral health issues. The CEC Model waivers allow pay for performance, such as timely completion of Transition of Care forms following hospitalizations (see **Section III.C.2.b.**), which also motivated some nephrologists to focus on medication management.

Barriers to Coordinating Non-Dialysis Care

ESCOs suggested that the cost of copays and the number of appointments may be prohibitive for some beneficiaries. Beneficiaries may also be uncomfortable talking about and using mental health services and palliative and hospice care.

However, ESCOs noted several challenges in coordinating non-dialysis care. A key barrier was poor access to external providers and services, particularly for dialysis facilities located in rural, lower income, and suburban areas. Furthermore, lack of mental health providers in these areas, especially those who accept Medicare, was a commonly cited barrier. Another obstacle was access to reliable transportation services, as some ESCOs faced logistic challenges arranging transport to and from appointments in areas that had fewer transportation options (e.g., rural areas) and for patients who used wheelchairs or required stretcher services. Given the heightened awareness of behavioral health needs and barriers to access, we will consider inclusion of behavioral health in the PY4 evaluation measures and site visits.

We evaluated whether the CEC Model increased the use of preventive health services, such as immunizations and lab tests, and the use of hospice. We also examined care correlated with chronic disease management, such as evaluation and management (E/M) office visits and medication management. We found some evidence that overall the CEC Model improved coordination of care beyond dialysis.

a. Preventive Care

Overall, the CEC Model increased the use of preventive care screening tests and labs, as well as flu vaccinations, as shown in **Exhibit 20**. For beneficiaries with ESRD who were also diabetic, we assessed testing for low-density lipoprotein (LDL) cholesterol control, HbA1c,[58] and dilated eye exams. These preventive care measures are important because of the high rate of diabetes and heart disease in the ESRD population. (Among the beneficiaries in our analytic sample, 75% had diabetes and 72% had congestive heart failure, or CHF.) In addition, dilated eye exams for

[58] According the to the 2017 USRD Report, HbA1c testing has been decreasing over time and may reflect an increasing awareness of the limitations of HbA1c as an indicator of average glycemia in diabetic patients with ESRD.

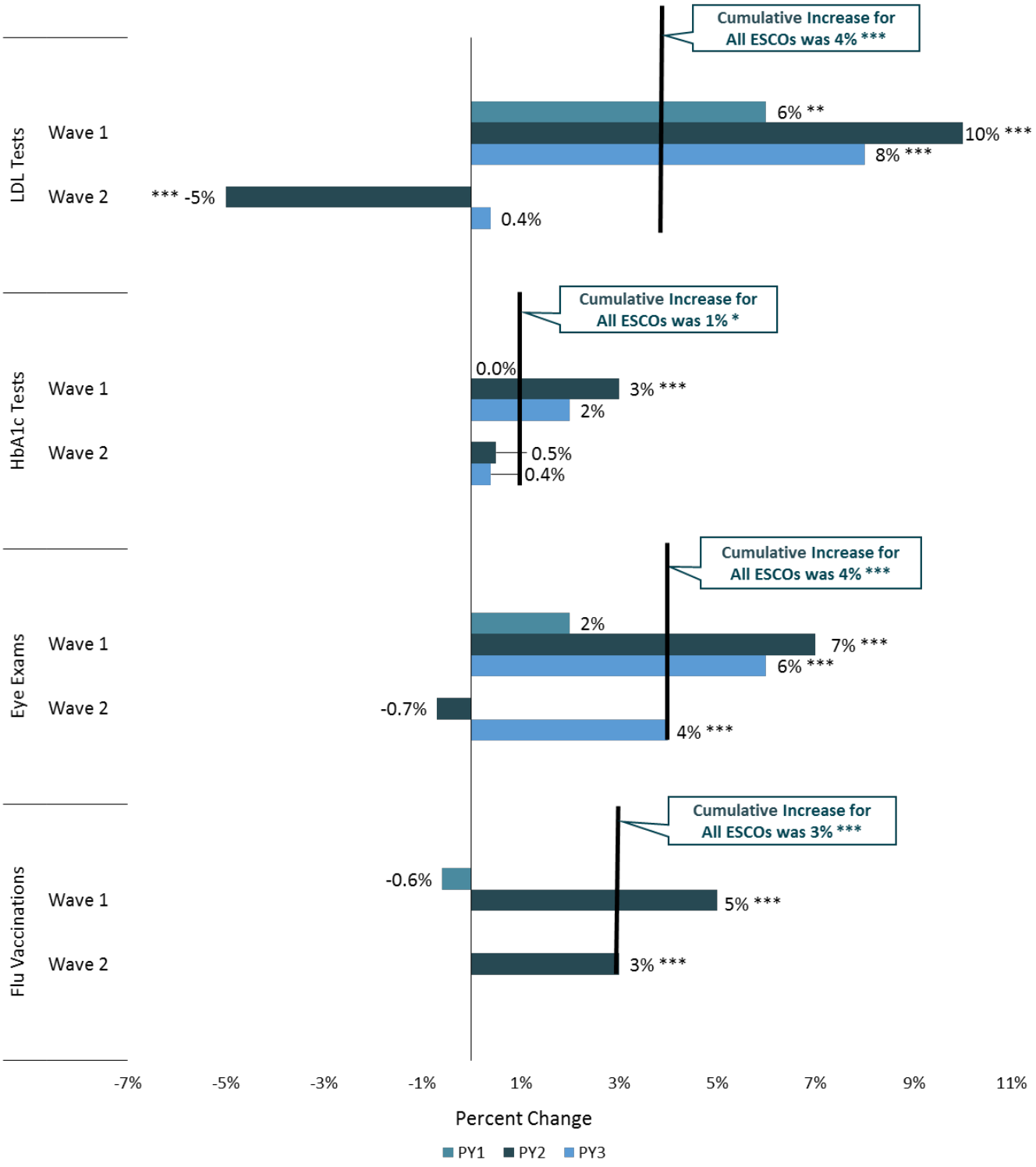
diabetic beneficiaries is one of the quality measures that determine ESCOs total quality performance for shared savings calculations.[59]

Our results showed that CEC beneficiaries were more likely to receive LDL tests, HbA1c tests, eye exams, and flu vaccinations, but these findings were primarily driven by Wave 1 ESCOs, with decreasing impacts over time for all measures but flu (see **Exhibit 20**). Increases in flu vaccinations were statistically significant for both waves in the second flu season.

> *"Half of our patients don't see a primary care provider in the course of the year. So, if the foot checks aren't done in the dialysis clinic, they're not being done. Same with flu vaccines…What the ESCO program does is kind of brings that into focus. Because outside the ESCO program, quite frankly, as a nephrologist, and as a dialysis organization, you're largely concerned with delivering a safe and effective dialysis treatment, one-stop."*
> – ESCO Site Visit Participant

[59] See https://innovation.cms.gov/initiatives/comprehensive-esrd-care/ for the full CEC quality performance set.

Exhibit 20. Impact of the CEC Model on the Likelihood of Receiving Preventive Services in a Given Year



Notes: Preventive care measures are evaluated at the yearly level. PY1 is defined as 2016; PY2 is defined as 2017; and PY3 is defined as 2018. All ESCOs estimates include both waves from 2016 through 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. The flu season is defined as August through April. Based on the data used for this analysis, a full flu season for PY3 joining Wave 1 facilities and

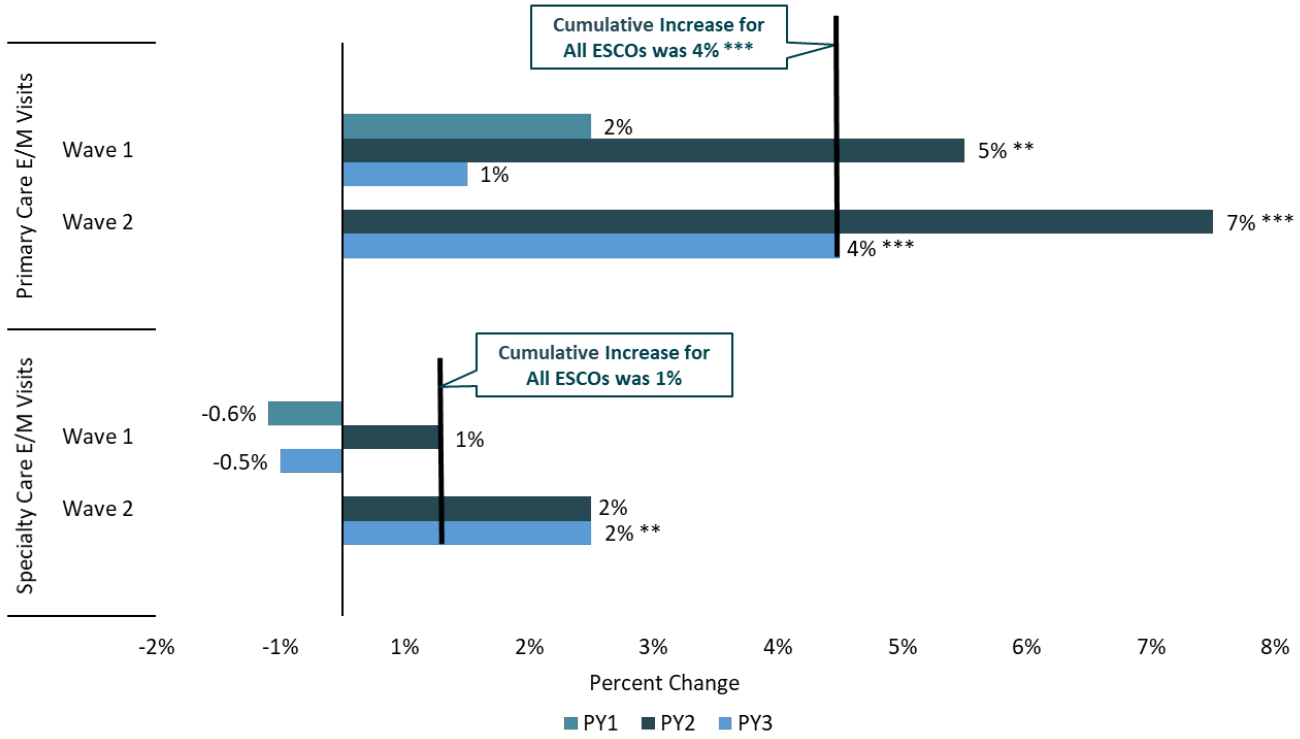
Wave 2 ESCOs was not available. As a result, the flu estimate only represents Wave 1 PY1 joiners and Wave 1 and Wave 2 PY2 joiners. Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

b. Evaluation and Management Office Visits

ESCOs reported increased provision of primary care during dialysis treatment visits and referrals for non-dialysis care. Overall, the number of primary care E/M visits in a given month increased by 4% ($p \leq 0.01$) under the CEC Model, relative to the pre-CEC period, as shown in **Exhibit 21**.[60] Statistically significant increases were found in both waves in PY2; primary care visits increased by 5% ($p \leq 0.05$) in Wave 1 ESCOs and by 7% ($p \leq 0.01$) in Wave 2 ESCOs. In PY3, the increase in primary care provision was only significant for Wave 2, which increased by 4% ($p \leq 0.01$). Unlike primary care, specialty care E/M utilization did not experience much change. A 2% ($p \leq 0.05$) increase was seen in Wave 2 ESCOs in PY3. Overall, these results demonstrate ESCOs' efforts in identifying primary care and specialty providers, referring beneficiaries to these providers, and/or setting up these appointments.

[60] The E/M measures used in PY3 differ from the versions used in PY2. The PY2 E/M measures were refined to include additional criteria for greater precision in PY3. See more detail in **Appendix F, Exhibit F-3.**

Exhibit 21. Impact of the CEC Model on the Number of Primary and Specialty Care Visits in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

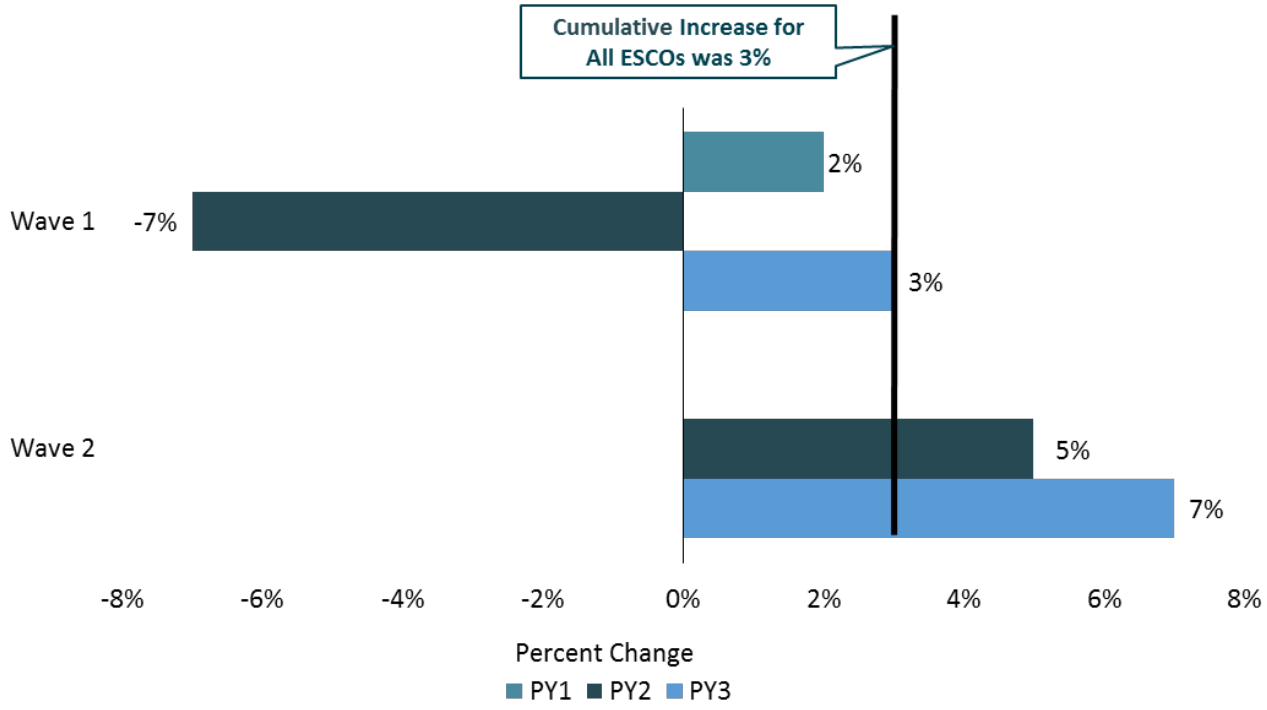
c. Hospice

In prior interviews, ESCOs reported that some staff and nephrologists were uncomfortable discussing end-of-life care and hospice services with beneficiaries and expressed a desire for more training and resources in these areas. Modest change was noted in the current round of interviews, as all four Wave 1 ESCOs described some limited discussion between staff, patients, and caregiver about hospice. These discussions typically involved staff providing referrals to external services for advance care planning or hospice care.

To investigate whether the CEC Model had an impact on hospice care, we evaluated hospice Medicare payments and hospice utilization. Although some ESCOs reported offering more education about hospice and end-of-life care, there was no indication that CEC affected hospice use (see **Exhibit 22**). There were no statistically significant changes in the percent of beneficiaries receiving hospice services in a given month. Because dialysis is a life-sustaining

service, beneficiaries without a life-threatening illness (other than ESRD) would have to decide to stop dialysis care in order to receive hospice care. Without dialysis care, there is a very limited period of time to establish and receive hospice care.

Exhibit 22. Impact of the CEC Model on the Likelihood of Receiving Hospice Services in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 – December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

d. Medication Management

ESCO focus on medication management was widespread since the beginning of the model.[61] Several ESCOs enhanced their medication reconciliation practices in PY3 to reduce the incidence of complications that require urgent care from an ED and can potentially result in a hospitalization. Therefore, we

ESCO Strategy

In PY3, ESCOs enhanced existing medication management practices, including physician consulting on high-risk cases and updating EHRs, to improve medication documentation.

[61] Please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf) and the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

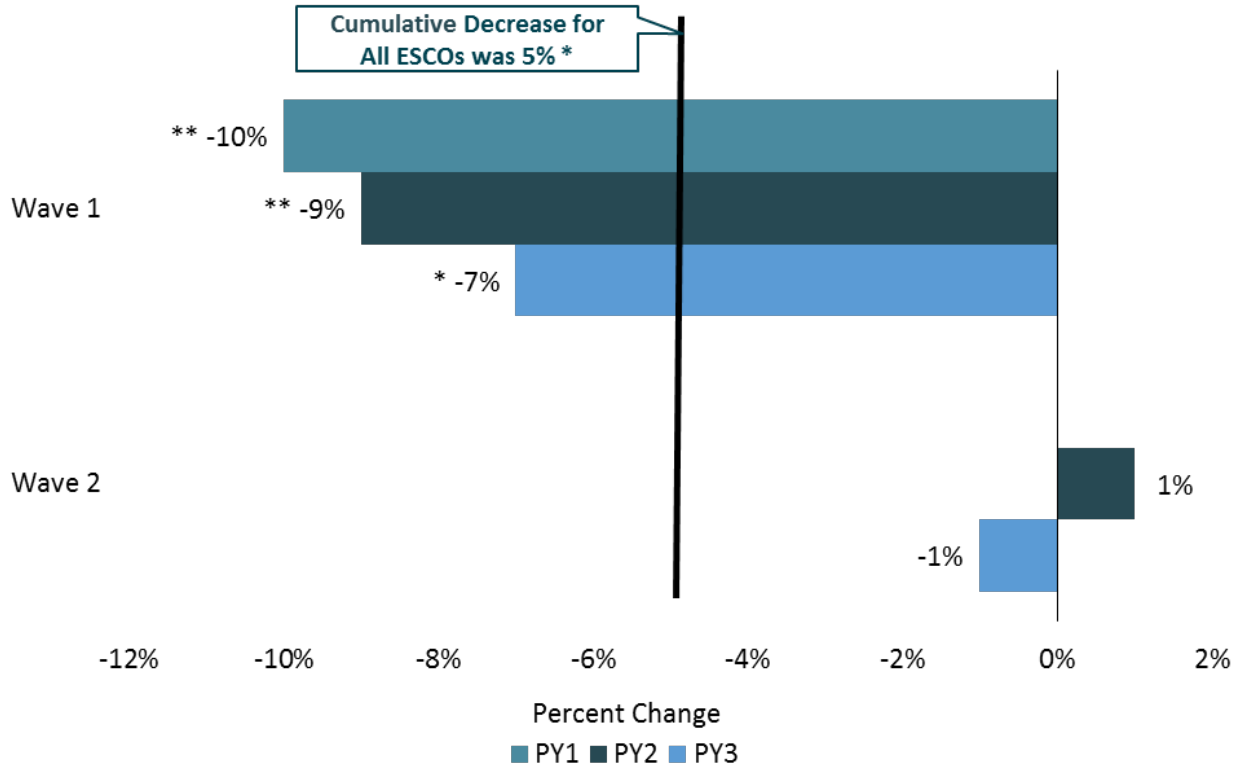
expected improved medication management. We evaluated the impact of the model on reducing overuse of opioids and use of contraindicated medications, and improving phosphate binder adherence. Phosphate binder adherence is important for minimizing bone disease in people with ESRD. Analysis of these three measures was restricted to beneficiary months where the beneficiary with ESRD had Medicare Part D coverage for prescription drugs, which accounted for approximately 83% of the sample.

The CEC Model had a statistically significant, favorable impact on opioid overuse and phosphate binder adherence (see **Exhibits 23** and **24**). We measured opioid overuse as the percent of beneficiaries who had an average daily morphine milligram equivalent (MME) greater than 50 milligrams: overuse declined by 5% ($p \leq 0.10$), relative to the pre-CEC period. This improvement was concentrated in Wave 1.

Both Wave 1 and Wave 2 CEC beneficiaries showed improved adherence to phosphate binders.[62] Overall, the rates of phosphate binder adherence in all ESCOs increased by 4% ($p \leq 0.01$), relative to the pre-CEC period. Wave 1 CEC beneficiaries showed improved phosphate binder adherence with at least 80% of their days covered in a month increased from 3% ($p \leq 0.10$) in PY1 to 5% ($p \leq 0.01$) in PY3. Wave 2 CEC beneficiaries also showed improved phosphate binder adherence in PY3; their adherence rate increased by 6% ($p \leq 0.01$).

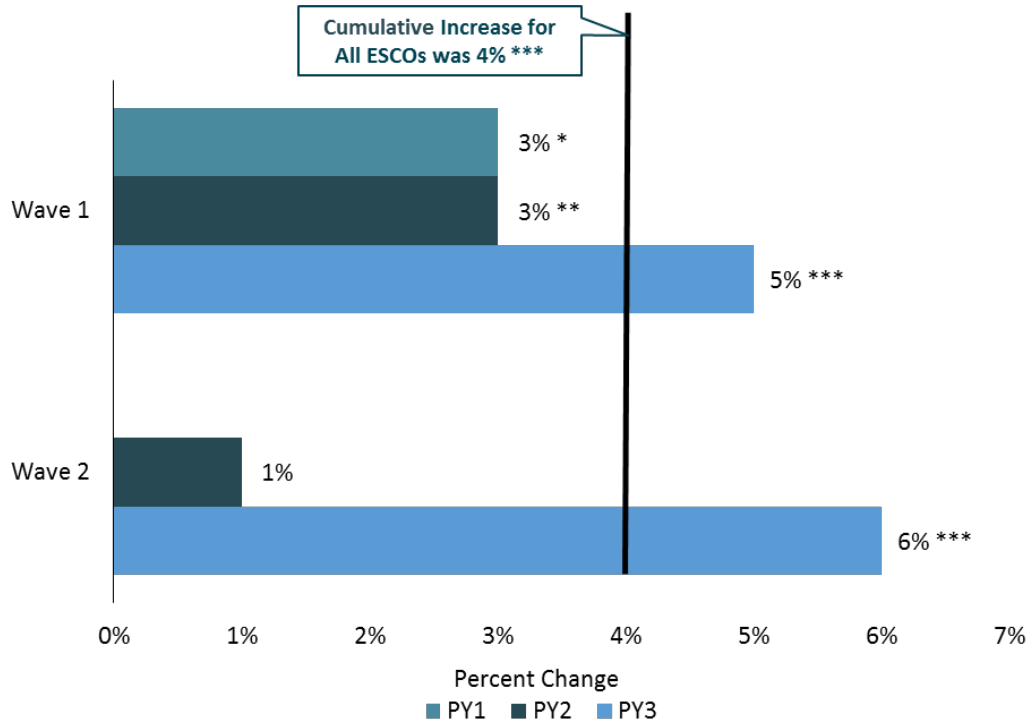
[62] Adherence was defined for beneficiaries who received at least two phosphate binder prescription in a given year, and was calculated as the proportion of days covered by phosphate binder over 80% in a given month.

Exhibit 23. Impact of the CEC Model on the Likelihood of Overusing Opioids



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

Exhibit 24. Impact of the CEC Model on Likelihood of Adhering to Phosphate Binder Medication in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2).

Finally, we evaluated whether there was an impact of the CEC Model on the use of medications that could be contraindicated for beneficiaries with ESRD, such as nitroprusside, a drug for high blood pressure that is associated with reduced nitroprusside metabolite and eventually toxicity.[63] There were no statistically significant impacts of CEC Model on contraindicated medication use (see **Appendix F**, **Exhibits F-21** (All ESCOs), **F-22** (Wave 1), and **F-23** (Wave 2)).

3. *What Was the Impact of CEC on Hospitalizations and Emergency Department Visits?*

Because the CEC is a shared saving model, it creates incentives for better coordination across the continuum of care to reduce expensive inpatient utilization. Hospital admissions and

[63] A complete list of contraindicated medications is provided in **Appendix F**, **Exhibit F-3**.

readmissions are a major burden for patients with ESRD, who, on average, are admitted to the hospital nearly twice a year.[64] Furthermore, inpatient treatment for beneficiaries with ESRD accounted for about 33% of total Medicare expenditures.[65]

ESCO efforts to prevent hospitalizations were successful in the first two years of the model,[66] and all Wave 1 ESCOs continued to employ multiple strategies to reduce hospitalizations, ED visits, and readmissions in PY3. These efforts included expanded access to dialysis care, expanded and more consistent patient and caregiver education, automated and informal ED notification, and management of all medications, especially following a hospitalization.

ESCOs pursued formal or informal relationships with hospital systems to help with:

- *Diverting beneficiaries from the ED*
- *Getting or streamlining access to inpatient discharge summaries or medical records, and*
- *Medication reconciliation.*

Despite their success in reducing hospitalizations, ESCOs experienced challenges sharing information with hospitals. In PY3, Wave 1 ESCOs reported that some hospitals were not receptive to ESCO goals (including ED diversion) due to a lack of interest in or education about the ESCO, differing incentives, and concerns about liability and the legal implications of sharing patient medical record information. Wave 1 ESCOs also experienced difficulties receiving notifications and records about ED visits as well as getting information from the hospital after a patient was admitted or discharged. IT investments, including notification alert systems, access to hospital health records or state health information exchange systems (if available), and direct communication and relationships with hospital case managers helped facilitate information sharing. However, delays persisted in alert notifications and were a barrier to successful implementation of these strategies. ESCOs preferred thorough discharge summaries and cohesive follow-up between hospital and facility staff after a visit rather than real-time notification of the admission or discharge.

"I have nurses that have direct access into the hospitals that their patients go to, and I have nurses that don't. And it is a huge difference in the way they're able to manage their patients and the time spent trying to retrieve what they need to manage the patients."
– ESCO Site Visit Participant

We explored 12 key hospitalization and ED utilization measures with relevance to the CEC Model. Each measure was analyzed by wave and by performance year, as well as cumulatively for all ESCOs (across waves and performance years). The 12 measures and the reasons these measures were selected for analysis are discussed below.

a. **Number of inpatient hospitalizations**, **ED visits**, **and hospital observation stays** (see **Exhibits 25 and 26**). ED visits are an expensive and often preventable alternative to timely ambulatory care. Observation stays are defined as a hospital stay with an expected length of stay of less than two midnights during which the beneficiary receives

[64] National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. (2018). United States Renal Data System. 2018 USRDS annual data report: Epidemiology of kidney disease in the United States, Bethesda, MD. https://www.usrds.org/2018/view/v2_04.aspx

[65] Ibid

[66] Please see the first annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py1.pdf) and the second annual report (https://innovation.cms.gov/Files/reports/cec-annrpt-py2.pdf).

medical services. When looking at hospitalizations, it is important to include observation stays to get a complete picture. Because the cost of an observation stay is lower than the per-night cost of an inpatient hospitalization, there may be an incentive to shift from inpatient admissions to observation stays.

b. **Number of inpatient hospitalizations by principal diagnosis** (see **Exhibit 27**). We explored hospitalizations associated with infectious, circulatory, and endocrine/metabolic principal diagnoses to help identify key drivers for impacts uncovered for overall hospitalizations.[67] Given the relationship between these diagnoses and ESRD care, these groups are likely to be impacted by the CEC Model.

c. **Percent of beneficiaries hospitalized for vascular access or ESRD-related complications** (see **Exhibit 28**). These ESRD related hospitalization measures are more likely to be impacted by the model. In addition, ESCOs reported encouraging the use of AV fistula and AV graft over catheters for vascular access to prevent infection-related hospitalizations.

d. **Percent of beneficiaries with infection-related hospitalizations** (see **Exhibit 29**). Three acute care hospitalization categories provide slightly different lenses (other than principal diagnosis) to explore at least one hospitalization in a given month for venous catheter bloodstream infection, peritonitis, and sepsis. We expected the ESCOs' reported emphasis on reducing long-term catheter use to have an impact on venous catheter bloodstream infections. Impacts of the model on the approximately 7% of beneficiaries in our sample that receive peritoneal dialysis might be captured by the peritonitis measure. Lastly, we explored the sepsis category, which represents complications from all infections, to assess the ESCO's reported emphasis on improving non-dialysis care.

e. **Percent of beneficiaries with Diabetes or CHF related complications** (see **Exhibit 30**). We expected the model to impact measures of hospitalizations for these two Ambulatory Care Sensitive Conditions (ACSC) because of the high prevalence in the ESRD population. ESCOs also reported addressing primary care needs during dialysis treatment and coordinating care beyond dialysis needs.

f. **Percent of beneficiaries with hospital readmissions or ED visits within 30 days of an acute hospitalization** (see **Exhibit 31**). These measures are helpful indicators of the quality of post-acute care. In addition, ESCOs reported coordinating care during transition from a hospital as well as medication management to prevent readmission.

a. Overall Hospitalizations, Observation Stays, and ED Visits

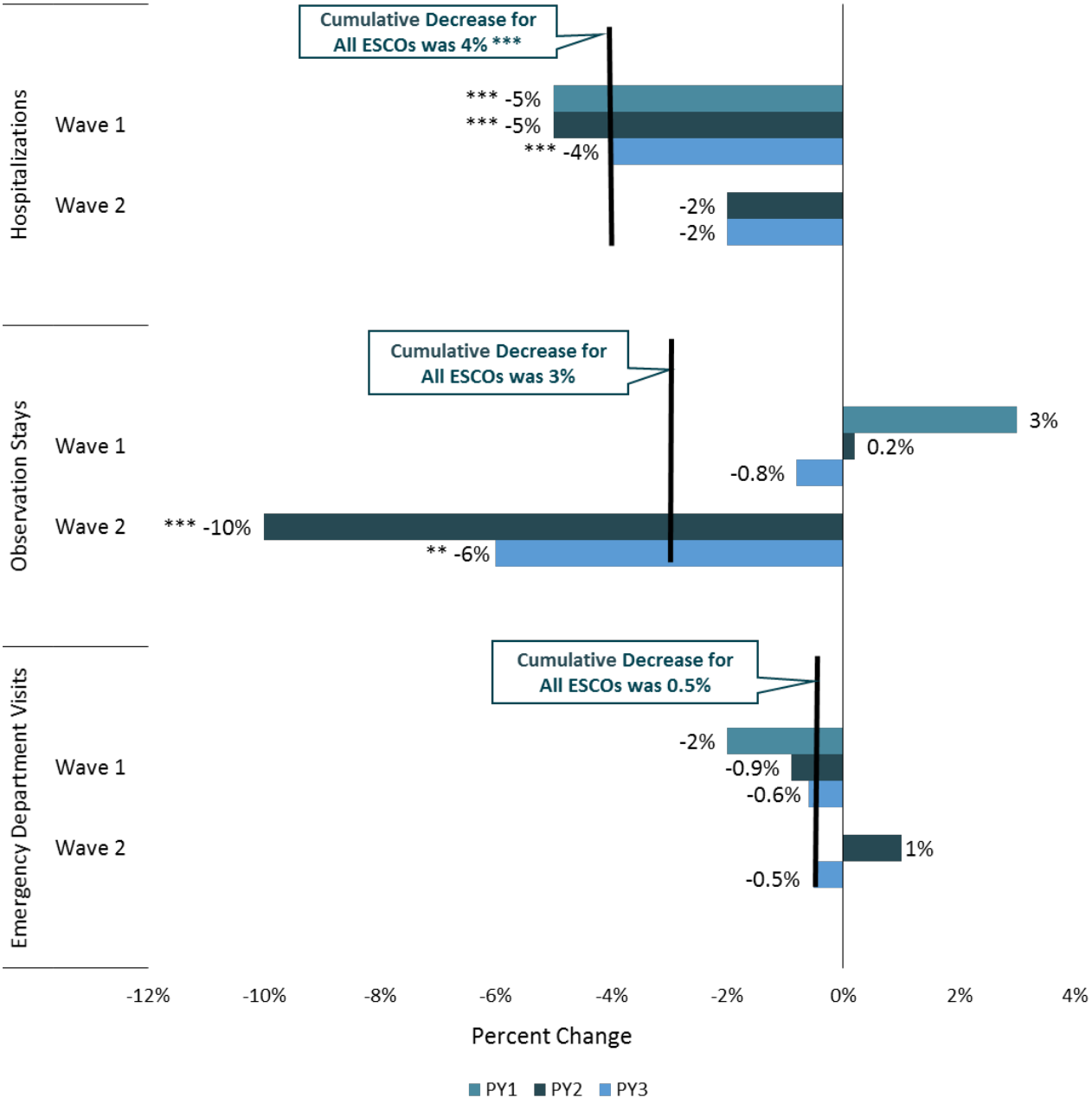
The CEC Model reduced the number of hospitalizations and observation stays, but it had no statistically significant impact on the number of ED visits (see **Exhibit 25**). The number of hospitalizations had a 4% PBPM ($p \leq 0.01$) net decline relative to the pre-CEC period. This impact translates into a decrease of 5 hospitalizations per 1,000 CEC beneficiaries per month. This result

[67] Measures were defined using the same diagnose codes used in the USRD report. Table 13.16; see https://www.usrds.org/2018/download/2018_Volume_2_ESRD_in_the_US.pdf. Principal diagnosis is the condition, after study, which occasioned the admission to the hospital.

is exclusively due to Wave 1 ESCOs, which experienced a 5% PBPM ($p \leq 0.01$) reduction in hospitalizations in PY1, a 5% PBPM ($p \leq 0.01$) reduction in PY2, and a 4% PBPM ($p \leq 0.01$) reduction in PY3, when compared to their pre-CEC period. While there were trends toward fewer ED visits, especially for Wave 1 beneficiaries, there was no significant change in the number of ED visits.[68] The number of observation stays decreased only for Wave 2 ESCOs which experienced a 10% PBPM ($p \leq 0.01$) reduction in observation stays in PY2, and a 6% PBPM ($p \leq 0.05$) reduction in PY3, when compared to their pre-CEC period.

[68] The distribution of the number of occurrences (e.g., number of ED visits PBPM) may have high variance due to outlier observations, which can increase standard error estimates and make it more difficult to identify statistical significance.

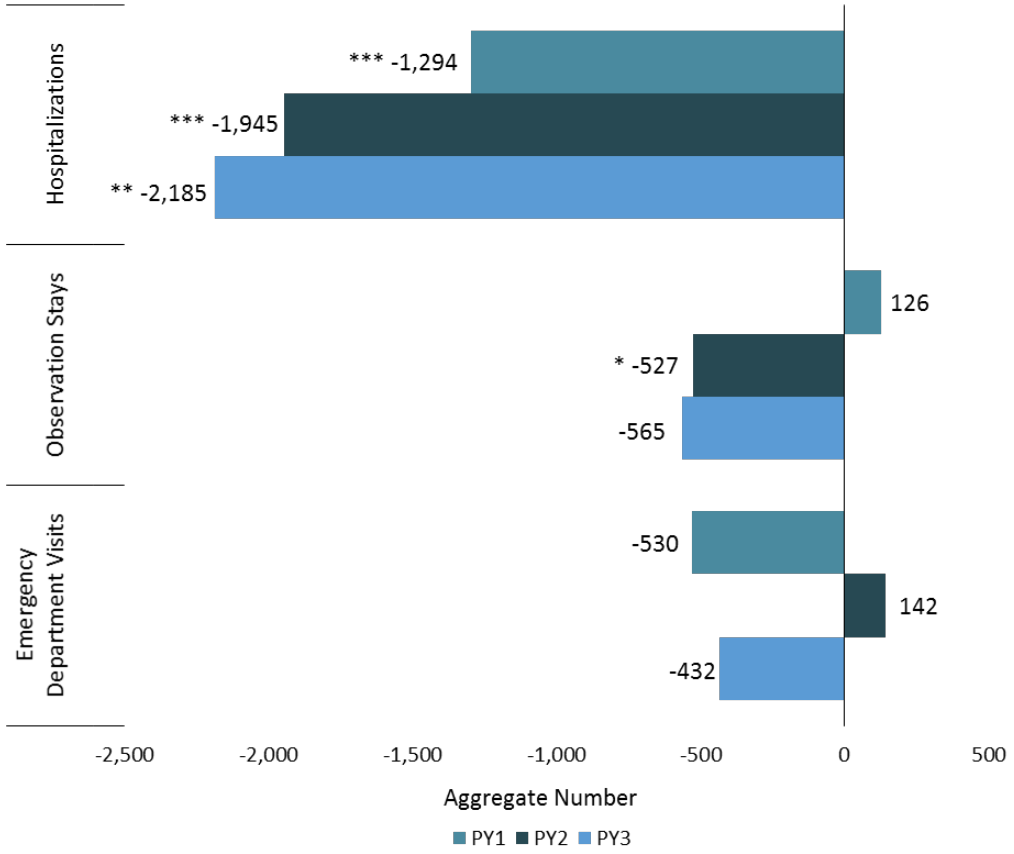
Exhibit 25. Impact of the CEC Model on the Number of Hospitalizations, Observation Stays, and ED Visits in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See additional results in **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2).

The impacts of the CEC Model on inpatient hospitalizations, observation stays, and ED visits translate into the aggregate impacts by PY, as presented in **Exhibit 26**. There were approximately 55 fewer observation stays in PY2. There were 1,261 fewer hospital admissions in PY1; 1,856 fewer admissions in PY2; and 2,165 fewer in PY3.[69]

Exhibit 26. Impact of the CEC Model on the Aggregate Number of Hospitalizations, Observation Stays, and ED Visits by PY



Notes: Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. Aggregate estimates are based on the estimated total number of aligned intervention member months for the 951 CEC facilities in the analytic sample.

b. Hospitalizations by Principal Diagnosis

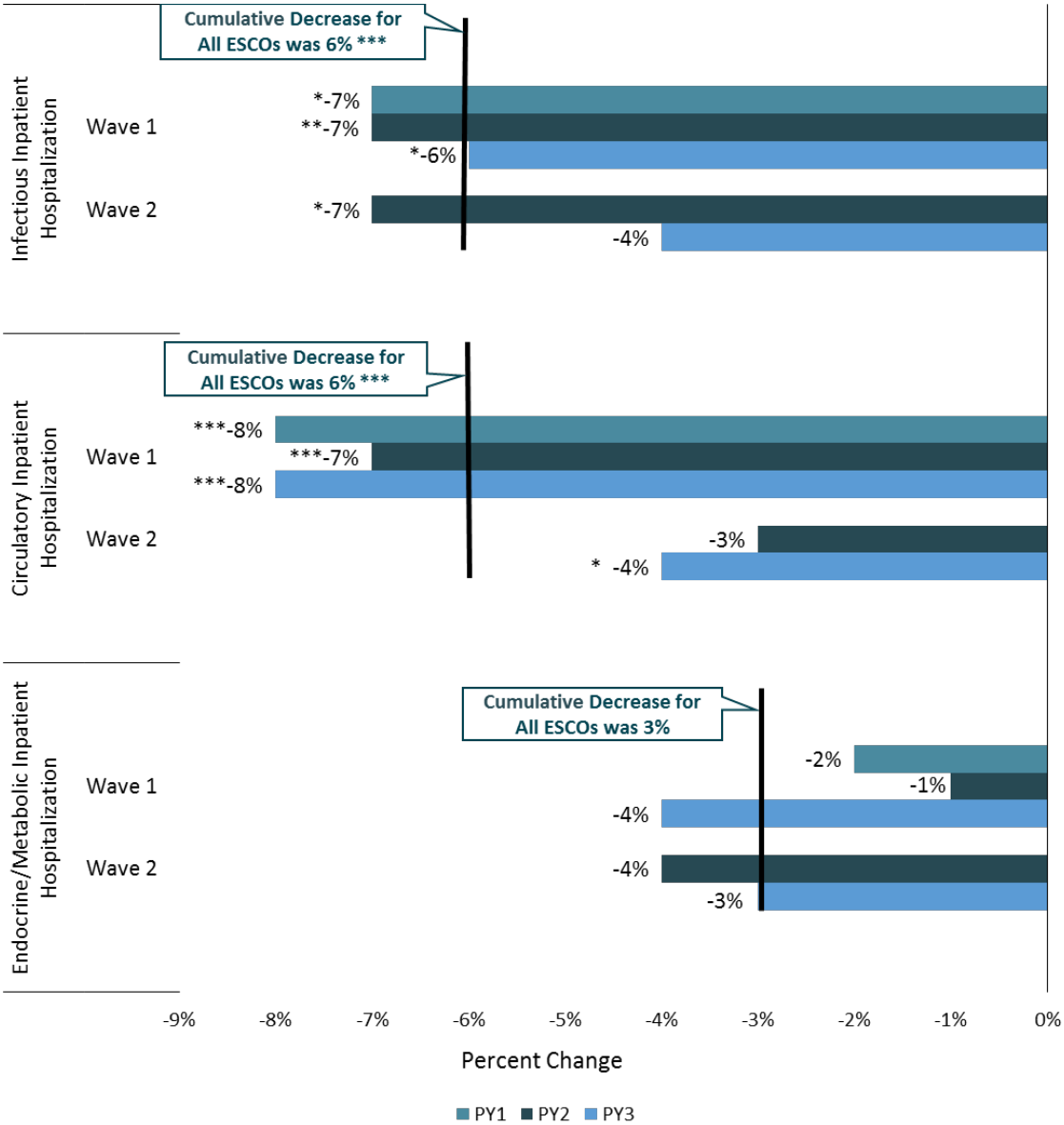
The CEC Model had a statistically significant impact on reducing the number of inpatient hospitalizations. To better understand the source of the reduced admissions, we examined hospitalization by principal diagnosis. We selected three admission diagnosis categories (which account for about 50% of hospitalizations) based on their relevance to ESRD care, including infectious, circulatory, and endocrine/metabolic admissions.[70] Results suggest that the number of

[69] Aggregate estimates are based on the number of aligned performance period CEC member months and the PBPM DiD estimate for each outcome. For example, aggregate PY1 reduced number of hospitalizations equals 192,973 member months multiplied by -0.0065 PBPM hospitalizations, which equals approximately 1,261 fewer estimated hospitalizations in PY1.

[70] Measure were defined using the same diagnose codes used in the USRD report. Table 13.16; see https://www.usrds.org/2018/download/2018_Volume_2_ESRD_in_the_US.pdf.

inpatient admission due to circulatory and infectious related causes decreased as a result of the CEC Model (see **Exhibit 27**). The number of admission for both circulatory and infectious inpatient hospitalization decreased by 6% PBPM ($p<0.01$) across all ESCOs. The impact was driven by Wave 1 ESCOs. The decline in endocrine/metabolic hospitalizations was not statistically significant. Overall, the results suggest that reductions among infectious and circulatory related inpatient admissions were key drivers in the total number of reduced hospitalizations.

Exhibit 27. Impact of the CEC Model on the Number of Hospitalizations by Principal Diagnoses in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference

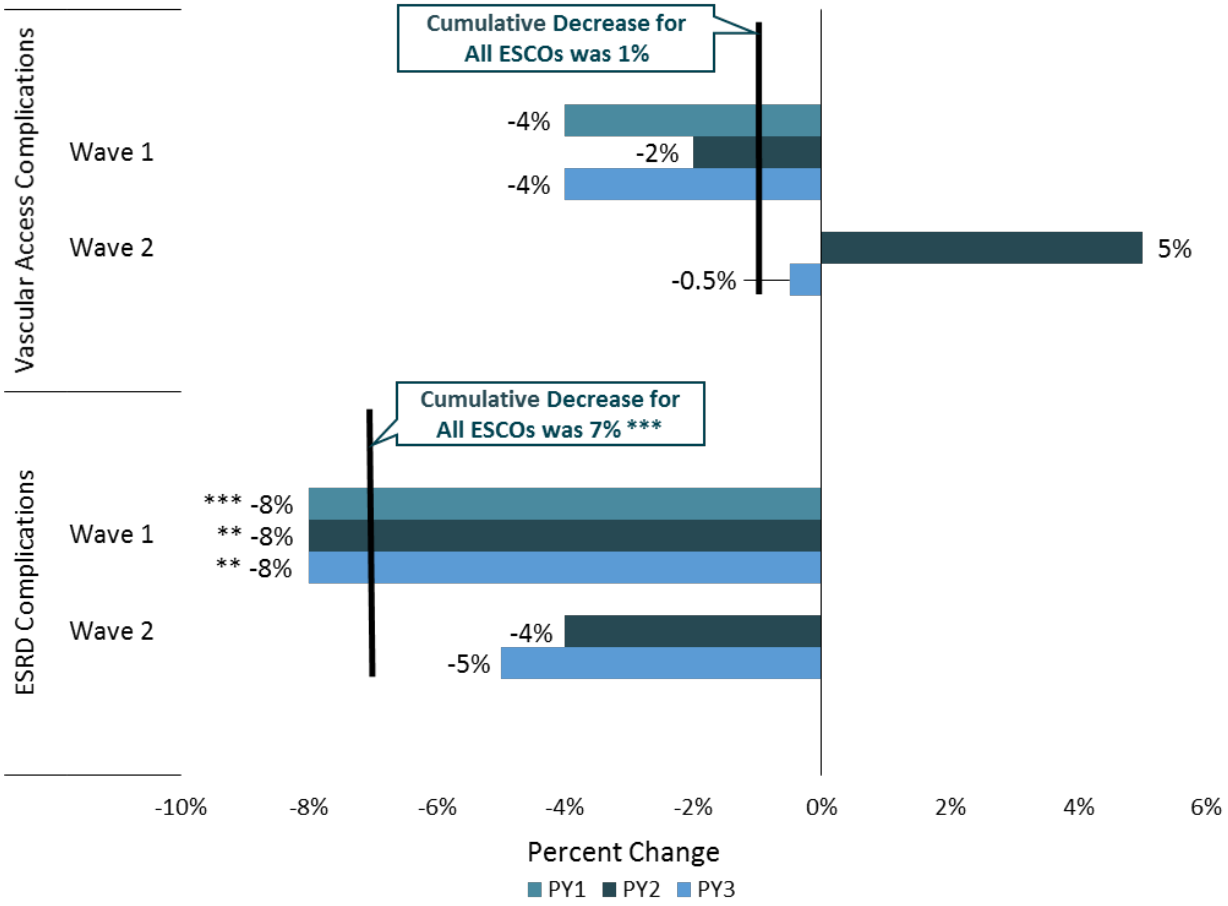
in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2)).

c. Hospitalizations for Vascular Access and ESRD Complications

ESCOs reduced catheter use, which is prone to infections and is the least preferred form of vascular access (see **Section VII.C.1.c**). However, there was no statistically significant impact on hospitalizations for vascular access complications overall or by wave over the first three performance years. ESRD complications such as volume depletion, fluid overload, and pulmonary edema[71] occur when beneficiaries miss or shorten dialysis treatments or poorly manage their diet. ESCOs' efforts to prevent these complications included increased access to dialysis treatment and education of patients about the importance of treatment adherence. The results for hospitalizations for vascular access complications and ESRD complications are presented in **Exhibit 28**. As expected, CEC beneficiaries were 7% ($p \leq 0.01$) less likely to experience a hospitalization for ESRD complications in a given month, relative to the pre-CEC period. This result was due primarily to Wave 1 ESCOs.

[71] The set of diagnoses codes that define each type of complication can be found in **Appendix I**.

Exhibit 28. Impact of the CEC Model on the Likelihood of Hospitalizations for Vascular Access or ESRD Complications in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2)).

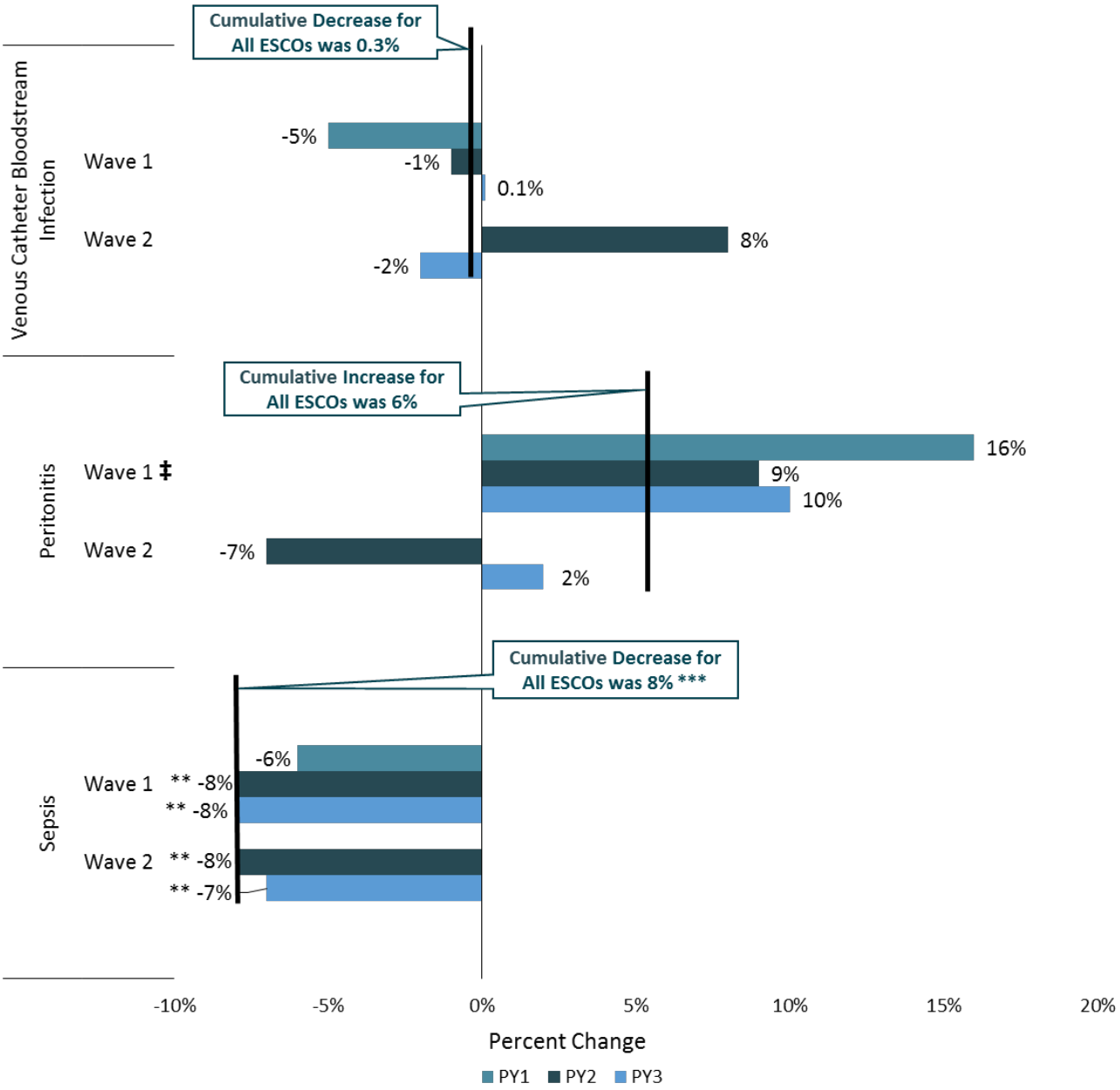
d. Infection Related Hospitalizations

Given the statistically significant reductions in hospitalizations associated with an infection related principal diagnosis shown above, we examined impacts on hospitalizations due to three types of infections: catheter-related blood stream infections, peritonitis, and sepsis. We examined catheter-related blood stream infections because catheter use is prone to infection and is the least preferred form of vascular access. We explored peritonitis because 7% of beneficiaries use peritoneal dialysis. Finally, we explored sepsis because it is one of the most frequent, lethal and

costly complications of central venous catheterization.[72] However, we did not restrict the sepsis to ESRD related infections in order to assess the impact of ESCO's reported coordination of care beyond dialysis. Results are presented in **Exhibit 29** and show that the CEC Model reduced the likelihood an ESRD beneficiary experienced at least one sepsis related infection for all ESCOs by 8% ($p<0.01$), relative to the pre-CEC period. Both Wave 1 and Wave 2 ESCOs had statistically significant reductions in the likelihood of a sepsis admission. There were no statistically significant results for bloodstream or other dialysis related infections.

[72] https://academic.oup.com/bjaed/article/5/2/49/422088

Exhibit 29. Impact of the CEC Model on the Likelihood of Hospitalizations for Catheter-Related Bloodstream Infection, Peritonitis, and Sepsis Infection in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the baseline period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate. See **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2)).

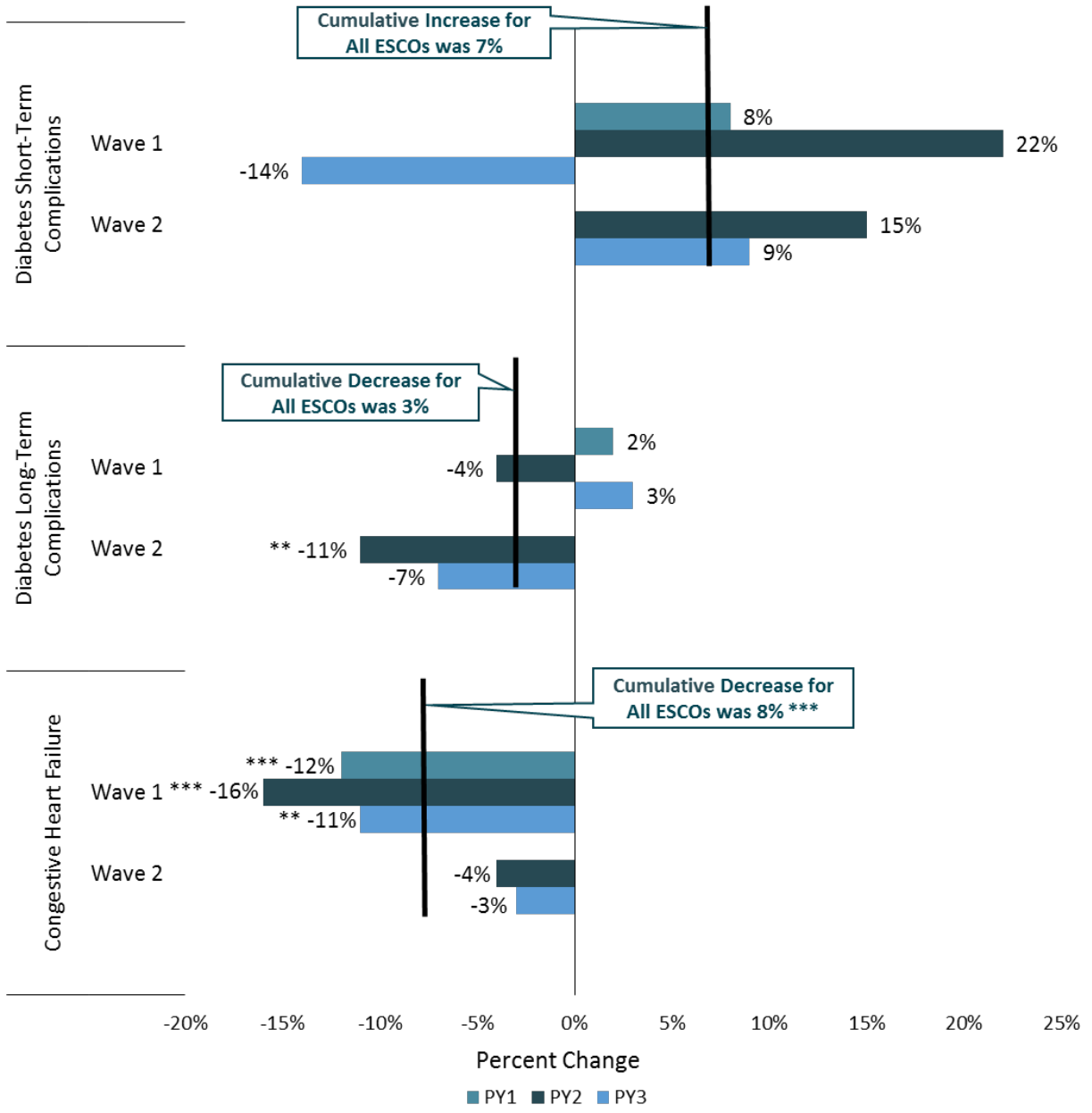
e. Hospitalizations for Ambulatory Care Sensitive Conditions

Under the CEC Model, ESCOs have an incentive to invest in prevention and management of chronic diseases to avoid complications that can lead to hospitalizations. The prevalence of two chronic diseases (diabetes and CHF) is particularly high among beneficiaries with ESRD; 75% have diabetes and 72% have CHF. Poorly managed fluid levels among beneficiaries with ESRD can both contribute to and complicate the management of CHF. Under the model, ESCOs changed their culture from a singular focus on dialysis to a broader coordination of care, including non-dialysis care. This shift includes increased emphasis on medication management, which may have improved adherence to CHF medications. The increase in testing for diabetes (i.e., HbA1c tests to measure blood glucose levels over time; see **Section VII.C.2.a**) are consistent with these efforts.

To further assess ESCOs' success in chronic disease management, we investigated changes in the percent of beneficiaries with at least one hospitalization in a 30-day period for a list of Ambulatory Care Sensitive Conditions (ACSC) defined by the Agency for Healthcare Research and Quality.[73] The results for ACSC hospitalizations for short-term or long-term complications of diabetes and for CHF are shown in **Exhibit 30**. The only ACSC measure that achieved statistically significant cumulative effects across all ESCOs was CHF hospitalizations, which decreased by 8% ($p \leq 0.01$), relative to the pre-CEC period. This result is due primarily to Wave 1, which decreased by 12% in PY1 ($p \leq 0.01$), 16% in PY2 ($p \leq 0.01$), and 11% in PY3. We also found statistically significant effects for admissions for diabetes short-term complications for Wave 2 ESCOs, which showed a decline of 11% ($p \leq 0.05$) in PY2.

[73] https://www.ahrq.gov/downloads/pub/ahrqqi/pqiguide.pdf

Exhibit 30. Impact of the CEC Model on the Likelihood of Hospitalizations for Ambulatory Care Sensitive Conditions in a 30-day Period



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2)).

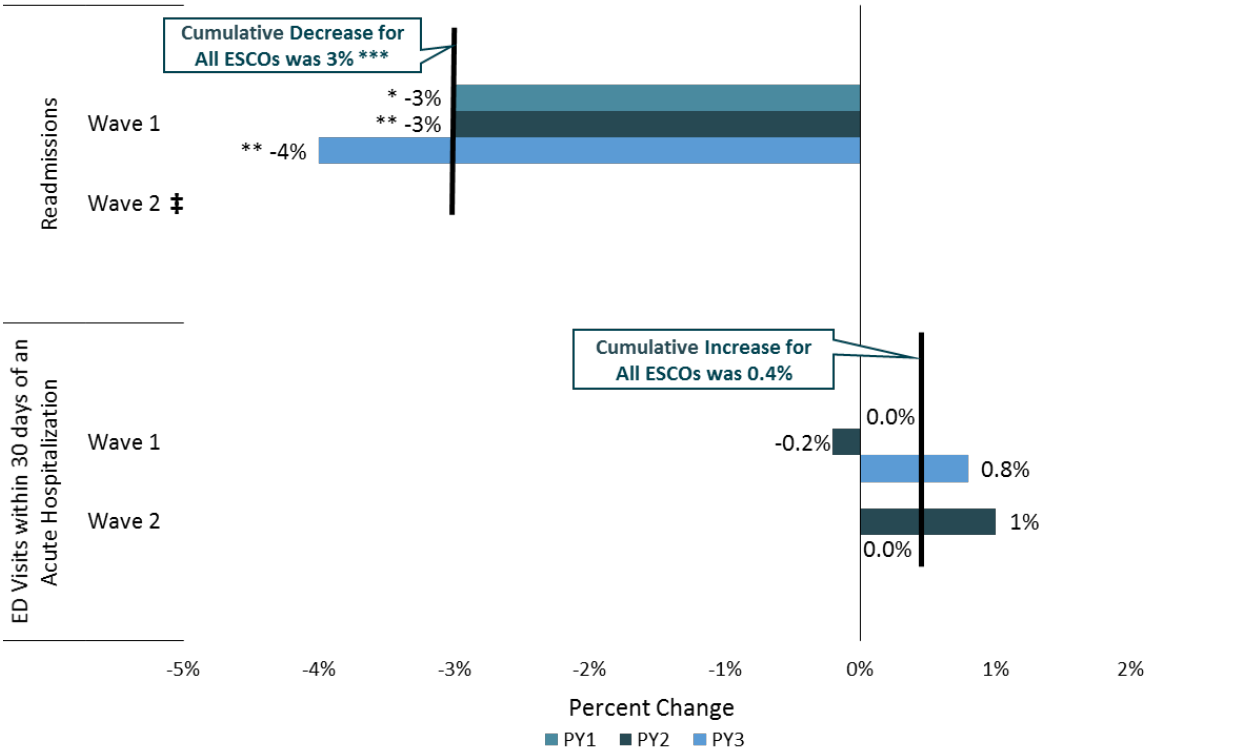
f. Readmissions and ED Visit within 30 days of an Acute Hospitalization

ESCOs increased attention to continuity of care for patients who were hospitalized to reduce readmission and prevent ED visits in the 30 days following hospitalizations. This heightened focus included intense care coordination and interdisciplinary team discussions of each hospitalization and strategies to prevent a readmission or similar hospitalizations, post-discharge medication management, and helping patients attend follow-up appointments with their PCP and specialists. Through post-discharge medication reconciliation, ESCOs attempted to address discrepancies between the list of medications with which a beneficiary was discharged and the medications they were taking prior to hospitalization, though challenges remained in obtaining the information from hospitals and assuring timely reconciliations.

> *"One of the biggest loopholes we see is when the patient gets discharged is the medication list. There's a discordance between what the patient was on and what the patient is discharged with. The ESCO reviews have really helped to improve the continuity of care from home to the dialysis unit and hospital."*
> – ESCO Site Visit Participant

We found statistically significant net declines in readmissions, which declined by 3% PBPM ($p \leq 0.01$). There was no impact on ED visits within 30 days of an acute hospitalization (see **Exhibit 31**).

Exhibit 31. Impact of the CEC Model on the Likelihood of Readmissions or ED Visits within 30 days of an Acute Hospitalization in a Given Month



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018); 44.8% of facilities have

8 quarters of CEC participation (January 2017 to December 2018); and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Readmission and ED Visit within 30 days of an Acute Hospitalization drop the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the baseline period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate. Results are presented in **Appendix F**, **Exhibits F-24** (All ESCOs), **F-25** (Wave 1), and **F-26** (Wave 2).

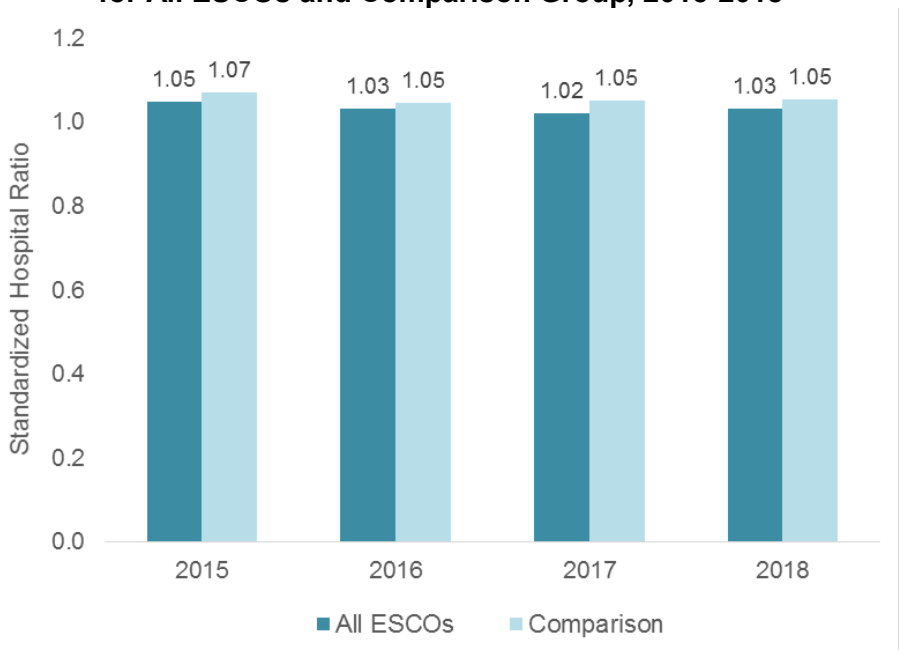
g. Standardized Hospitalization, 30-day Readmission, and Mortality Ratios

Hospitalization, readmission, and mortality are primary health outcomes and serve as important indicators for assessing quality of care under any health care delivery model. In the CEC context, these measures provide a potential assurance that the CEC Model is not adversely impacting beneficiary outcomes, such as survival.

Specifically, standardized measures for these outcomes are useful for examining whether ESCO-specific adverse event rates (i.e., hospitalizations, 30-day readmissions, and mortality) are similar to event rates for the comparison group, adjusted for case mix. These standardized measures reflect the number of adverse events for beneficiaries in an ESCO, relative to the number of adverse events that would be expected based on overall Medicare ESRD rates, adjusted for the characteristics of beneficiaries at that ESCO.

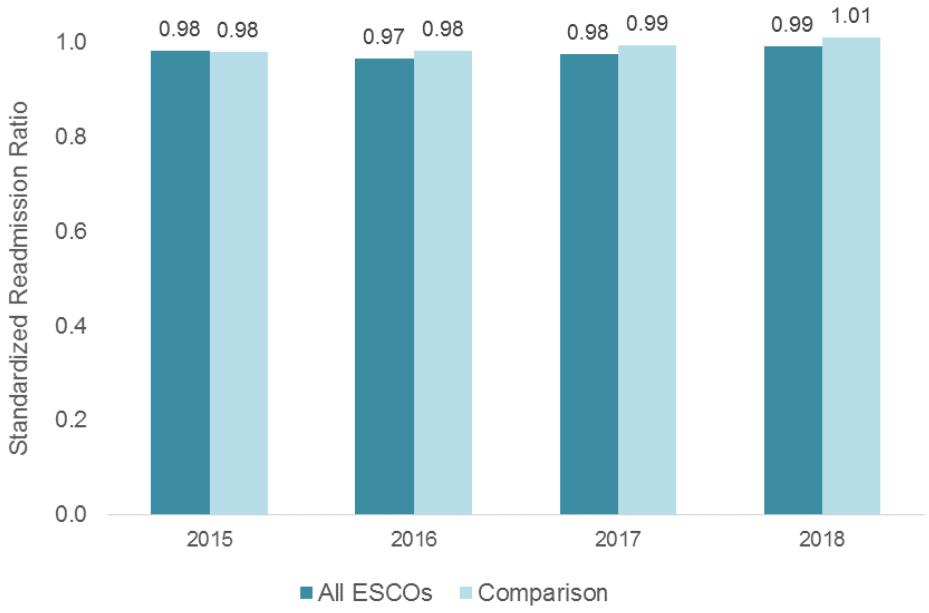
Beginning in 2015, hospitalization rates, as measured by the standardized hospitalization ratio (SHR), improved similarly to the comparison group, with the greatest differences between the comparison group and the all ESCO group in calendar year 2017. The SHR for all ESCOs and the comparison group for each year, from 2015 through 2018, are presented in **Exhibit 32**.

Exhibit 32. Standardized Hospitalization Ratio for All ESCOs and Comparison Group, 2015-2018



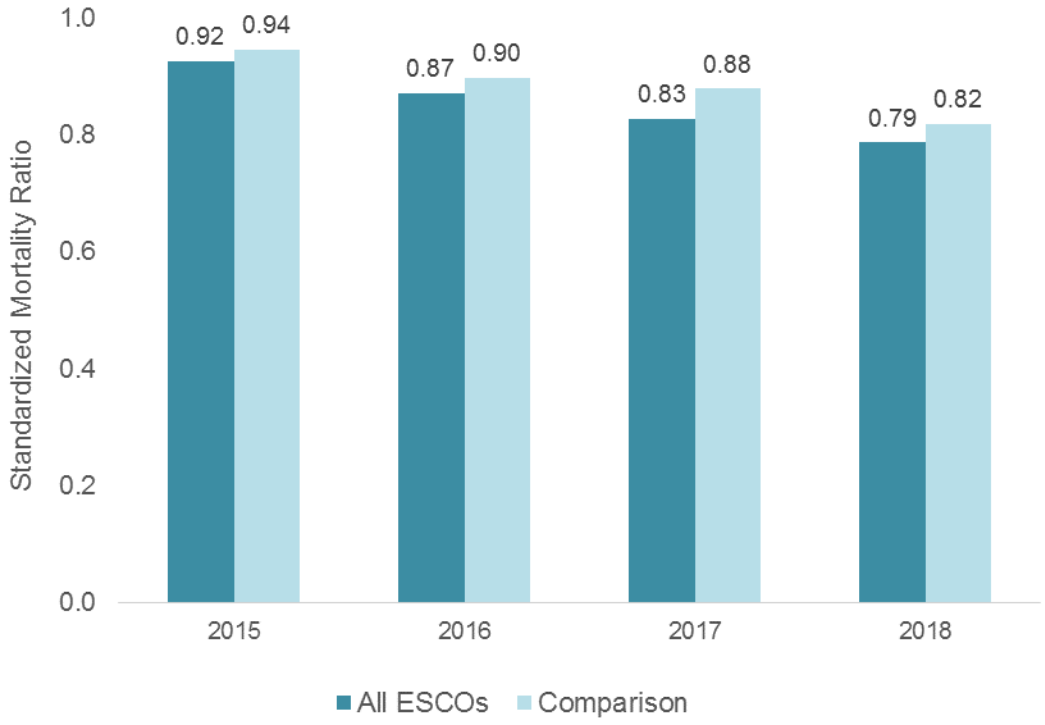
No improvement was seen in readmissions, as the standardized readmission ratio (SRR) for both the ESCOs and the comparison group increased over time. The all ESCO group exhibited a 0.9% increase in SRR, which was a smaller relative increase than the 3.2% increase in SRR by the comparison group. The SRR for all ESCOs and the comparison group for 2015 through 2018 are shown in **Exhibit 33**.

Exhibit 33. Standardized Readmission Ratio for All ESCOs and Comparison Group, 2015-2018



The standardized mortality ratio (SMR) for all ESCOs and the comparison group from 2015 through 2018 are displayed in **Exhibit 34**. Overall, we observed decreasing SMR trends for all ESCOs and the comparison group. The all ESCOs group had somewhat lower SMR over the same period, with a trend toward declining mortality that is most pronounced from 2015 to 2016, while the most notable decline for the comparison group was from 2017 to 2018. These trends suggest a possible effect of the CEC Model on mortality, although results should be interpreted with caution as some of the CEC results in 2016 are for Wave 2 ESCOs and reflect those organizations' baseline performance rather than a CEC effect. Even when interpreted conservatively, these trends may provide assurance that these observed declines and other potential changes in care motivated by the CEC Model incentives have not adversely impacted beneficiary mortality.

Exhibit 34. Standardized Mortality Ratio for All ESCOs and Comparison Group, 2015-2018



Calculation and interpretation of the standardized measures are subject to some limitations, including ambiguity in determining whether observed changes over time are due to changes in risk-adjusted expected events, observed events, or both. For a detailed description of the standardized measures, as well as of the limitations in the measures, see **Appendix I**.

4. *What Was the Impact of the CEC Model on Mortality?*

In the logic model underlying this evaluation, higher mortality was considered a potential unintended consequence of the CEC Model. This reflected the possibility that providers would respond to incentives to achieve shared savings by skimping on care. Therefore, the evaluation plan proposed monitoring mortality, primarily through the Standardized Mortality Ratio (SMR) in order to ensure that mortality was not worse in the CEC than in the comparison group.

Based on findings of greater SMR improvements in the CEC than in the comparison group and the emergence of longer average time on dialysis in the CEC than in the comparison group (which could occur if mortality was lower in the CEC group), we also conducted a survival analysis to test whether the CEC impacted mortality more formally.

The primary framework we used to assess mortality is survival analysis, which models the time from when a patient is aligned to the model until the occurrence of the event (i.e., death). We estimated survival models, adjusted for patient characteristics. Details of the modeling approach appear in **Appendix J**.

We estimated several survival models to understand the relationship between alignment to the CEC Model and survival. The most general model compares survival in the entire CEC-aligned

population (all waves and cohorts) to the entire matched comparison population (i.e., all prevalent beneficiaries).

Next, we estimate a model that limits patients' follow-up period to the first two years after alignment, so that beneficiaries aligned to early and later joining CEC waves could contribute to the analysis in a more proportional fashion. For example, beneficiaries aligned to Wave 1 PY1 joiners contributed all of the observed patient experience beyond two years of follow-up in the most general model.

Furthermore, we hypothesized that any impact of the CEC Model on survival would be stronger among those patients who were aligned early in their course of dialysis. First, the CEC impact on survival may be stronger for patients in their first year of dialysis (i.e., incident patients) since this is a clinically unstable time during which interventions might be more impactful. Second, unlike more experienced dialysis patients, they are less likely to have already developed care referral networks and mechanisms to deal with dialysis-related issues.

Finally, to examine whether the impact of the CEC Model on survival differed by wave we focused on the beneficiaries in Wave 1 PY1 and Wave 2 PY2 joiner facilities. These beneficiaries represented the large majority of each wave. We excluded the later joiners because of fewer patients and shorter follow-up than the original groups, which may limit statistical power to detect differences between cohorts.

We found a modest but statistically significant survival benefit for CEC patients, based on the most general model, which includes all waves as a single treatment group (CEC) relative to their single matched comparison. On an absolute basis, 1 year survival is 0.3 percentage points (PPT) higher for CEC patients, with a 0.9 PPT advantage in 3 year survival (see **Exhibit 35**). On a relative basis, this represents about a 3 percent reduction in the number of mortality events (e.g., 10% 1 year mortality in CEC vs. 10.3% in the comparison group). Furthermore, when restricting follow-up to 2 years post-alignment, the survival benefit remains significant and similar in magnitude (see **Exhibit 35**).

Exhibit 35. Estimated Survival for CEC and Comparison Beneficiary Populations PY1-PY3

Group		Survival	
		1-Year	3-Year
All Prevalent Beneficiaries	CEC*	90.0%	71.9%
	Comparison	89.7%	71.0%
All Prevalent Beneficiaries with 2-year Follow-up	CEC*	90.2%	
	Comparison	89.9%	
All Incident Beneficiaries	CEC*	89.9%	
	Comparison	89.3%	

Notes: PY1-PY3 covers October 2015 – December 2018. Survival is measured as the time from when a patient is aligned to the model until the occurrence of the event (i.e., death). Prevalent beneficiaries include all patients aligned to a CEC or comparison group facility. Incident beneficiaries had been on dialysis for 12 or fewer months when aligned to the model. *The CEC indicator in the survival model was statistically significant at 1%. See **Appendix J** for detailed results: **Exhibits J-1**, **J-2**, and **J-3**.

We hypothesized that the CEC impact would be larger among patients who were exposed to the program earlier in their course of treatment. The models for incident patients (i.e., aligned during

their first year on dialysis) supported this hypothesis as the CEC treatment effects were about twice the magnitude of those in the prevalent models. On an absolute basis, 1 year survival is 0.6 percentage points (PPT) higher for CEC patients (see **Exhibit 35**). This finding may reflect the fact that the initial year on dialysis is a clinically unstable time during which interventions might be more impactful. In addition, beneficiaries aligned later in their course of dialysis may be less likely to benefit from CEC interventions because they have already developed care referral networks and mechanisms to deal with dialysis-related issues such as transportation. In the beneficiary focus groups conducted during each year of this evaluation, more experienced dialysis patients regularly commented that they thought the types of interventions implemented under the CEC would be most valuable to newer patients.

Finally, we examined whether the effects on survival differed by wave (see **Appendix J, Exhibit J-5**). Alignment to Wave 2 PY2 joiner facilities was associated with slightly better survival than alignment to Wave 1 PY1 joiners, but the association was not statistically significant. When restricting to 2 years of follow-up, or incident beneficiaries, the results remained similar to those from the unrestricted model (see **Appendix J, Exhibit J-7** and **Exhibit J-9)**. As more data becomes available, we will re-evaluate these models to tease out wave specific effects.

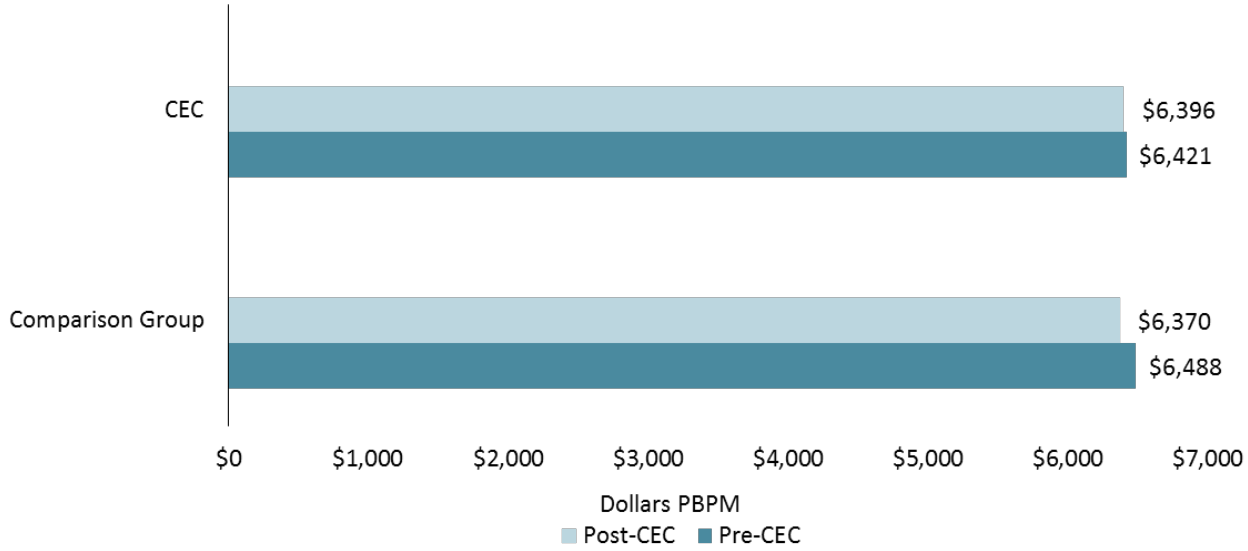
Each of the models is adjusted for observable variables that may impact survival, including patient demographics, body mass index (BMI), receipt of pre-ESRD nephrology care (a proxy for having good preparation for dialysis), and comorbidities present at onset of ESRD. Most of these control variables had statistically significant associations with survival in the expected directions, and these associations were similar across the alternative model specifications. Using the general model as an example (see Appendix J, Exhibit J-1), conditions reported at incidence on CMS Form 2728 all significantly predicted lower survival. Other strong predictors of survival included white race and BMI.

5. What Was the Impact of CEC on Medicare Payments across the Continuum of Care?

The impacts of the CEC Model on Medicare payments across the continuum of care are consistent with the changes in utilization described above. Medicare payments for outpatient dialysis sessions increased slightly, while Medicare payments for hospitalizations and readmissions went down. In general, Wave 1 ESCOs had more significant and consistent impacts on payments compared to Wave 2 ESCOs. Impacts on payment increased in PY2 but declined in PY3. In aggregate, these changes combined to reduce Medicare Part A and B payments.

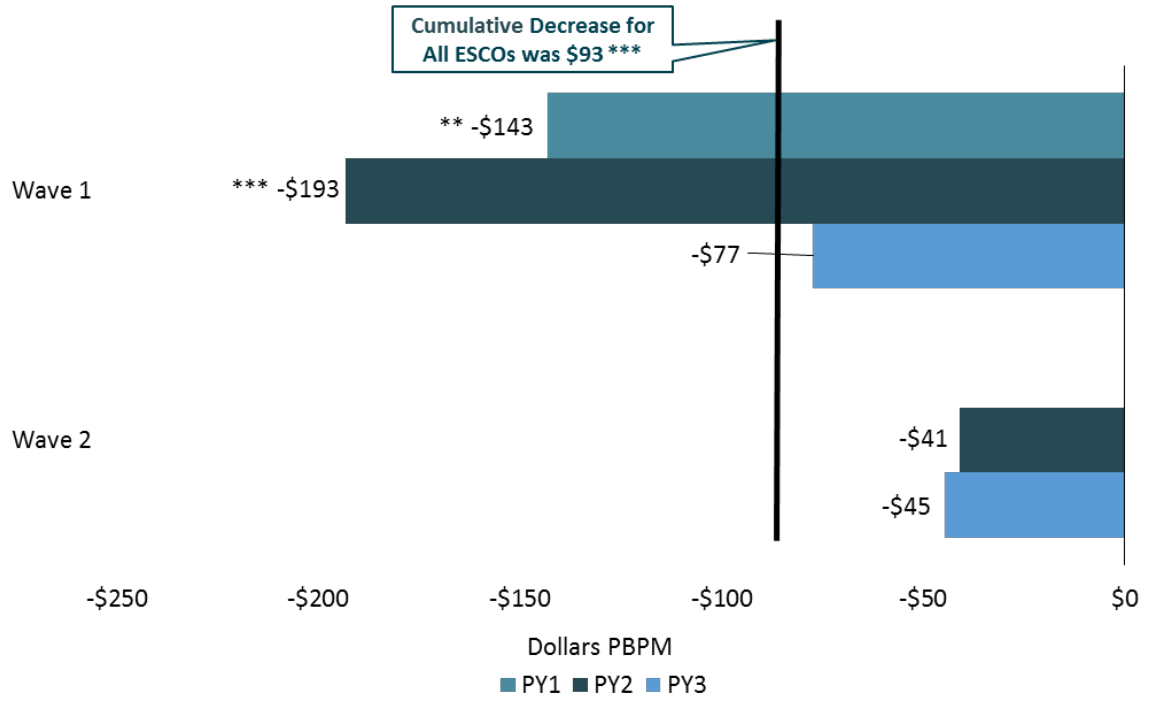
Overall, the total Medicare Part A and Part B standardized payments, a measure of overall Medicare payments, increased for both CEC beneficiaries and the matched comparison group beneficiaries, but increased faster for the comparison group relative to CEC (see **Exhibit 36**). This resulted in a statistically significant relative reduction in payments of $93 PBPM ($p \leq 0.01$) for CEC beneficiaries. This relative reduction represents about 1.5% of the average PBPM Medicare Part A and Part B payments for CEC beneficiaries at baseline of $6,396.

Exhibit 36. Average Risk-Adjusted Total Medicare Part A and Part B Payments PBPM for CEC and Comparison Beneficiaries



This result was primarily driven by Wave 1 ESCOs, which reduced payments by $143 PBPM in PY1 ($p \leq 0.05$), $193 PBPM in PY2 ($p \leq 0.01$), and $77 in PY3 (not significant). Wave 2 ESCOs decreased payments by only $41 PBPM in PY2 and $45 PBPM in PY3, but none of the Wave 2 estimates achieved statistical significance (see **Exhibit 37**). While Wave 1 ESCO facilities had, on average, longer exposure to the CEC Model than Wave 2 ESCOs, the difference in impacts is not likely due to differences in their length of CEC participation since Wave 1 ESCOs lowered payments in both their first and second performance years, while Wave 2 ESCOs did not.

Exhibit 37. Impact of CEC on Total Part A and Part B Medicare Payments PBPM

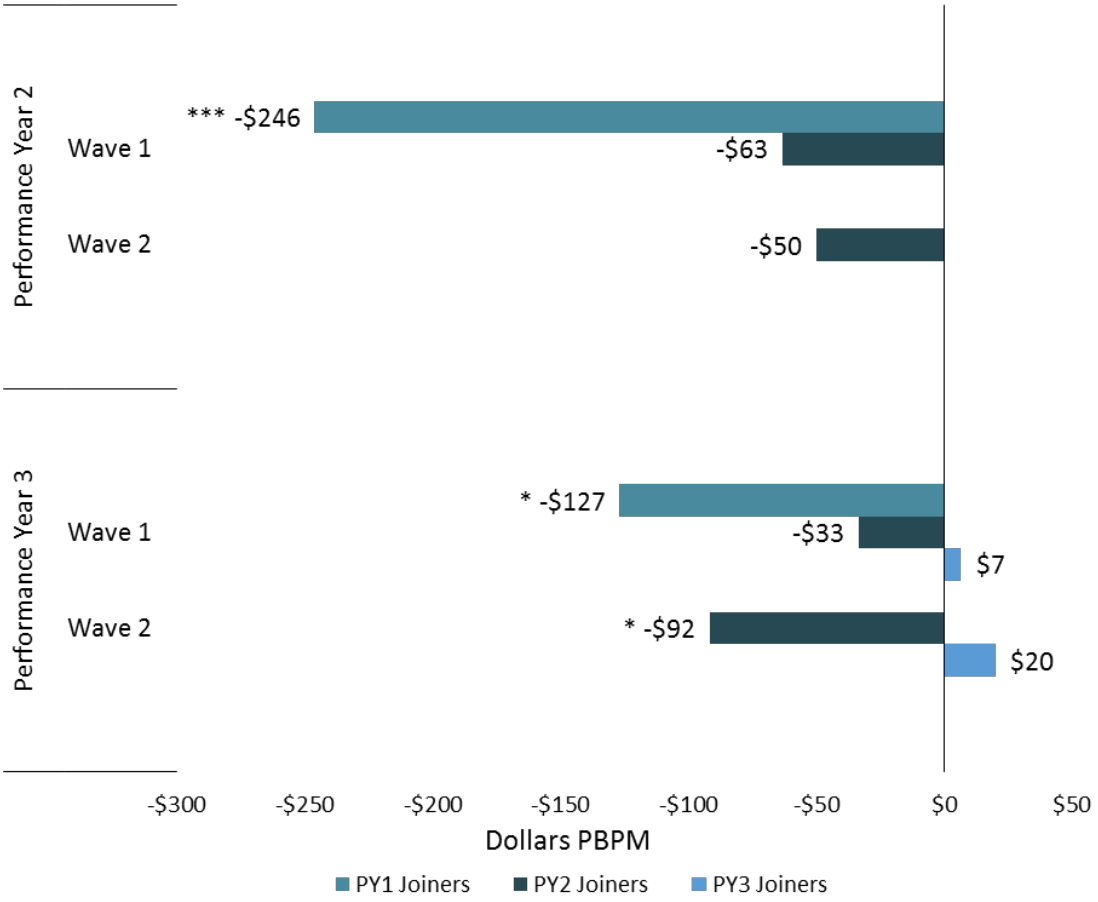


Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number; therefore, bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F-29** (Wave 2)) for detailed results.

To determine whether the lack of statistically significant results for payments in PY3 was due to poor performance by ESCO facilities that joined in PY3 and/or to decreased performance over time by established ESCO facilities (who joined in PY1 and PY2), we examined payment results for PY2 and PY3.[74] Our results showed that facilities that joined in PY3 (and thus had only one performance year) had no statically significant impact on payments, as presented in **Exhibit 38**. Wave 2 ESCOs that joined in PY2 improved their performance and achieved statistically significant reductions in payments in PY3 (-$92 PBPM ($p<0.10$). Additionally, payments by PY1 joiners, the only cohort who participated in all three PYs, decreased in magnitude and statistical significance from PY2 (-$246 PBPM ($p<0.01$) to PY3 (-$127 PBPM ($p<0.10$)). Overall, breaking down payments impacts by PY and ESCO facility cohort suggests that the lack of statistically significant results in PY3 was due to poor performance from ESCO facilities who joined in PY3 and decreased impacts among established ESCO facilities who joined in PY1 and PY2.

[74] Wave 1 is the only cohort of ESCOs in PY1. As a result, -$143 ($p<-0.05$) PBPM in **Exhibit 35** represents the PY1 joiner result in the first PY and therefore was omitted from **Exhibit 36.**

Exhibit 38. Impact of CEC on Total Part A and Part B Medicare Payments by Performance Year and ESCO Cohort PBPM



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. See **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F-29** (Wave 2)) for detailed results.

The main drivers of decreases in Medicare payments under the CEC Model were reductions in payments for hospitalizations and services that regularly accompany hospitalizations (e.g., readmissions, institutional post-acute care [PAC]). (See **Exhibit 39**.) Specifically, relative to the comparison group, payments declined for acute inpatient stays ($59 PBPM, $p \leq 0.01$),

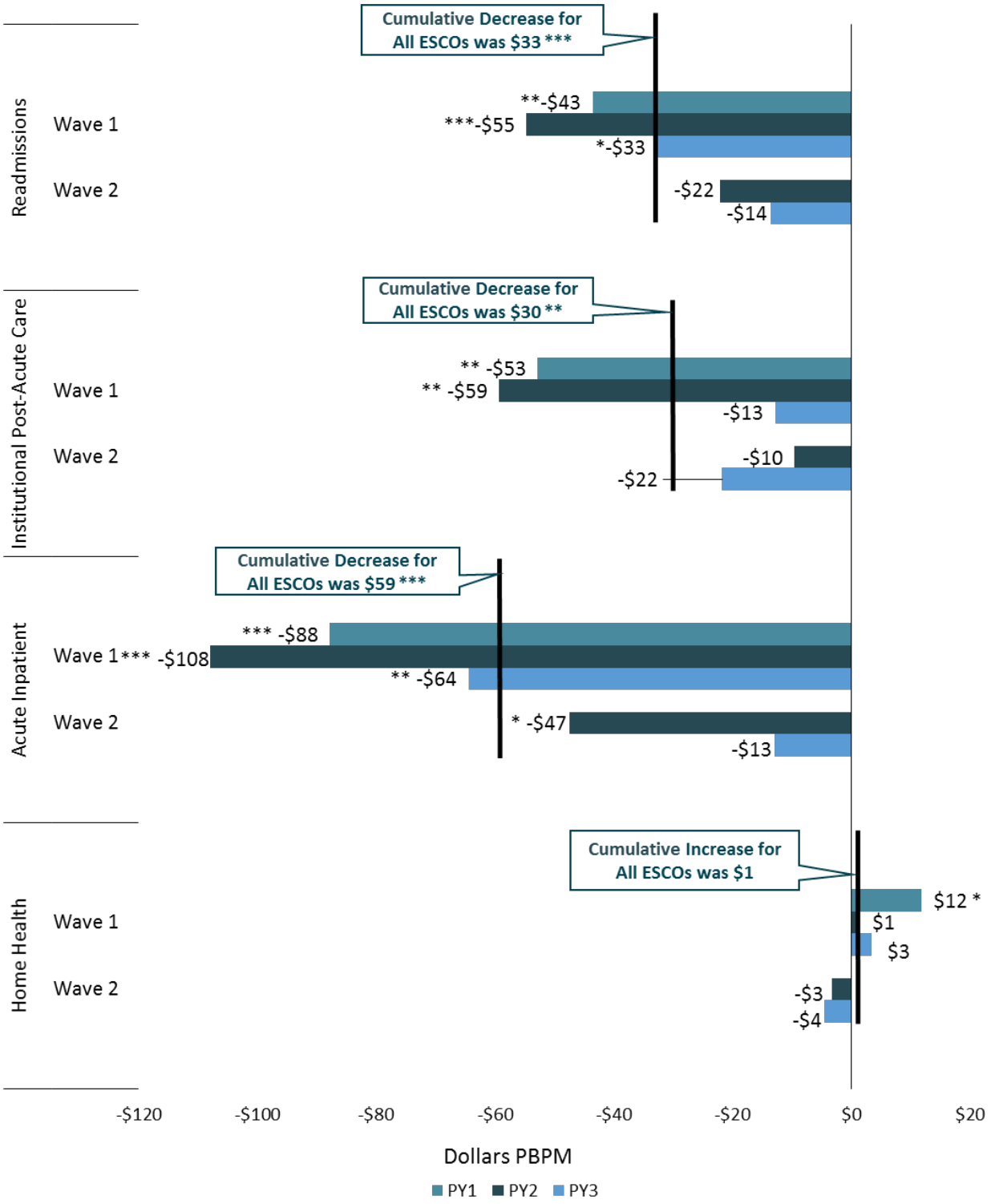
readmissions ($33 PBPM, p≤0.01), and institutional PAC ($30 PBPM, p≤0.05).[75] These declines in payments are consistent with our finding that CEC beneficiaries had fewer hospitalizations relative to the comparison group and were less likely to be readmitted (see **Exhibits 25** and **26**). Payments also declined for hospitalizations for ESRD complications ($11 PBPM, p≤0.01), in line with the fact that CEC beneficiaries were less likely to experience a hospitalization for ESRD complications (**see Appendix F, Exhibit F-27**). Wave 1 ESCOs consistently achieved larger reductions in payments compared to Wave 2 ESCOs, even during their first two performance periods. Their payment reductions were greater in PY2 relative to PY1, but lower in PY3.

Payments for home health services, which are often provided to safely transition patients home after an acute or post-acute institutional stay, increased by $12 PBPM (p≤0.10) for Wave 1 ESCOs in PY1, but was otherwise not statistically significant. Home health use could increase despite fewer hospitalizations if beneficiaries are substituting institutional PAC for home health care. The fact that we observed a reduction in payments on PAC supports this hypothesis. Additionally, home health services are not always associated with a hospital stay,[76] so we may observe higher home health use if beneficiaries are referred to other covered home health services like teaching and training activities by skilled nursing personnel.

[75] Institutional PAC includes payments from inpatient rehabilitation facilities (IRF), SNFs, and long-term care hospitals. Individual analysis of these payments groups identified that payment reductions in institutional PAC was primarily driven by long-term care hospital Medicare payment reductions.

[76] In 2018, 53% of home health episodes in our sample were not preceded by a hospital stay.

Exhibit 39. Impact of CEC on Readmissions, Institutional Post-Acute Care, Home Health, and Acute Inpatient Payments PBPM



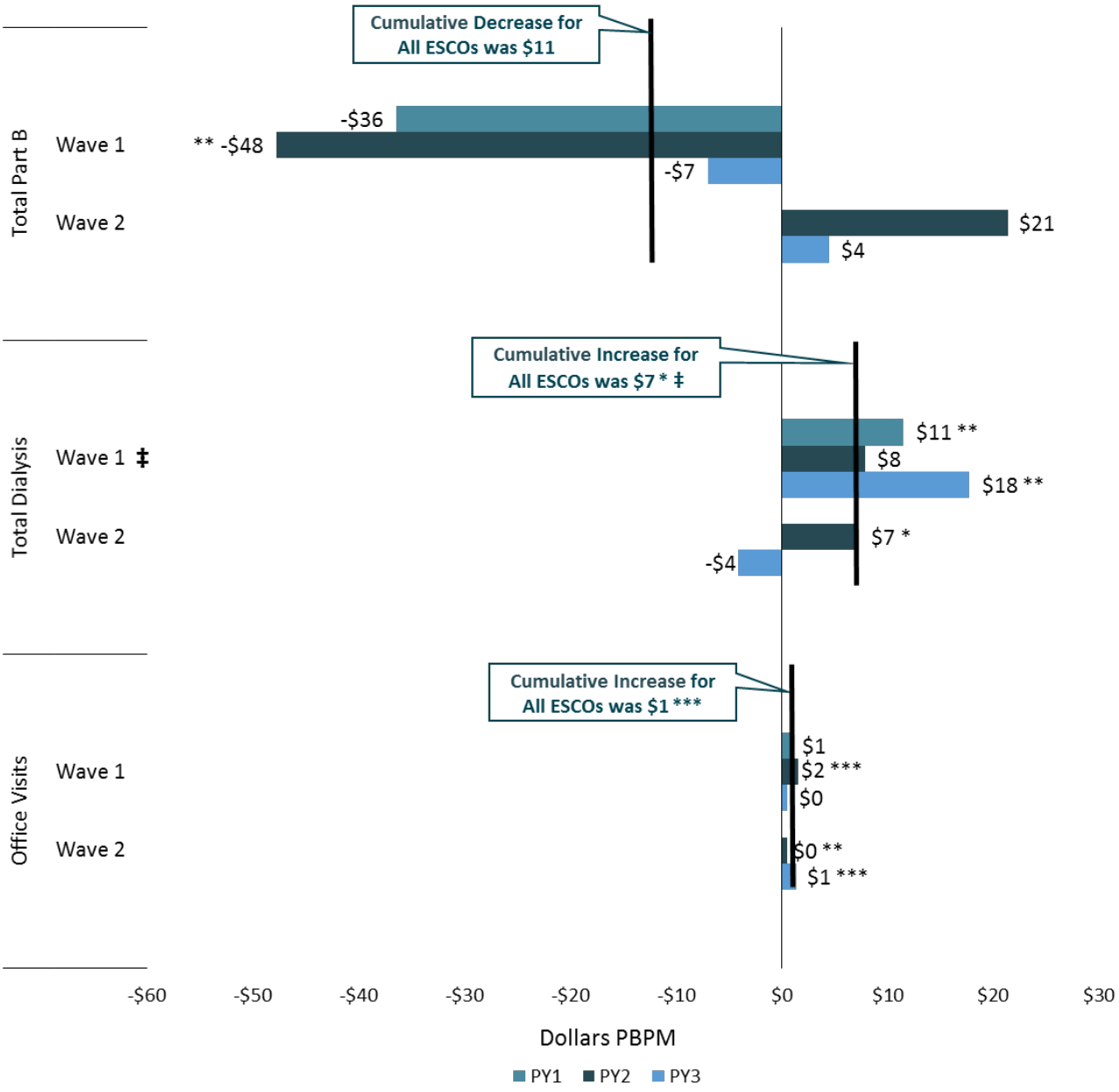
Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About

21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. Readmission are included in the overall acute inpatient payments and we exclude the last quarter of intervention data to account for a lag in claims to prevent underestimation. See **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F-29** (Wave 2)) for detailed results.

There were also statistically significant impacts in payments for certain Part B services (see **Exhibit 40** below). Driven by Wave 1, all ESCOs' dialysis payments increased by $7 PBPM ($p \leq 0.10$), relative to the comparison group.[77] Given that the bundled payment rate per session is fixed (aside from case-mix adjustments), this increase is consistent with the increase in the number of outpatient treatments (see **Exhibit 12**), An increased number of outpatient office visits for CEC beneficiaries (see **Exhibit 21**) translated into relative increases for both Wave 1 and Wave 2 ESCOs' payments for office visits, an increase of $1 PBPM ($p \leq 0.01$). No statistically significant impacts were estimated for other Part B services such as hospital outpatient and Part B drugs (see **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F-29** (Wave 2)).

[77] Since dialysis payments did not pass statistical testing of the parallel trends assumption for all ESCOs and Wave 1, we also inspected the trends graph which compared trends between the CEC beneficiaries and the comparison group and observed no evident differences. Additionally, the coefficient on the difference in trends at baseline, although significant, equaled: $0.66 (all ESCOs) and $0.84 (Wave 2). See **Appendix F**, **Exhibit F-17.**

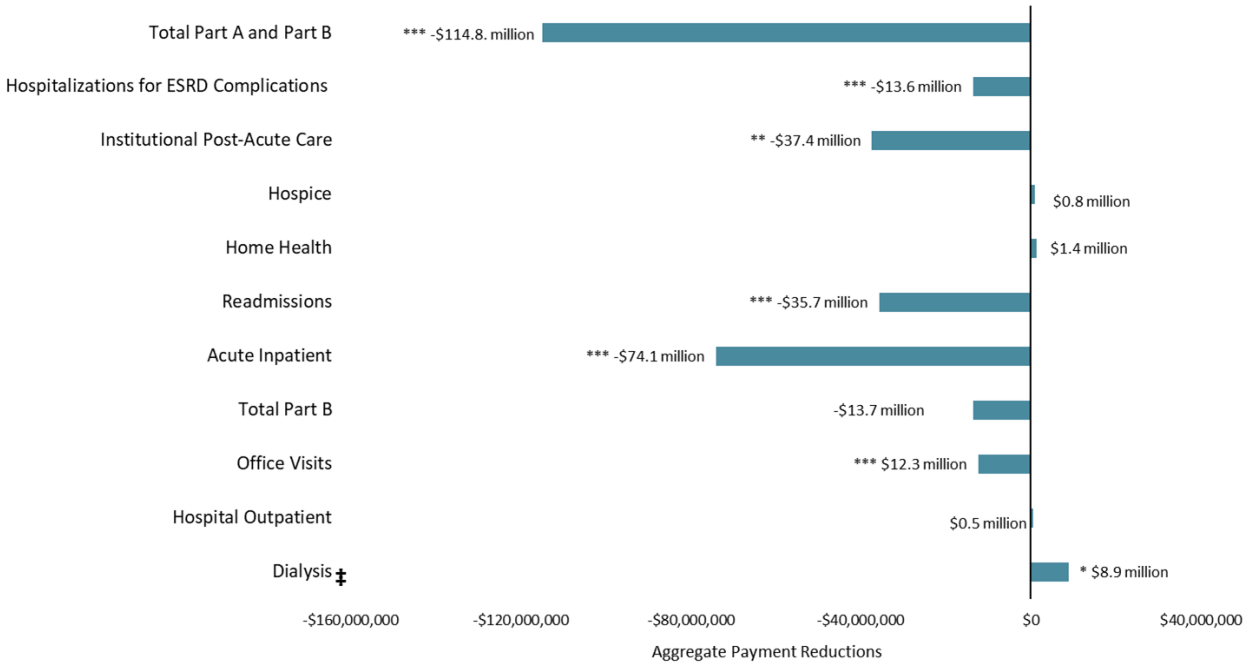
Exhibit 40. Impact of CEC on Total Part B, Total Dialysis, and Outpatient Office Visit Payments PBPM



Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ DiD results are not shown because data from the pre-CEC period showed intervention and matched comparison beneficiaries were not on parallel trends for this outcome, which is required for an unbiased estimate. See **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F-29** (Wave 2)) for detailed results.

The impact of the CEC Model on total Part A and Part B payments before accounting for payments between ESCOs and CMS resulting from financial reconciliation, translates into an aggregate change in payments of approximately -$115 million (90% CI, -$183 to -$47 million, p<0.01) over the first three performance years: -$29 million in PY1 (90% CI, -$49 to -$9 million, p<0.05), -$48.5 million in PY2 (90% CI, -$75 to -$22 million, p<0.05), and -$37.5 million in PY3 (90% CI, -$77 to $2 million, p=.12) (see **Exhibit 41**). A key contributor to the decline in total payments was an aggregate change in payments for acute inpatient services (-$74 million).

Exhibit 41. Aggregate Estimates of Changes in Medicare Payments by Service Setting



Notes: Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. Reductions in payments are based on the total number of intervention member months of the facilities participating in the CEC Model. DiD impact estimates are adjusted to non-standardized values using the average ratio total standardized and non-standardized payments. Readmission and hospitalizations for ESRD complications expenditures are included in the overall acute inpatient payments. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

In addition to the DiD estimates, we estimated the net change in spending for Medicare as a result of the CEC Model by taking into account the shared savings payments to ESCOs. After accounting for the $172 million in shared savings ($143 PBPM) that ESCOs received across PY1, PY2, and PY3, Medicare experienced aggregate net losses of $57 million (90% CI, -$11 to $125 million, p=.17). This equates to net losses of $48 PBPM. In PY1 through PY3 of the model, Wave 1 ESCOs experienced net losses of $49 million (90% CI, -$7 to $106 million, p=.15), while Wave 2 ESCOs experienced net losses of $8 million (90% CI, -$26 million to $41 million, p=.71) over PY2 and PY3. Wave 1 ESCOs received $214 PBPM in shared savings payments, while Wave 2 ESCOs received much less, $59 PBPM.

6. What Was the Impact of CEC on Medicare Beneficiary Subpopulations?

We investigated the extent to which the CEC Model had a differential impact on subgroups of Medicare beneficiaries with ESRD varying in their demographic characteristics (race, sex), basis of Medicare eligibility, dual Medicaid status, and their time on dialysis (six months or less versus over six months). The results are reported in **Appendix F**, **Exhibit F-30.** To this end, we estimated stratified DiD models with the specification described in **Appendix F.** The decomposition provides insights to the subpopulations that may be influencing the respective DiD results.

For most groups, the stratified results are consistent with those observed for total Part A and Part B Medicare payments, hospitalizations, readmissions, ED visits, catheter use, and fistula use in the full CEC population. However, the stratified results show that average impacts mask differences across subgroups. For example, the largest reductions in total PBPM Part A and Part B payments by demographic group was found among Medicare beneficiaries with ESRD who:

- Were Other race (non-White/non-Black) (-$121 PBPM, $p \leq 0.10$),
- Were female (-$124 PBPM, $p \leq 0.01$),
- Entered Medicare due to ESRD and disability (-$116 PBPM, $p \leq 0.05$), or
- Were fully Medicaid eligible (-$146 PBPM, $p \leq 0.01$).

Additionally, beneficiaries with ESRD with greater than six months of dialysis experienced significant declines in payments (-$102 PBPM, $p \leq 0.01$). We found no impact on payments for beneficiaries with less than six months of dialysis, which is consistent with the first six months of dialysis being the period during which beneficiaries with ESRD are at greatest risk for complications and need more services.

The largest reductions in hospitalizations by subpopulation were found among Medicare beneficiaries with ESRD who were Other race (non-White/non-Black) or were fully Medicaid eligible. Significant decreases in 30-day readmissions were also observed for beneficiaries who were categorized as White or Other race (non-White/non-Black), female, entered Medicare due to ESRD, had full Medicaid coverage, or had more than six months of dialysis. Additionally, beneficiaries categorized as Other race (non-White/non-Black) or entered Medicare due to ESRD and disability had significant decreases in ED visits.

While the subgroup analyses were exploratory, it will be useful to determine the extent to which these patterns continue to hold consistent over time and use further analyses or site visits to build an understanding of their causes and consequences.

D. Discussion

Overall, the experience under the CEC Model over the past three performance years suggests some improvements in delivery and quality of dialysis care and reductions in acute care utilization and Medicare payments. A variety of evaluation measures were explored, covering several domains of performance (e.g., dialysis care, coordination beyond dialysis, acute care and emergency department utilization). First, consistent with ESCOs' strategies to improve dialysis-related care and coordination of care beyond dialysis, the CEC Model generated improvements in

terms of vascular access—specifically, reduction in long term catheter use, adherence to dialysis treatment, and preventive health screening measures. Second, reductions in utilization provided further evidence of efforts to reduce acute care utilization, with notable and statistically significant declines in hospitalizations. The changes found in the quantitative DiD analysis largely corresponded with the areas many ESCOs emphasized in the qualitative site visits (e.g., reducing acute care use was a broadly stated focus area). Finally, CEC resulted in Medicare relative payment reductions across the continuum of care. Specifically, the impact analyses found relative reductions of over $93 PBPM for total Part A and Part B Medicare payments. This relative reduction represents about 1.5% of the average PBPM Medicare Part A and Part B payments for CEC beneficiaries at baseline of $6,396.

Wave 1 ESCOs consistently achieved larger relative reductions in payments and larger impacts on most other outcome measures, compared to Wave 2 ESCOs. Their relative payment reductions were greater in PY2 relative to PY1, but lower in PY3.[78]. Payments for Wave 2 ESCOs declined modestly in PY3, while ESCO facilities that joined in PY3 experienced small increases in payments (not statistically significant). Given that facilities that joined in PY3 only had one year of model experience, next year's annual report will examine whether an additional year yields continued or larger declines in payments for ESCOs that included PY3 joiners. The payment reductions were most evident in Medicare Part A, with significant reductions in acute inpatient, readmission, and institutional PAC categories. Dialysis payments also rose while payments for dialysis complications declined, which correlates with qualitative findings that ESCOs increased dialysis access in order to increase adherence and avoid complications.

CEC Model impacts varied across waves and over time within waves. Wave 1 ESCOs reduced payments by about 2.1%, while reductions in payments were lower, at 0.7%, for Wave 2 ESCOs. Wave 1 ESCOs continued to have generally larger impacts on clinical and payments outcomes than did Wave 2 ESCOs, when comparing each wave across the performance years. Additionally, Wave 1 ESCOs generally had larger impacts in their second year of operation than in their first year, with moderately smaller improvements in PY3. The differences across waves could reflect several factors. It is possible that, in the absence of MACRA, Wave 1 ESCO participants were more strongly motivated to join the program than Wave 2 ESCO participants. In addition, because of delays with model start, Wave 1 ESCOs may have had more lead time to prepare for CEC and develop and implement their care coordination services. The source of the somewhat mitigated impacts of the model in PY3 for Wave 1 ESCOs are less apparent. The follow-up site visits conduced with Wave 1 ESCOs near the end of PY3 revealed some concerns about the sustainability of the model, but those concerns seemed focused on program rules and changing benchmarks rather than on concerns that outcomes in PY3 were falling short of PY2 levels. Further, most ESCOs reported refining, but not dramatically changing, their activities to achieve program outcomes.

The survival analyses suggest that there is a survival benefit associated with the CEC Model. That benefit is modest overall, but is larger for those patients aligned during their first year of dialysis. Attempts to tease out wave specific effects yielded imprecise results. The effects appeared stronger in Wave 2 PY2 joiners than in Wave 1 PY1 joiners, but the difference between

[78] This decline may in part stem from the changes to the beneficiaries within the cohort, as the average age of beneficiaries aligned to Wave 1 PY1 joiner facilities increased from 2016 to 2018 more than for other cohorts.

those waves was not statistically significant. Overall, the findings on mortality are promising and should continue to be monitored as additional follow-up data becomes available.

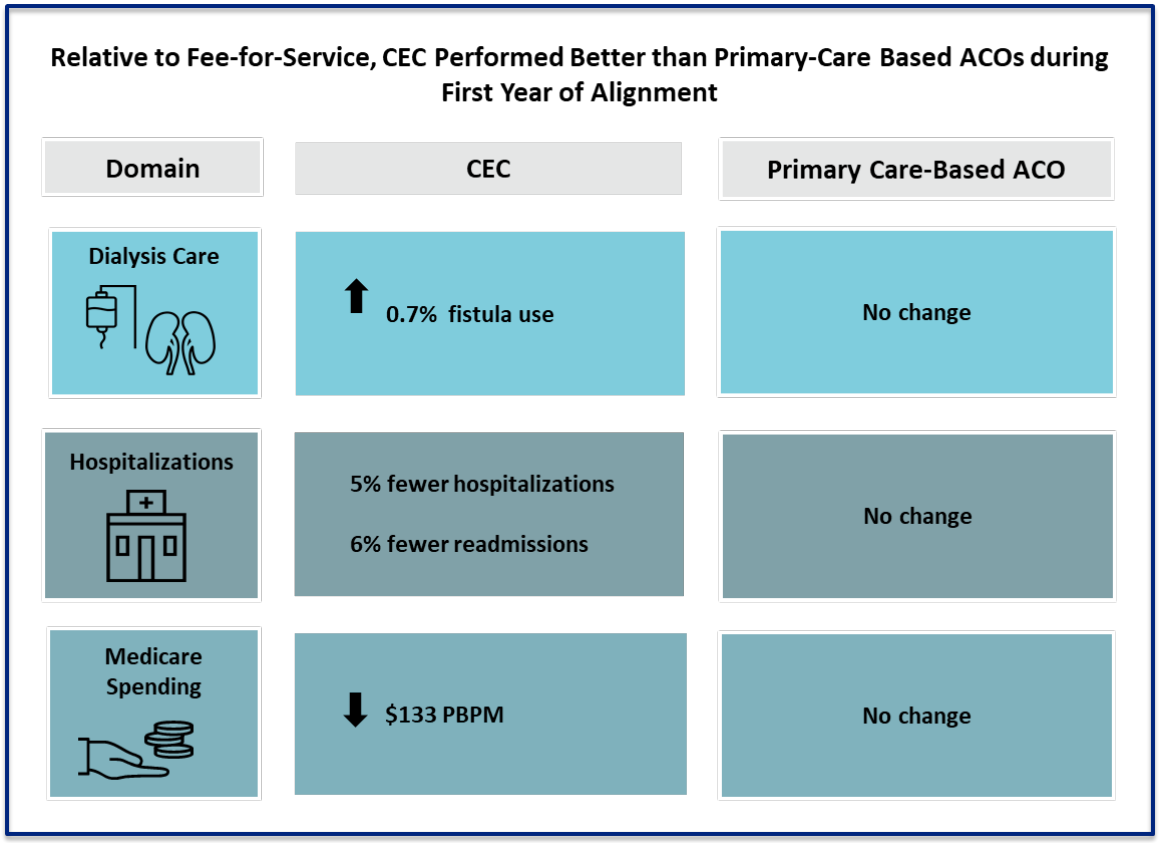
Future analyses will be able to determine the extent to which Wave 1 ESCOs can maintain or further build upon their early results. In particular, it will be useful to see whether PY4 results remain in line with the somewhat lower PY3 performance levels or return to the more favorable PY2 levels. Next year's report will also show whether Wave 2 ESCOs were able to close the performance gap relative to Wave 1 ESCOs, and whether Wave 2 ESCOs show increasing impact with time in the model. Notably, next year's report will also include follow-up site visit findings from a sample of Wave 2 ESCOs, which can be correlated to the quantitative results. Additional analyses will also examine whether facilities joining ESCOs in PY3 are able to experience improvements in outcomes and payment reductions realized by the earlier joiners in Waves 1 and 2. Taken together, these future analyses will help reach significant conclusions about the scalability and replicability of the CEC Model.

VIII. What Were the Differences in Performance between the CEC and Primary Care-Based ACO Models?

Primary care-based ACO models existed prior to the CEC and have continued to expand since the CEC was initiated. Therefore, ESRD patients receiving dialysis could be aligned to either a primary care-based ACO model that is accountable for costs and outcomes for patients with a wide variety of clinical conditions, or to the CEC Model which specializes in care for dialysis patients. The purpose of this analysis is to compare outcomes for dialysis patients in these two types of ACO models to inform future CMS policy making. In particular, we seek to determine whether the CEC Model's theoretical advantages of specializing in the care of patients with a particular complex chronic condition and placing risk on the specialty providers results in better outcomes relative to those achieved by aligning dialysis patients to non-specialized ACOs who serve the general Medicare population. The overall goals and financial incentives of the CEC Model are similar to those of primary care-based ACOs. In both models, participants assume financial responsibility for the quality of care and Medicare Part A and Part B payments of their aligned beneficiaries. Despite these shared characteristics, there are important differences between the two models. One of the main differences is that participants in the CEC Model (ESCOs) only provide care to Medicare beneficiaries with ESRD, whereas primary care-based ACOs serve the general Medicare population. Additionally, ESCOs are built around dialysis centers and nephrologists, while traditional ACOs are built around PCPs. Thus, ESCOs have more frequent and regular interactions with their aligned population, as hemodialysis patients typically visit the clinic three times a week for three- to four-hour sessions (contact with home dialysis patient is typically monthly), whereas contact with PCPs would be more sporadic and variable. Frequent and regular contact with the ACO's at risk entities may provide opportunities to monitor patient condition and intervene to improve outcomes.

To analyze whether CEC provided better results for beneficiaries with ESRD than primary care-based ACOs, we compared six outcomes (Medicare payments, hospitalizations, readmissions, ED visits, and two vascular access types) before and after alignment to each of these models, relative to a matched comparison group. The additional year of data available in AR3 and the addition of a new primary care-based ACO Model (SSP 1+) in 2018 allowed us to focus this analysis on two-sided risk, as we recommended in AR2.

A. Key Findings



B. Methods

We used a DiD approach to evaluate whether CEC performed better than primary care-based ACOs. With this approach, we compared the experiences of beneficiaries with ESRD over time, before and after they transitioned into either an ESCO or a primary care-based ACO, relative to beneficiaries with ESRD who remained in Medicare FFS. The additional year of data in AR3 updates the results from AR2 as well as implements our recommendation from the previous report to limit the analysis to beneficiaries that transition into two-sided risk arrangements. Specifically, the intervention groups included beneficiaries with ESRD aligned with ESCOs or primary care-based ACOs with two-sided risk arrangements. Primary care-based ACOs included Pioneer, Shared Savings Program (SSP) Tracks 1+, 2, and 3, and Next Generation ACO (NGACO). The comparison group consisted of CEC-eligible matched beneficiaries who continued to receive services FFS.

Due to the high mortality rate in the ESRD population, the intervention and comparison groups may become unbalanced over time. Beneficiaries with better odds of survival will increase their share in the analytic sample as we extend the observation period. To help mitigate this potential bias, we limited the observation period to the year before and after alignment to either CEC or a primary care-based ACO. The comparison and intervention groups are described in **Exhibit 42**. See **Appendix K** for a full description of methods and differences from the core evaluation.

Exhibit 42. Intervention and Comparison Groups of the DiD Model

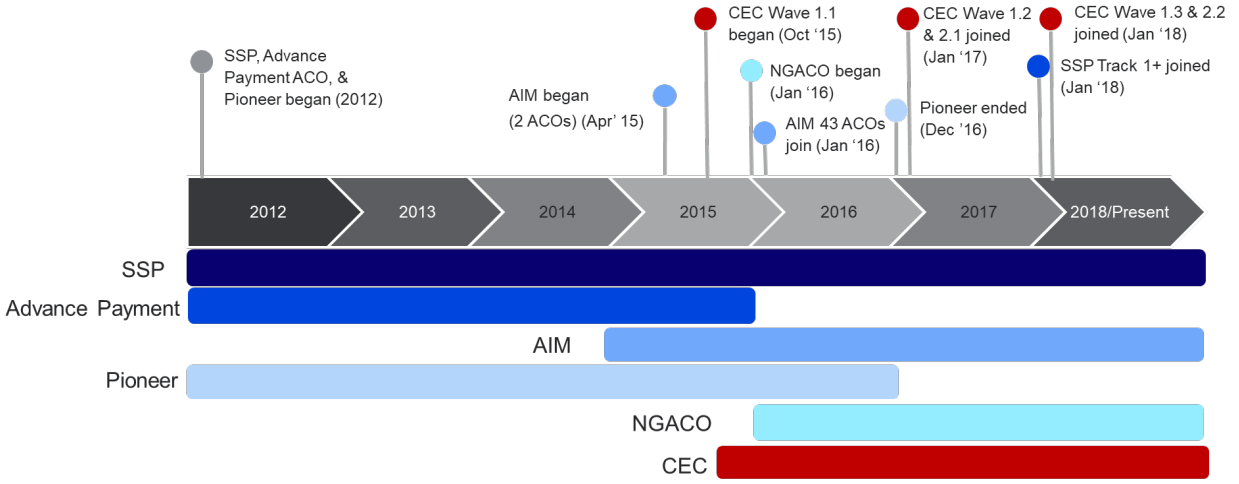
Group	Pre-Intervention Period
Intervention Group 1 (ACO)	CEC-eligible beneficiaries who received services under usual Medicare FFS, became aligned to a primary care-based ACO, and met the following criteria: ▪ Were eligible during the entire 12 months preceding the alignment start date ▪ Were eligible up to 12 months following alignment
Intervention Group 2 (CEC)	CEC-eligible beneficiaries who received services under usual Medicare FFS, became aligned to CEC, and met the following criteria: ▪ Were eligible during the entire 12 months preceding the alignment start date ▪ Were eligible up to 12 months following alignment
Matched Comparison Group	Matched CEC eligible beneficiaries who received services under usual Medicare FFS, did not become aligned to either model, and met the following criteria: ▪ Were eligible during the entire 12 months preceding one of the four potential alignment dates ▪ Were eligible up to 12 months following one of the four potential alignment dates

The intervention sample included beneficiaries who became newly aligned to a primary care-based ACO or CEC in 2015[79] or later. Alignment changes happened at multiple points throughout this period, which spanned different starting dates for the primary care-based ACO programs and CEC's ESCO waves included in the analysis (see **Exhibit 43**). We identified intervention and comparison groups for five potential alignment dates beginning in the year CEC started: January 2015, October 2015, January 2016, January 2017, and January 2018. These include alignment dates where we were able to identify transitions from FFS to CEC at the three start dates of the model[80] (October 2015, January 2017, and January 2018) and alignment dates for FFS to primary care-based ACOs transitions (January 2015, January 2016, January 2017, and January 2018).

[79] This date was chosen because CEC launched in October 2015.

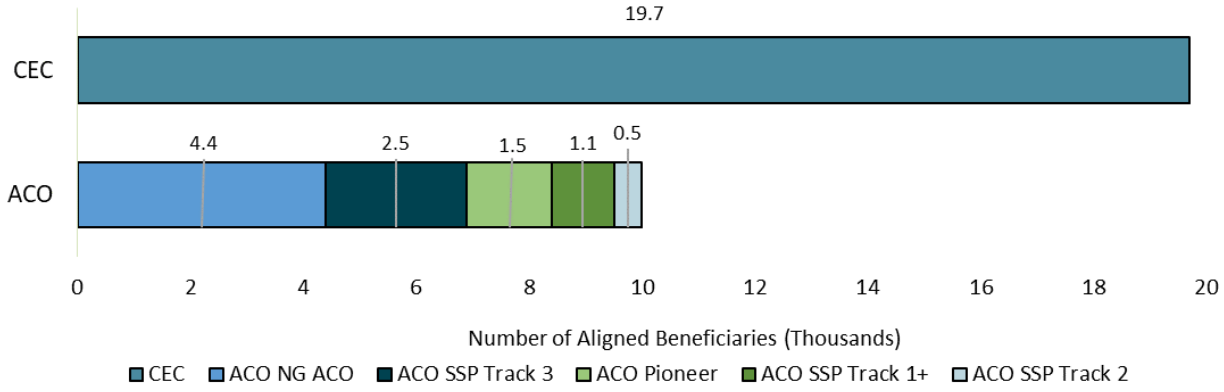
[80] While beneficiaries with ESRD can become aligned to the CEC Model at any month if they start receiving dialysis services from a CEC facility, these transitions were excluded from the analysis in order to minimize transitions associated with a change in facility of care.

Exhibit 43. Primary Care-Based ACO and CEC Timeline



The number of beneficiaries with ESRD included in each group used in the analysis are shown in **Exhibit 44**.

Exhibit 44. Number of Beneficiaries (in Thousands) with ESRD in CEC and Primary Care-based ACO Intervention Groups (with Two-Sided Risk)



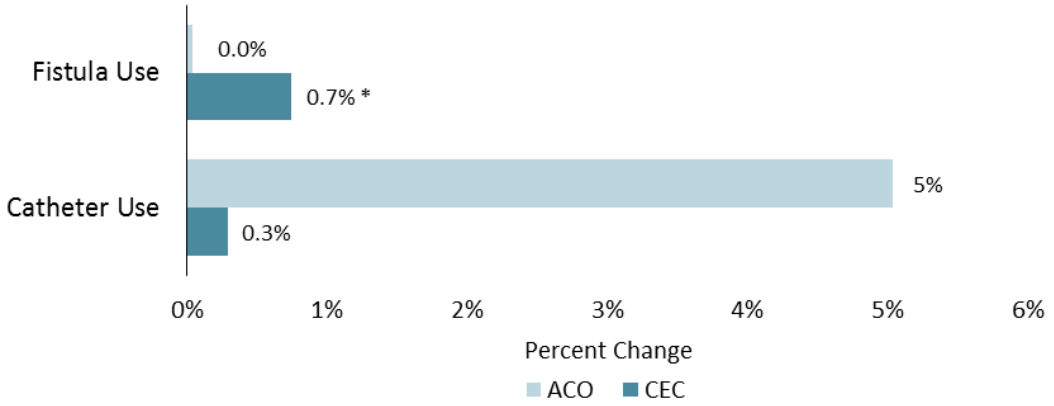
The analytic sample consisted of 19,736 CEC and 9,904 primary care-based ACO newly aligned beneficiaries and 29,640 matched comparison beneficiaries. The sample size is sufficient to detect payment impacts of 3% or more. The primary care-based ACO sample size, however, may not be sufficient to capture an impact of less than 3%. We estimated the impact of CEC and primary care-based ACO care models using a risk-adjusted DiD model that included the same beneficiary, facility, and market characteristic controls used in the main DiD analysis. We estimated the DiD impact of CEC relative to FFS and the DiD impact of primary care-based ACOs relative to FFS, and we compared the respective results. This approach controlled for beneficiary-, market-, and facility-level differences between the intervention and comparison populations, minimized biases from time-invariant differences between the intervention and comparison populations, and controlled for secular trends. The matching methods, DiD model specifications, and power calculations are described in **Appendix K**.

C. Results

We found differences in performance between CEC and primary care-based ACO care models, with only the CEC Model resulting in a reduction in Medicare payments, hospitalizations, and readmissions. Also, fistula use increased under the CEC Model, but did not change under the primary care-based ACO model. Impacts on catheter use or ED visits were not statistically significant under either model.[81]

Exhibit 45 shows results on quality measures for vascular access. Fistula use increased significantly (0.7%) among CEC beneficiaries relative to the pre-intervention period during the first year of alignment, but there was no statistically significant impact for newly aligned ACO beneficiaries. Catheter use for hemodialysis for over 90 days did not significantly change for either newly aligned CEC or ACO beneficiaries in their first year of alignment.

Exhibit 45. Impact of the CEC and Primary Care-Based ACO Models with Two-Sided Risk on the Likelihood of Vascular Access Type in a Given Month

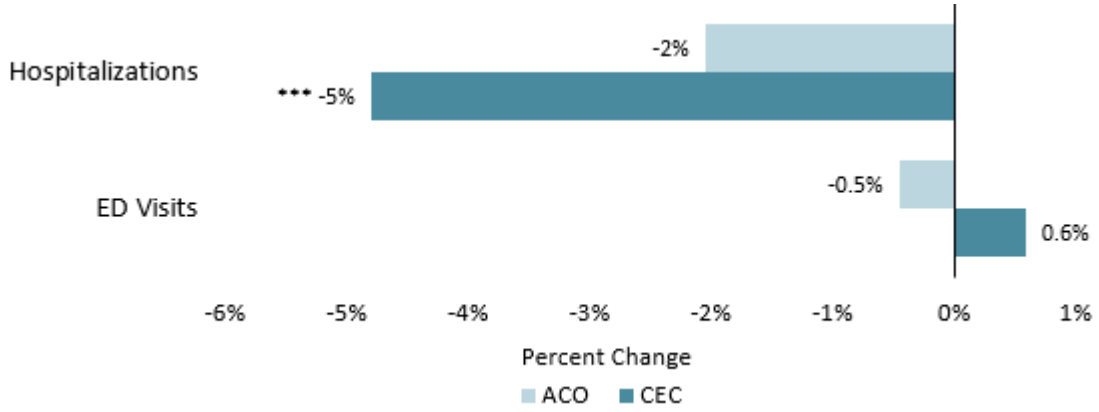


Notes: Each impact estimate is based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months following alignment into CEC or an ACO care model relative to matched comparison groups of beneficiaries who did not transition from Medicare FFS. ***p≤0.01, **p≤0.05, *p≤0.1. None of the outcomes show statistically significant results. See **Appendix K** for detailed results.

The impacts on hospitalizations and ED visits are presented in **Exhibit 46**. In their first year of alignment, CEC beneficiaries experienced statistically significant reductions in the number of hospitalizations (5%, p≤0.01) relative to the pre-intervention period. These results translate into 5.5 fewer hospitalizations per 1,000 beneficiaries per month among the CEC population. However, there was no significant change in the number of hospitalizations or ED visits among primary care-based ACO beneficiaries after they were aligned to an ACO.

[81] Impacts for the CEC sample are not directly comparable with the impacts reported in the main DID analysis (Chapter VII). There are important differences in design, inclusion restrictions and observation period across the two analyses as described in **Appendix K**. In particular, this analysis represents the first year experience of CEC beneficiaries who had 12 months of Part A and B enrollment history prior to alignment into a two-sided risk ESCO. This represents 17% of the CEC population in the DiD analysis. Also, because beneficiaries are followed only during their first year of alignment, the sample composition across cohorts is more balanced in this analysis compared to the main DiD analysis.

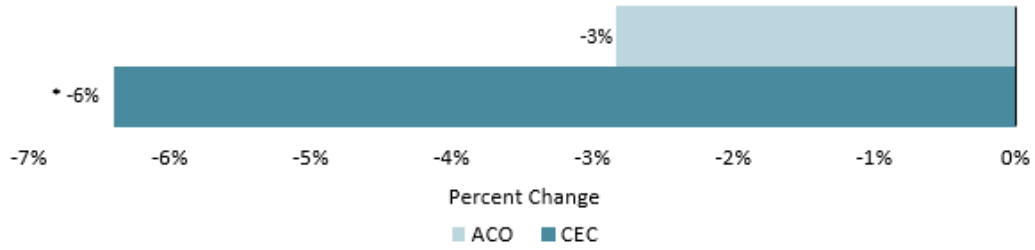
Exhibit 46. Impact of the CEC and Primary Care-based ACO Models (with Two-Sided Risk) on the Number of Hospitalizations and ED Visits PBPM



Notes: Each impact estimate is based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months following alignment into CEC or a primary care-based ACO model relative to matched comparison groups of beneficiaries who did not transition from Medicare FFS. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. ***p≤0.01, **p≤0.05, *p≤0.1. See **Appendix K** for detailed results.

As shown in **Exhibit 47**, readmissions significantly decreased among CEC beneficiaries in their first year of alignment (6%, p<0.01), relative to the pre-intervention period. Primary care-based ACO beneficiaries, however, did not experience a significant change in readmissions after they were aligned to an ACO.

Exhibit 47. Impact of the CEC and Primary Care-based ACO Models with Two-Sided Risk on the Likelihood of Readmissions in a Given Month

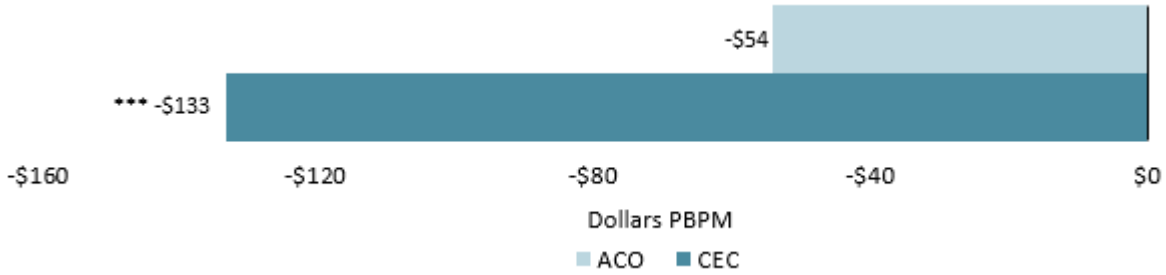


Notes: Each impact estimate is based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months following alignment into CEC or a primary care-based ACO model relative to matched comparison groups of beneficiaries who did not transition from Medicare FFS. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. ***p<0.01, **p<0.05, *p<0.1. The last quarter of intervention data is excluded to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. **See Appendix K for detailed results**.

Similar to our findings in AR2, the CEC Model had a greater impact on total Medicare Part A and Part B payments than the primary care-based ACO models, as shown in **Exhibit 48**. Relative to a matched comparison group, Medicare payments decreased by $133 PBPM (2.45%, p≤0.01) in the first year of alignment for beneficiaries with ESRD who were aligned to CEC. This is a $23 PBPM improvement in reduced payments compared to AR2. There were no statistically significant changes in Medicare payments for beneficiaries with ESRD who were aligned to a primary care-based ACO in the first year of alignment. The reduction in payments observed in

newly aligned CEC beneficiaries was driven by a reduction in the number of hospitalizations and readmissions (see **Exhibits 46** and **47**).

Exhibit 48. Impact of the CEC and Primary Care-Based ACO Models (with Two-Sided Risk) on Total Medicare Part A and Part B Payments PBPM



Notes: Each impact estimate is based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months following alignment into CEC or a primary care-based ACO model relative to matched comparison groups of beneficiaries who did not transition from Medicare FFS. ***p≤0.01, **p≤0.05, *p≤0.1. See **Appendix K** for detailed results.

D. Discussion

Results continue to support the hypothesis that that beneficiaries with ESRD fare better in a specialty-oriented ACO model like the CEC rather than in a primary care-based ACO model. A plausible mechanism for this result may be that a specialty-oriented care model is more effective for the ESRD population, given their regular contact with at-risk providers (dialysis facility and nephrologist). Another potential mechanism is the CEC's focus on the dialysis population and its particular needs vs. dialysis patients making up a very small share of the patients aligned to primary care-based ACOs

IX. Did the CEC Model Have Unintended Consequences?

An important component of the evaluation of the CEC Model is identifying potential unintended consequences that may result from the incentives created by the CEC Model. In this section, we explore if the CEC Model affected cost-shifting, patient selection, and transplant waitlist participation.

Part D Cost-Shifting. Medicare Part D drug costs are not included in the total cost of care calculations for determining ESCO shared savings and losses. As a consequence, ESCOs may not consider Part D drug costs in care redesign, may not be aware of the impact such changes have on drug costs, and have an incentive to prescribe drugs rather than non-drug therapies that are included in the total cost of care calculations. This section evaluates the impact of the CEC Model on Part D PBPM total drug costs.[82]

Patient Selection. The CEC Model may incentivize CEC nephrologists to refer sicker patients to non-CEC facilities while keeping healthier patients at CEC facilities. The model, however, is designed to limit the ways in which CEC nephrologists may cherry-pick patients. The "first touch" approach of the program limits physicians' ability to steer existing patients away from the ESCO. Furthermore, once patients' dialysis schedules are established at their chosen facility, it takes a significant amount of effort to get patients to switch facilities. Selection might occur if nephrologists decide to steer patients that are new to dialysis to certain types of facilities depending on their expected risk. This section focuses on whether there is evidence that new dialysis patients in CEC facilities were healthier compared to new dialysis patients in matched comparison facilities.

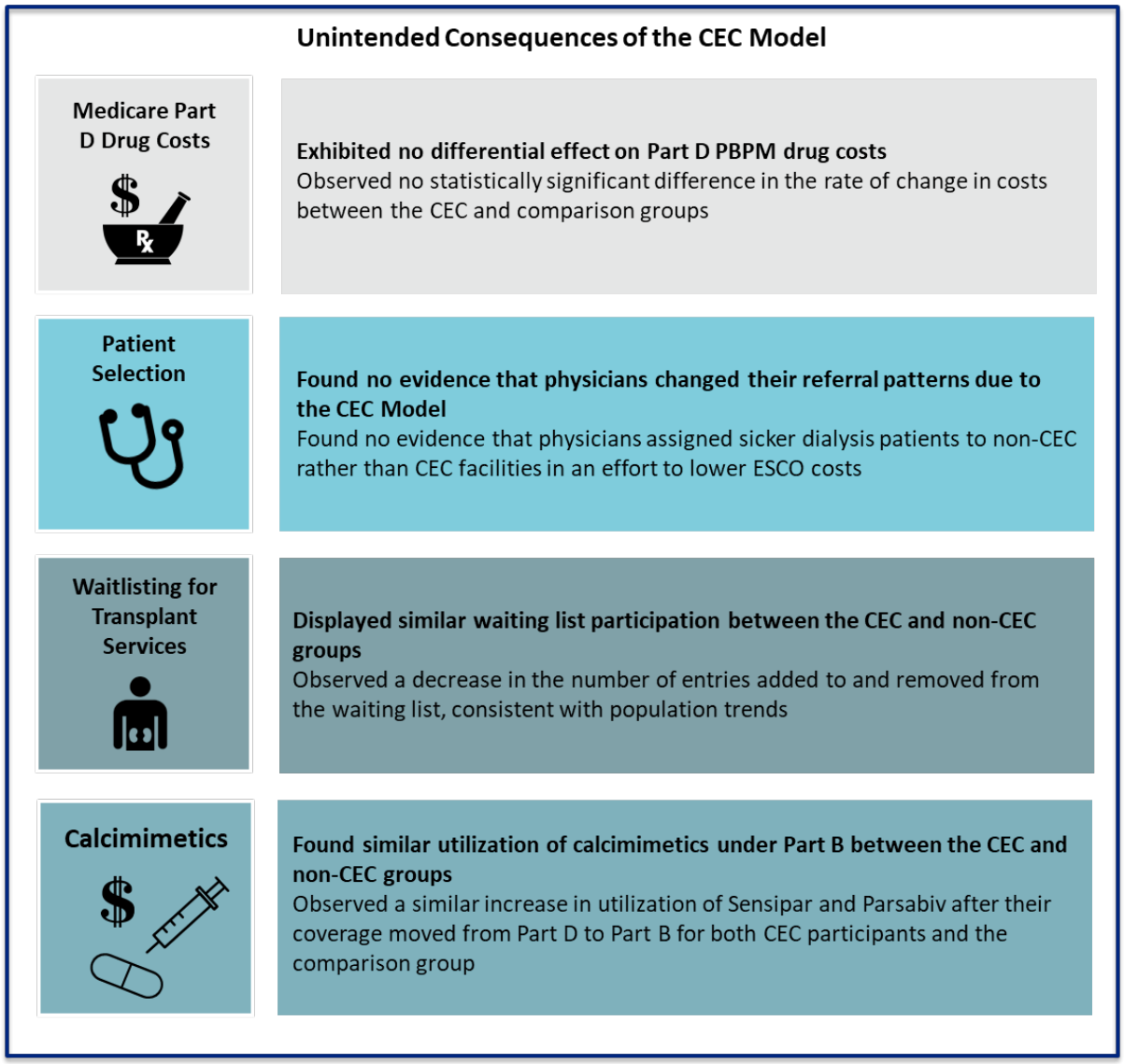
Waitlisting for Transplant Services. Dialysis providers can initiate the process for waitlisting for a transplant either directly (by referring the patient for waitlisting evaluation) or indirectly (by educating the patient about the option of transplantation). Patients that are waitlisted have gone through an evaluation of their suitability for transplant and thus are considered relatively healthier. Therefore, the removal of beneficiaries from the CEC Model if they receive a transplant may create an incentive to decrease referrals. We do not directly observe referrals or patient education, but a decline in the rate of waitlisting could indicate that CEC providers are delaying transplant referrals of patients with the intent of extending the time that relatively healthier patients are aligned to ESCOs. Keeping healthier patients aligned for longer periods could improve the ESCOs' overall performance and increase their chance of meeting requirements to qualify for shared savings under the model. This section presents findings on the impact of the CEC Model on participation in the Organ Procurement and Transplantation Network (OPTN) waiting list during the first three performance years of the CEC.

Calcimimetics. Medicare Part B coverage of calcimimetic drugs (Sensipar and Parsabiv), which were newly available in injectable and intravenous form, moved from Part D to Part B in January 2018. Because these drugs were not included in the ESRD PPS bundled payment, CMS made a Transitional Drug Add-on Payment Adjustment (TDAPA) to dialysis claims beginning in

[82] Total Part D drug cost represents total cost of prescriptions including ingredients costs, dispensing fee, sales tax, and vaccine administration fee (if applicable).

January 2018. The purpose of the TDAPA is to reimburse providers for costs incurred while utilization data needed to update PPS payments is gathered.[83] In general, utilization is expected to increase as a result of the availability of injectable and intravenous forms and additional payment, and PY expenditure benchmarks for reconciliation will increase to reflect TDAPA payments. However, the amount of the TDAPA payments will be based on average utilization in the reference population so there is an incentive for ESCOs to under prescribe calcimimetics in PY3 in order to generate shared savings. This section explores the use of calcimimetics before and after TDAPA for CEC participants and the comparison group.

A. Key Findings



[83] https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ESRDpayment/ESRD-Transitional-Drug.html

B. Methods

We used several data sources and methods to assess unintended consequences of the CEC Model.

Medicare Part D Drug Costs. We used a DiD approach to estimate impacts of the CEC Model on Part D PBPM costs, relative to the comparison group. The DiD model for Part D PBPM drug costs followed the same specifications as the models described in **Section VII** and **Appendix F**.

Patient Selection. We used a facility-level DiD framework to assess the impact of the CEC Model on patient selection by comparing the number of new dialysis patients with comorbid conditions in ESCO facilities before and after implementation of CEC, relative to this number in comparison facilities before and after implementation of CEC.[84] We defined patients as new to dialysis if they have been on dialysis for three or fewer months as reported in CMS Form 2728.[85] We also used data from CMS Form 2728 to identify beneficiaries with multiple comorbid conditions at the start of dialysis or in the 10 years preceding the start of dialysis. Our sample includes 66,005 new dialysis patients from 2014 to June 2018. On average, new dialysis patients had 2.9 comorbid conditions, and almost half (49%) had at least three comorbidities.

Because taking on new dialysis patients can pose potential financial risk for dialysis facilities, we also considered the total number of new dialysis patients as an outcome in our analyses. We then analyzed the number of new dialysis patients who had at least three comorbid conditions. A challenge in this analysis was the small number of new dialysis beneficiaries with a certain number of comorbid conditions in a given facility. [86] A detailed description of the sample, the distribution of outcomes, and DiD models can be found in **Appendix L**.

Waitlisting for Transplant Services. We used a DiD approach to quantify the impact of the CEC Model by comparing the changes in waitlist participation between the pre-CEC and intervention periods for the aligned CEC population and the comparison population. This approach attributes any change in waitlist participation to CEC by contrasting the experience of beneficiaries under age 70 aligned to ESCOs to the experience of beneficiaries under age 70 aligned to comparison facilities. We estimated two DiD models, one that estimated the impact of the CEC Model for all 37 ESCOs and one that estimated the impact for each ESCO wave and performance year.[87] The DiD models are described in **Appendix L**.

The study population included all beneficiaries under the age of 70 who were aligned between 2014 and 2018 to either a CEC facility or a matched comparison facility. The methods used to select the comparison facilities are described in more detail in **Appendix F**. The study population included only beneficiaries under 70 because older patients are waitlisted for and

[84] The methods used to select the comparison facilities are described in more detail in **Appendix F**.
[85] https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/CMS-Forms-Items/CMS008867.html
[86] Due to potential limitations in variation in the data for those with at least five comorbidities, we focus on those with at least three and four comorbidities. See **Exhibit 41.**
[87] Wave 1 is comprised of the original 13 ESCOs that first entered the CEC Model in October 2015. Wave 2 is the additional 24 ESCOs that entered in 2017.

receive transplants with much less frequency than younger patients.[88] The analysis was based on yearly Medicare claims and enrollment data along with data from the Scientific Registry of Transplant Recipients (SRTR).[89] The SRTR data system includes data on all donor, wait-listed candidates, and transplant recipients in the US, submitted by the members of the Organ Procurement and Transplantation Network (OPTN).[90] The beneficiary's Medicare information was linked to the corresponding waitlist record in the SRTR database by the SRTR data administration team. The linkage indicated if the beneficiary identified in the Medicare database was in the SRTR database and the time period the beneficiary was active on any of the organ waiting lists.[91]

In a given calendar year, a beneficiary in the study population was identified as active on the waitlist if the beneficiary was active on the OPTN waitlist at some time during the year, and the beneficiary was waiting for either a kidney or a kidney and pancreas transplant. A beneficiary who received a donation from a living donor was considered active on the OPTN waitlist during the year that the donation occurred.

Calcimimetics. To measure use of calcimimetics before and after these drugs were moved from Part D to Part B, we analyzed the percentage of beneficiaries covered under Part D with a Parsabiv and/or Sensipar claim. Our analysis was based on Medicare Part D claims in 2017 and Medicare Part B claims in 2018. Observations were restricted to beneficiary months with Medicare Part D coverage.

C. Results

Our analyses found no conclusive evidence of cost-shifting, adverse selection, a differential increase in use of calcimimetics, or a reduction in transplant waitlist participation under the CEC Model.

1. Is There Evidence of Cost-Shifting to Medicare Part D?

There was no statistically significant difference in the rate of change in Part D PBPM drug costs from baseline to intervention between the CEC and comparison groups (see **Exhibit 49**).[92]

[88] Transplants in people aged 70 or greater occur with much less frequency than do transplants in younger patients. As a robustness check, the analysis described in this chapter was also performed. All results were robust to removing this age restriction and to using an age cutoff of 75.

[89] Since transplant wait listing is a rare event, a yearly dataset was used instead of a monthly dataset.

[90] The Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services provides oversight to the activities of the OPTN and SRTR contractors.

[91] The data reported here have been supplied by the Hennepin Healthcare Research Institute (HHRI) as the contractor for the Scientific Registry of Transplant Recipients (SRTR). The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy of or interpretation by the SRTR or the U.S. Government.

[92] Since Total Part D Drug cost did not pass statistical testing of the parallel trends assumption for all ESCOs and Wave 1, we also inspected the trends graph which compared trends between the CEC beneficiaries and the comparison group and observed no evident differences. Additionally, the coefficient on the difference in trends at baseline, although significant, equaled: -1.42 (all ESCOs) and -1.64 (Wave 2). See **Appendix F**, **Exhibit F-17.**

Exhibit 49. Impact of the CEC Model on Part D Drug Cost PBPM

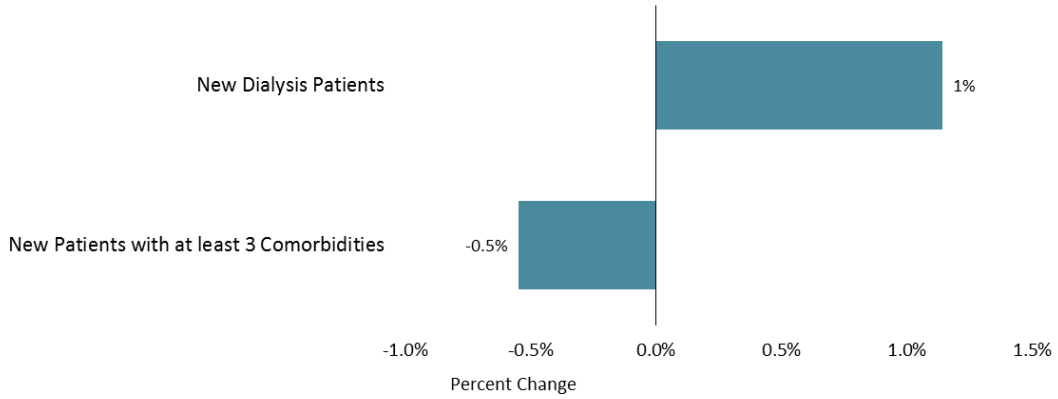
Measure	ESCO Wave and PY	CEC		Comparison		DiD Estimate			
		Pre-CEC	Post-CEC	Pre-CEC	Post-CEC	DiD	90% Lower CI	90% Upper CI	Percent Change
Total Part D Drug Cost	ALL ESCOs	$822	$1,022	$836	$1,016	$20 ‡	-$92	$132	2.4%
	WAVE 1 PY1	$822	$1,083	$836	$1,089	$8	-$95	$112	1.0%
	WAVE 1 PY2	$822	$1,175	$836	$1,164	$25	-$114	$165	3.1%
	WAVE 1 PY3	$822	$794	$836	$792	$15	-$102	$133	1.9%
	WAVE 2 PY2	$904	$1,159	$918	$1,163	$10 ‡	-$77	$96	1.1%
	WAVE 2 PY3	$904	$811	$918	$792	$32 ‡	-$116	$180	3.6%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the baseline period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate. Total Part D represents total cost of prescriptions including: ingredients costs, dispensing fee, sales tax, and vaccine administration fee (if applicable). See **Appendix F**, **Exhibits F-27** (All ESCOs), **F-28** (Wave 1), and **F- 29** (Wave 2).

2. Is There Evidence of Adverse Selection within CEC Facilities?

Overall, we did not find consistent evidence that CEC facilities treated healthier new dialysis patients compared to matched comparison non-CEC facilities. Results are presented in **Exhibit 50**. Relative to non-CEC facilities, CEC facilities had 1% more new dialysis patients. In assessing the number of comorbidities that patients had, we found that CEC facilities had 0.5% fewer new patients with at least three comorbidities. None of these estimates were statistically significant. We will continue to monitor for adverse selection as more facilities join the model and sample sizes increase.

Exhibit 50. Impact of the CEC Model on the Number of New Dialysis Patients with Comorbidities



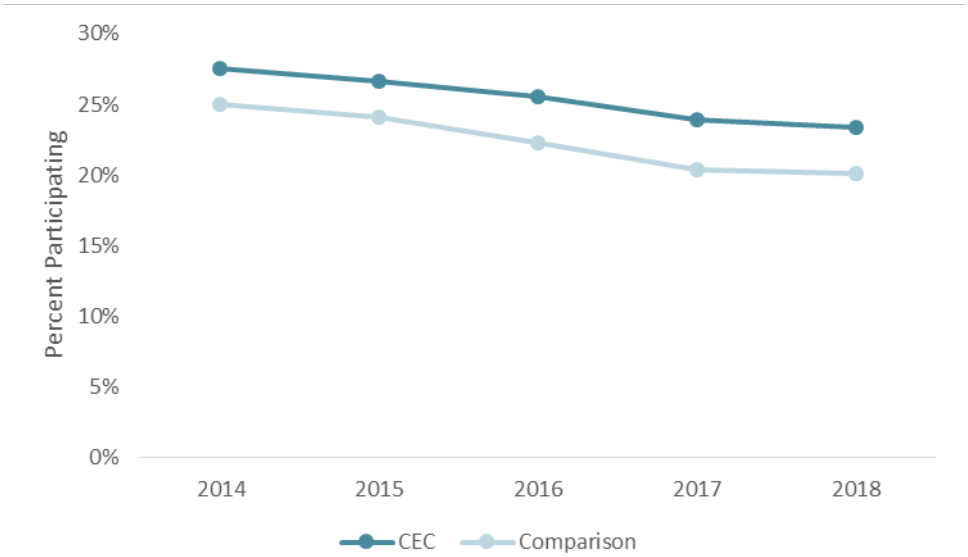
Notes: Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. Regression controls for the number of new dialysis patients (with the exception of the New Dialysis Patients outcome), number of dialysis stations at each facility in each quarter, beneficiary count, whether or not the facility offers a late shift, for-profit status, indicators for LDO, rural/urban indicators, region dummies and market characteristics (percent of population that has ESRD, median family income, dual population, MA percent, ACO percent, and PCPs per 10,000). For more details, see **Appendix L**, **Exhibit L-1** and **L-2**.

3. What Was the CEC Model's Impact on Transplant Waiting List Participation?

We summarize in **Exhibit 51** the yearly transplant waitlist participation by CEC participation status. The raw year-over-year change in waitlist participation was very similar between the CEC and non-CEC groups.[93] The average waitlist participation for CEC facilities was 28% in 2014 and 23% in 2018. Waitlist participation in the CEC facilities was consistently higher than that in comparison facilities, which had an average of 25% in 2014 and 20% in 2018. The decreasing trend in both groups was consistent with what was observed in the larger population of beneficiaries who were active on the transplant waitlist. Specifically, we observed a decrease in the overall number of entries added to the waitlist and an increase in the number of entries removed from the waitlist in recent years (see **Appendix L, Exhibit L-3**).

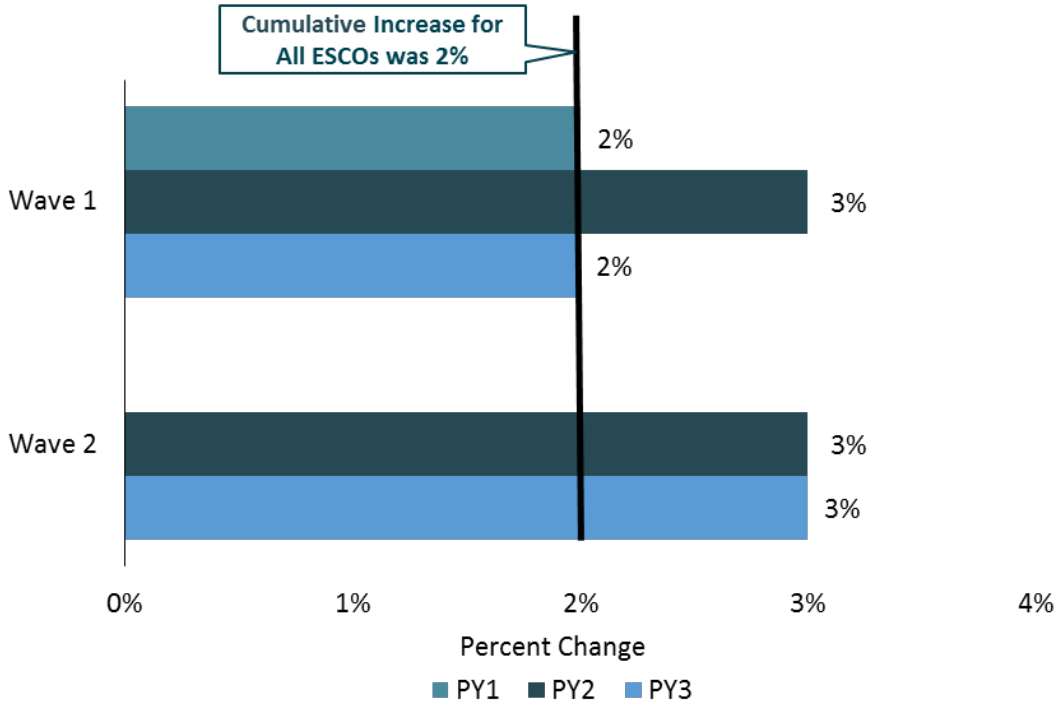
[93] These numbers may be impacted by changes in the kidney allocation system which took effect in December 2014. These changes impact both comparison and participating facilities.

Exhibit 51. Transplant Waiting List Participation by CEC Participation Status



The findings from the DiD analysis are summarized in **Exhibit 52** (see also **Appendix L**, **Exhibit L-6**). The transplant waitlist participation decreased from the baseline to intervention for both CEC and comparison group beneficiaries, but slightly more so for comparison group beneficiaries, resulting in positive DiD estimates for both Wave 1 and Wave 2 across all performance years. However, the DiD estimates were not statistically significant in either the analysis for the overall impact or the analysis separating ESCO waves by performance year. Therefore, we conclude that there is no evidence that CEC changed the waitlist participation in the first two performance years.

Exhibit 52. Impact of the CEC Model on Transplant Waiting List Participation PBPM



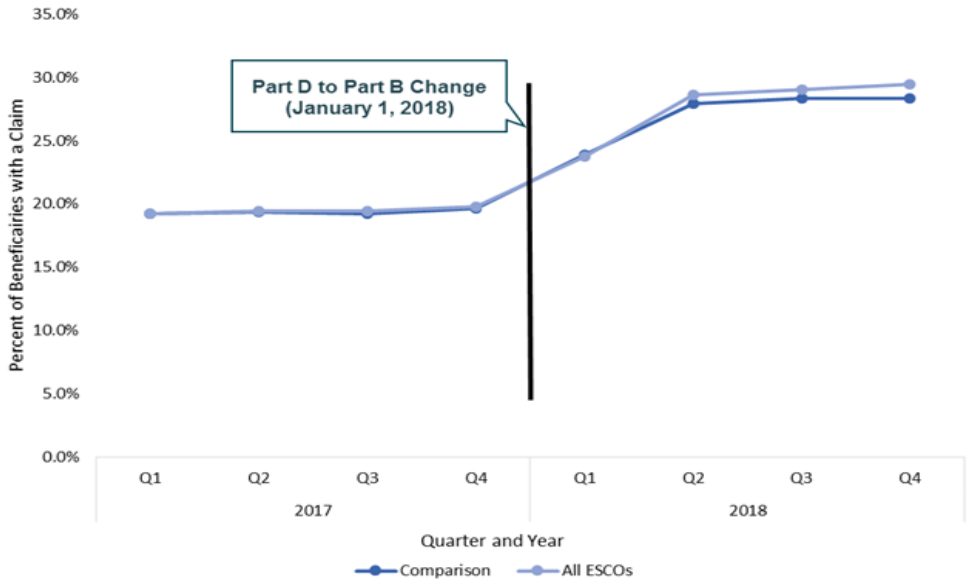
Notes: Estimate label values are rounded to the nearest whole number, therefore bar lengths may differ despite showing the same rounded label value. Significance of the DiD impact estimate is indicated next to each outcome bar plot where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. None of these estimates are statistically significant. For more details, see **Appendix L**, **Exhibit L-6**.

4. Did the Utilization of Calcimimetics under Part B differ between CEC and non-CEC groups?

Our analyses found an increase in total calcimimetic utilization after Sensipar and Parsabiv moved from Part D to Part B in 2018 for both CEC beneficiaries and the comparison group.[94] The trends in the two groups followed each other very closely over the two year period (see **Exhibit 53**) with a small relative increase for CEC beneficiaries, relative to the comparison group. The percent of CEC beneficiaries with a Sensipar and Parsabiv claim increased from almost 20% in the last quarter of 2017 to nearly 30% in the last quarter of 2018. The comparison group experienced a similar increase over the same period, from about 20% to 28%. We found no evidence that ESCOs underutilized calcimimetics after they became available under Part B; rather, we found utilization under part B was very similar among ESCOs than in the comparison group.

[94] The majority of calcimimetic claims in 2018 were for Sensipar rather than Parsabiv.

Exhibit 53. Percent of Beneficiaries with a Sensipar and Parsabiv Claim for All ESCOs and the Comparison Group, 2017-2018



Note: Part D claims are used in 2017 and Part B claims are used in 2018.

D. Discussion

In a model such as CEC that encourages lower payments, it is important to search for potential unintended consequences that may negatively affect beneficiary care. The analysis did not yield conclusive evidence of the unintended consequences of cost-shifting to Medicare Part D, adverse selection, or a reduction in transplant waitlist participation under the CEC Model. There was no statistically significant difference in the change in Medicare Part D drug costs from pre-CEC to intervention between the CEC and comparison groups. In this preliminary descriptive analysis, we found that CEC facilities did not have a statistically significant difference in the number of new dialysis patients or new patients with at least three comorbid conditions. Transplant waitlist participation among beneficiaries of Wave 1 and 2 ESCOs has been declining over time. However, the decline was even larger for the comparison beneficiaries (though the difference in trend was not statistically significant). The declines among all groups are plausibly related to national changes. In particular, transplant priority is now based on start date of dialysis rather than waitlisting date, reducing the urgency of waitlisting. Finally, utilization of calcimimetics increased with the change in coverage from Part D to Part B and there was no evidence that ESCOs underutilized calcimimetics to generate shared savings.

There are several important limitations in our analysis. First, we lack pre-ESRD claims on about half of the beneficiaries who are eligible for Medicare due to ESRD because they were not Medicare beneficiaries prior to their ESRD diagnosis, and, as a result, we cannot completely assess the comorbidity status of all new dialysis patients. Second, we may have selected a healthier population because we required beneficiaries survive to their third month of dialysis before we counted them as a new dialysis patient in our analysis. Third, the waitlist participation analysis is limited by the frequency with which the transplant waitlist is updated. When the health status of a beneficiary changes there is typically a delay in when the waitlist entry is updated. Therefore, the dates of waitlist participation are approximate.

X. What Were Wave 1 ESCOs' Perceptions of Model Scalability and Sustainability?

During interviews with Wave 1 ESCO leadership in PY3, we asked about the scalability and sustainability of the CEC Model within their organizations. ESCOs reported on existing efforts to implement model design features for non-CEC beneficiaries or non-ESCO facilities, plans to continue model design features beyond the CEC Model, and the resources needed for and barriers to sustainability. Respondents also shared recommendations for improving the CEC Model.

A. Key Findings

Wave 1 ESCOs' Perceptions of Model Scalability and Sustainability

Model Scalability

Described model design features already scaled to non-ESCO patients and facilities

Expanded use of interdisciplinary teams, medication management in EHR, ED notification, and telephonic care coordination

Reported potential barriers to model scalability

Identified lack of transparency and predictability in financial methodology as a potential deterrent to wider nephrologist involvement

Model Sustainability

Identified some sustainable model design features

Emphasized communication across the dialysis care team and coordination with non-dialysis providers as well as monitoring quality measures

Reported potential barriers to model sustainability

Perceived the termination of the MACRA waiver in 2024 as a challenge to retention of nephrologists

Anticipated inability to continue to reduce costs over time

B. Methods

We used the methods described in **Section II.B** and **Appendix C** to analyze the qualitative data derived from the site visit**.**

C. Results

Some existing model design features are already provided to non-CEC beneficiaries or non-ESCO facilities. ESCOs plan to maintain some model design features after completion of the CEC Model. Interviewees reported that the Medicare Access and CHIP Reauthorization Act of

2015 (MACRA) A-APM reporting exemption was important in motivating nephrologists to participate and its expiration in 2024 would be a significant barrier to sustainability.

1. Have Wave 1 ESCOs Incorporated Model Design Features in Non-ESCO Facilities or Markets?

Several Wave 1 ESCOs have already applied some design features of the CEC Model beyond their ESCO beneficiaries and facilities. For example, some changes made to EHRs, including medication management enhancements and use of automated ED notification systems, were implemented across facilities. Other examples of model design features incorporated in non-ESCO facilities are listed below.

- The telephonic support provided by the Fresenius CNU is used to divert patients from the ED regardless of whether they are aligned to the ESCO.
- The DaVita ESCO rolled out their Integrated Care Center (ICC) interdisciplinary team meetings to all of their facilities nationwide.
- Another organization expanded the close fluid monitoring, medication management, and care coordination implemented within their ESCO to all of their facilities.

Barriers to Scalability. ESCOs identified two barriers to scaling the model. One barrier was concern about losing money under the model. They felt that the lack of transparency in the financial methodology makes it difficult for them to gauge whether they would have any savings or losses. Additionally, the lack of predictability in financial risk makes it challenging to get wider nephrologist involvement. ESCOs also suggested that the need for more nephrologists that embrace the paradigm of providing care to the whole patient, not just addressing or treating ESRD dialysis clinical needs, was another potential barrier to scalability.

> *"[It's] a great program. It helps everybody. But the stress of losing money takes the focus away from what we really want to do with this."*
> – ESCO Site Visit Participant

2. What Were Wave 1 ESCOs' Perceptions of Model Sustainability?

Some care redesign approaches may be sustainable beyond the CEC Model. In particular, ESCOs felt that certain model design features, such as education of physicians and partners (e.g., hospitals and EDs), cross-team communication, medication management, care transition processes, and IT enhancements, could be sustained. ESCOs may also continue to monitor the Individual Quality Index (IQI) reporting metrics and several of the primary care measures, such as foot checks, after the CEC Model ends.

Barriers to Sustainability. ESCOs expected that the anticipated end to the A-APM waiver under MACRA in 2024 will make it more challenging to obtain or retain nephrologist participation in future models. Most ESCOs also raised concerns about sustainability due to the likely inability to continue to reduce costs over time, fearing a ratcheting down of payments targets. They were uncertain about the sustainability of the care coordinator role and support for transportation because of the financial resources required. Although nephrologists and dialysis

staff felt the role is vital to delivering patient care, the investment in the care coordinator role may not be cost effective without the shared savings provided under the model.

> *"[If] the care coordinator goes away, then the care of the dialysis patients will go away or get less. That's my biggest fear about losing the ESCO. I'm not getting any financial incentive. I'm not trying to get any financial incentive. I just know that the patients do so much better when they have a nurse whose job is to be sure they're compliant. They get their appointments. They get their right medicines. How could that not be one of the biggest plusses? If the ESCO falls apart, we just hope they keep the care coordinator."*
>
> – ESCO Site Visit Participant

2. What Changes Do Wave 1 ESCOs Recommend for the Model?

Wave 1 ESCOs recommended changes to the model's financial methodology and arrangements, increasing the scope of beneficiaries and providers involved in the model, and providing patient incentives to improve treatment adherence.

Financial Methodology. To reduce uncertainty for model participants, and to garner more buy-in and trust from nephrology practices in particular, most ESCOs recommended greater transparency in the quality measure benchmarks and reconciliation methodology used in the model. Because the current retrospective model is perceived as too unpredictable, some ESCOs suggested CMMI use a prospective payment methodology to help model participants better understand how much money they would have to provide care coordination and other services. Others suggested relaxing the transportation waiver (e.g., raising the monetary cap). They also suggested increasing transparency and timeliness in the alignment methodology and data to help ESCOs target interventions to incident patients sooner.

Scope. All four dialysis organizations felt the model should be extended to include CKD stage 4 and 5 populations, but they recognized CMMI would need to allocate more resources to expand the covered population. Including patients with CKD would allow ESCOs to reach the upstream patients before they begin dialysis and potentially slow patient progression to ESRD. One dialysis organization also recommended including transplant patients in the model.

One dialysis organization suggested that teaching hospitals, in particular, need incentives to communicate and work collaboratively with the dialysis unit and nephrologists. Another stressed the importance of including other partners, such as specialists, in the model.

Beneficiary Incentives. Because poor patient adherence is a cost driver through higher risk of hospitalization or ED visits, several ESCOs suggested that patients should be incentivized to avoid missed treatments (through either a penalty or reward).

> *"… unless we have patients show up… so it keeps it top of mind, it's a lot of human glue holding it together. That's one of the things I hope in the next sort of revision of the ESCO model, they figure out ways to incentivize these other participants that may not be direct owners of the joint venture, but really let's put the patient at the center of this thing and incentivize the community resources and providers to really sort of keep patient first and work together, whether it's information sharing, whether it's care coordination, to help get the best outcomes for the patients."*
>
> – ESCO Site Visit Participant

D. Discussion

All Wave 1 ESCOs applied design features of the model (such as care coordination, medication management, or IT infrastructure) to non-ESCO patients and facilities, which will extend some improvements beyond the conclusion of the CEC Model. Other model elements were also likely be sustained such as staff education, cross-team communication, and quality measures. Several ESCOs also acknowledged that more financial resources would be required to sustain care coordination and transportation beyond the current CEC Model. They also said that the expiration of the A-APM reporting exemption and lack of transparency and predictability in the financial methodology would challenge retention of existing nephrologists as well as wider nephrologist involvement. All four dialysis organizations recommended that the model be expanded to include CKD stage 4 and 5 populations.

XI. Discussion

The CEC Model is designed to create incentives for dialysis facilities and nephrologists to coordinate care for Medicare beneficiaries with ESRD across settings by making the ESCO accountable for the total cost of care of their aligned beneficiaries. The time period covered by this third annual report includes the first three performance years for the 13 original ESCOs (Wave 1) that began operations in October 2015 and the first two performance years for the 24 ESCOs (Wave 2) that began operations in January 2017. With this cumulative experience, the current report allows a more thorough investigation of performance over time, which has implications for model sustainability, and differences between early and later adopters, which has implications for model scalability.

Nationally, 15% of dialysis facilities were participating in the model in PY3. Participating facilities tended to be somewhat larger than non-participating facilities, and the markets served by ESCOs tended to be larger than those without an ESCO. Since CEC attained status as an A-APM under MACRA, it motivated nephrologists' willingness to bear risk to participate in the new ESCOs and may ultimately contribute to both differences in performance across the waves and the potential to recruit new participants; however, the scheduled end of the A-APM waiver in 2024 was thought by some participants to be a threat to obtaining or retaining nephrologist participation in future models. CEC participating providers often cited alignment with CEC quality and cost outcomes as a motivation for participating. Shifting attitudes towards value-based payment might also enhance more providers' interest in the model going forward.

Overall, after three years of experience, the CEC Model appears promising, with lower payments, improvements in some quality and utilization measures, and no obvious indicators of unintended adverse consequences. Declines of 1.5% were observed for total Part A and Part B Medicare payments. Payment reductions were most evident in Medicare Part A, with significant reductions in acute inpatient, readmission, and institutional post-acute care (PAC) categories. Reductions in utilization paralleled the payment reductions, with significant declines in hospitalizations and readmissions. Utilization reductions were also consistent with ESCOs' reported efforts to avoid hospitalizations through risk stratification, care coordination, and improved adherence to dialysis treatments. ESCOs specifically described strategies to decrease skipped dialysis treatments by improving communications with the ED and adding standby dialysis slots (available chairs) to divert patients from the inpatient setting for conditions that could be addressed through dialysis. The number of dialysis treatments and payments on dialysis increased while payments for hospitalizations for ESRD complications declined, which provides further evidence of fewer missed treatments. ESCOs also improved the quality of dialysis care, as seen in reductions in long-term catheter use, and improved some aspects of care beyond dialysis, as demonstrated in higher rates of use of preventive health services.

Aside from no longer finding a statistically significant change in ED use, this pattern of results is qualitatively similar to those reported last year on the basis of the first two performance years for Wave 1 and the first performance year for Wave 2. However, examining results by performance year reveals some important changes. First, while Wave 1 ESCOs improved their performance in PY2 relative to PY1, performance in PY3 was not as strong. For example, Wave 1 ESCOs saved $143 PBPM for total Medicare Part A and B payments in PY1 and $193 in PY2 (both statistically significant), but saved only $77 PBPM (not statistically significant) in PY3. Second,

Wave 2 ESCOs continued to have generally weaker results than Wave 1, reinforcing the conclusion drawn in last year's annual report that the overall impact of the CEC was driven by Wave 1 ESCOs. Third, compared to Wave 1 ESCOs, Wave 2 showed less improvement in their second year of operation. For example, Wave 2 ESCOs saved $41 PBPM in their first year and $45 in their second year (both not statistically significant). Fourth, ESCOs in both waves continued to add dialysis facilities. When comparing results between facilities that joined their ESCO in different years, it was clear that on-boarding new facilities pulled down overall performance. As ESCOs expanded, the added facilities were less likely to be located within metropolitan areas, had fewer dialysis stations and were less likely to offer a late shift. Beneficiaries in these facilities may experience greater barriers to accessing all types of medical care which may hinder the ability of later joining facilities to reduce Medicare payments.

In PY2, the $193 PBPM savings attributed to by Wave 1 ESCOs reflected a blend of $246 savings (significant) for their original dialysis facilities and $63 savings (not significant) for the facilities they added in PY2. Similarly, Wave 2 ESCOs actually achieved statistically significant payment reduction of $92 PBPM in PY3 for their original facilities while experiencing a $20 increase (not statistically significant) in payments for their newly added facilities. These findings suggest that ESCOs in both waves might see performance improvements as their new facilities "mature." Next year's report will offer the opportunity to test this hypothesis.

As noted in last year's report, the conclusion that most results were driven by Wave 1 ESCOs may reflect several factors. Facility characteristics differed by wave. Facilities in Wave 1 ESCOs had higher Medicare payments and higher standardized hospitalization and readmission rates than non-CEC facilities. Conversely, those joining in Wave 2 had lower payments and lower standardized hospitalization and readmission rates than non-CEC facilities, and therefore might have had less room to improve on their pre-CEC performance. Additionally, nephrologists in Wave 1 ESCOs may have been more strongly motivated to join the CEC Model since they joined before it was deemed an A-APM under MACRA. Finally, because of delays with the initial model start, Wave 1 ESCOs may have had more lead time to develop their strategies and capabilities. Future analyses that incorporate an additional performance year will determine the extent to which these differences between waves are maintained.

A new set of analyses in this report showed that the CEC was associated with improved survival. Although the magnitude of the effect was modest, it appeared to be stronger for beneficiaries aligned earlier in their course of dialysis. Other measured model effects, such as the increase in dialysis treatments and declines in hospitalizations overall and specifically due to dialysis complications are potential mechanisms that might underlie improved survival. This association should continue to be monitored as more beneficiary follow-up time accrues.

Given the incentives for efficiency that are central to shared-savings models like the CEC Model and the vulnerable population served by CEC, it is important to monitor for unintended consequences. We continue to find no evidence of adverse outcomes such as reductions in quality of life, cost-shifting to Part D, increased mortality, diversion of sicker patients away from the ESCO, or reduced transplant waitlist participation for CEC beneficiaries.

This report also reflects the qualitative findings from the follow-up site visits to the 13 Wave 1 ESCOs that occurred in the last quarter of PY3. Those ESCOs were originally visited near the

end of PY1. The overall picture is that the ESCOs have focused on refinements of the structures and care redesign strategies they had developed in PY1. Nonetheless, some significant changes occurred. One notable example was Fresenius changing their care coordination model from a purely remote telephonic system to a hybrid system that combined telephonic support with an on-site coordinator that served multiple facilities with an ESCO. Also, several new partnerships were developed (e.g., one ESCO added a home health partner). ESCOs raised concerns regarding transparency and predictability of the model's financial methodology and challenges in continuing to exceed benchmarks that become stricter over time. Along with the expected end of the A-APM waiver in 2024, participants considered these factors to be barriers to the scalability and sustainability of the model.

Findings presented in this report have several limitations. Because the 37 ESCOs are not representative of the population of Medicare providers, our ability to generalize the results presented here are limited. However, the addition of new participants in PY2 increased the representation of markets participating in CEC. Also, although the analysis employs matching methods to select an appropriate comparison group to infer counterfactual outcomes for the ESCOs, the characteristics we selected for matching and the specificity of the data may not adequately account for all differences between CEC and comparison facilities and their beneficiaries. Further, as new facilities and markets are added to ESCOs and other ACO programs continue to evolve, the construction of appropriate comparison groups becomes even more challenging (e.g., a facility that might have been in an earlier comparison group is now in the model). Additionally, the analyses in this report are risk-adjusted to account for differences in provider and market characteristics, as well as patient mix that is measurable with claims data. As with all regression models, it is possible that we did not control for all characteristics that may affect the outcomes such as the motivation to participate in a voluntary payment model.

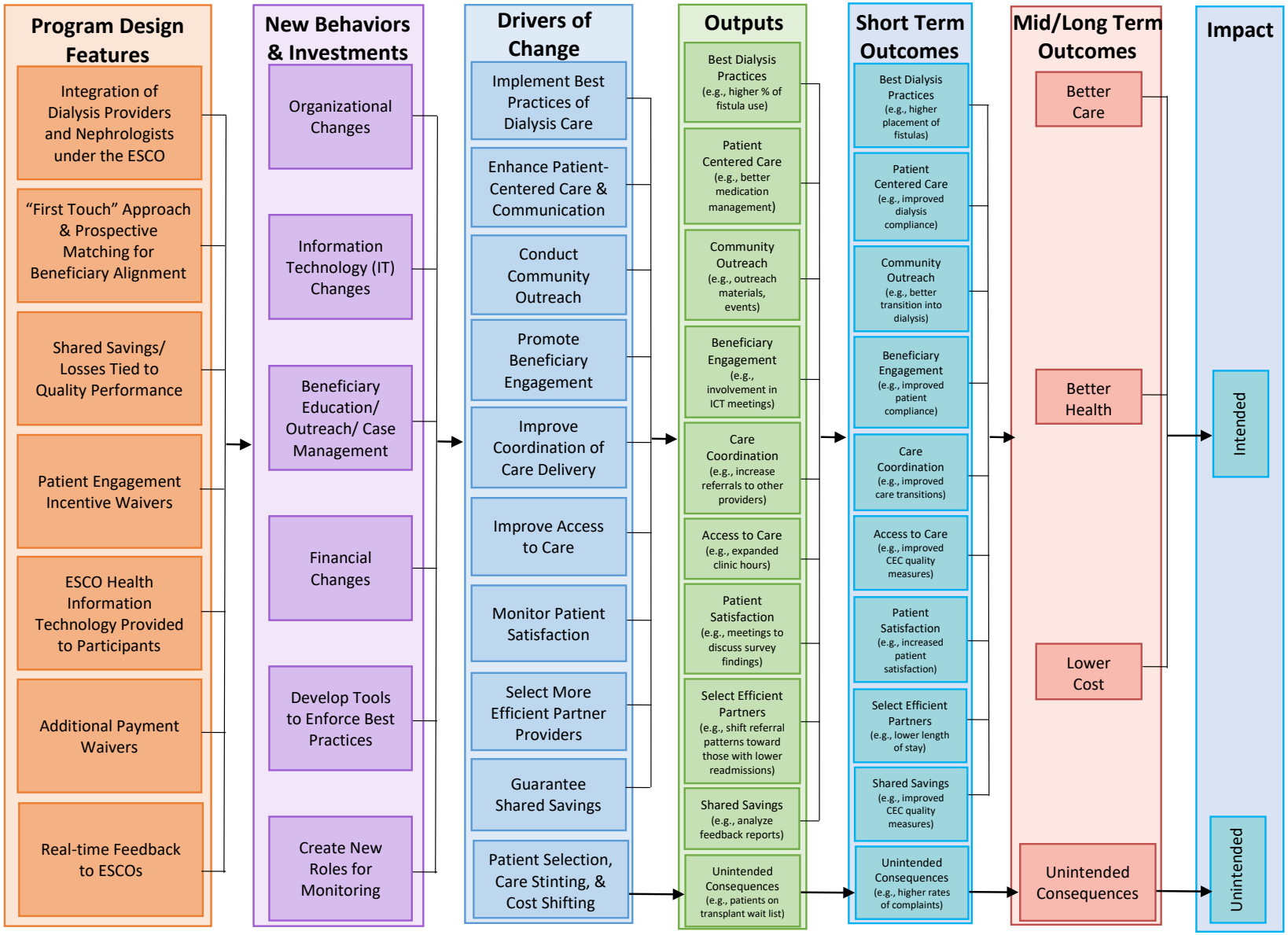
Future annual reports will build on these analyses in several ways. With increased sample sizes, as well as extended exposure under the model, we will be able to do more in-depth analyses of particular participant types, market effects, and beneficiary sub-populations. In particular, we will compare the performance of participants from LDOs and non-LDOs, compare performance across LDOs, and investigate the experience of subpopulations who may be more vulnerable to declines in quality of care. Finally, we will evaluate the scalability of the model and examine what would be the impact of the model if it were implemented nationally. We will also investigate whether the protocols and processes developed for the CEC Model can be broadly implemented and sustained among providers, physicians, beneficiaries, and caregivers who are not currently participating in the CEC Model.

Appendix A: CEC Waivers

Waivers in the Comprehensive End-Stage Renal Disease (ESRD) Care (CEC) Model included:

- Patient Engagement Incentive. Patient engagement incentive waivers allow ESRD Seamless Care Organizations (ESCOs) to provide in-kind items or services to CEC beneficiaries when related to their medical care. These waivers include technology, oral nutrition supplements (ONS), and non-emergency transportation.
    - Technology: Technology may be provided if the beneficiary does not possess or own similar technology and if it is considered "medically necessary" in that it will either (1) improve beneficiary-provider communication, health monitoring, or telehealth services, or (2) improve beneficiary adherence to medications, their plan of care, or their management of chronic conditions and diseases.
    - ONS: ONS may be provided free or discounted to beneficiaries only when their serum albumin level falls below the designated target level.
    - Non-emergency transportation: Non-emergency transportation can be provided for beneficiaries to access medically necessary care if they meet certain pre-set requirements.
- Performance-based Payments to Participant Physicians. ESCOs can provide incentives to participant providers for conducting certain medically necessary procedures or providing care that leads to better outcomes to CEC beneficiaries. These payments are based on performance-based metrics and are conditional to accurate reporting on such metrics.
- Health Information Technology. Participating providers and facilities may receive a health information technology (IT) waiver, but its usage must not be based upon referrals or other business generated between the participant and other parties. ESCOs must provide a consistent rationale for providing health IT based on a participant's overall use, quality reporting standards and other performance-based metrics, and care coordination activities.
- Care Coordination Arrangements. Care coordination arrangement waivers include ESCO clinical support services (i.e., case managers, care coordinators, and clinical training), the ability to have care coordination staff onsite at a dialysis facility, and other items or services to improve care coordination (i.e., administrative, quality management, and data services necessary to the delivery, documentation, and assessment of care coordination services).
- Remuneration Furnished by the Company/Organization to the ESCO. Remuneration by the dialysis organization (DaVita, Fresenius, Dialysis Clinic, Inc. [DCI], Rogosin, Atlantic, Centers for Dialysis Care [CDC], Northwest Kidney Centers [NKC]) for ESCO support (which includes clinical support services, location and rounding accommodations, and other items or services to improve care coordination), ESCO health IT, and patient engagement incentives can be provided to the ESCO as a whole, but not to individuals, participants, or entities.

Appendix B: CEC Evaluation Logic Model



Appendix C: Site Visit Methodology

Initial site visits were conducted at each of the 13 Wave 1 ESCOs in PY1. Corporate representatives from the four dialysis organizations with Wave 1 ESCOs (DaVita, DCI, Fresenius, and Rogosin) and nephrologists and facility staff engaged in the ESCOs were interviewed during these site visits.

For the PY3 site visits, we met with corporate representatives at each of the Wave 1 ESCOs a second time to identify changes in implementation and to hear ESCOs' perspectives on impacts of the initial years of the model as well as the scalability and sustainability of the model.

A. Selection Criteria

For the PY3 site visits, we sampled two to four facilities from each Wave 1 ESCO. Selection focused on facilities that originally joined the model at the start of PY1 on October 1, 2015; we did not include Wave 1 facilities that joined after this date (i.e., at the start of PY2 or PY3). A number of criteria were taken into account in sampling facilities, with the primary goal of ensuring diversity across facilities. The specific metrics and characteristics considered were:

- Change in total costs between 2016 and 2017: All Wave 1 facilities were categorized based on total average per beneficiary per month (PBPM) costs at baseline in 2016 (high vs. low in comparison to other facilities within their ESCO) and in terms of PBPM costs in 2017 (decreased costs vs. no change in or increased costs from baseline).
- Change in quality metrics between 2016 and 2017: We examined percent change in the rate of hospitalizations, readmissions, emergency department visits, and mortality.
- Facility characteristics: Selected facilities included those that had participated in a prior site visit in PY1 as well as those that had not. Other facility characteristics considered were location (rural/urban) and facility size (number of dialysis stations and number of beneficiaries).
- Beneficiary characteristics: We looked at the percentage of beneficiaries who are White, beneficiaries' average number of months on dialysis, and the percentage of beneficiaries new to dialysis.

A breakdown of the metrics and characteristics of site visit facilities is displayed in **Exhibit C-1**. In total, 34 facilities were selected for the PY3 site visits.

Exhibit C-1. Characteristics of Wave 1 ESCO Facilities Selected for PY3 Site Visits

Characteristics		PY3 Site Visit Facilities (N=34)	
		#	%
Total PBPM Costs in 2016 (Baseline)^‡	Lower Baseline Costs	16	47.1%
	Higher Baseline Costs	18	52.9%
Facility Had Prior Site Visit	Yes	13	37.1%
	No	21	60.0%
*Number of Dialysis Stations at Facility**	0-22	15	44.1%
	23+	19	55.9%
*Beneficiary Volume at Facility**	0-71	18	52.9%
	72+	16	47.1%
*Percent of Beneficiaries Who are White**	<41%	20	58.8%
	41%+	14	41.2%
*Beneficiary Average Months on Dialysis**	<69 months	17	50.0%
	69+ months	17	50.0%

Notes: ^ PY1 site visit facilities are summarized in terms of baseline (2016) costs only. Costs shown are PBPM.
‡ Lower and higher baseline costs were determined based on the top and bottom 1/3 of facilities within each ESCO. Four facilities with moderate costs (middle 1/3) were grouped with high or low because they had borderline costs and/or provided unique characteristics (e.g., demonstrated across-the-board reductions in utilization and costs).
* Reference points based on bottom and top 1/2 of all Wave 1 facilities that joined in PY1.

B. Data Collection Procedures

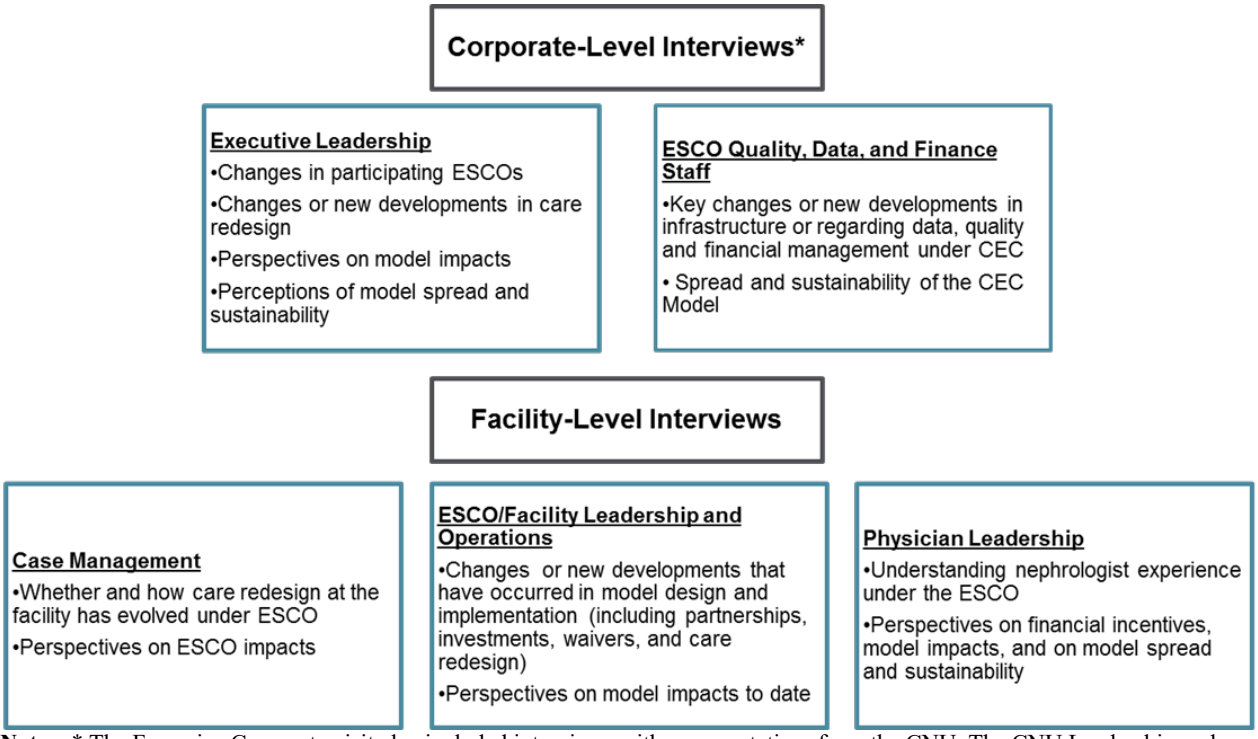
Dialysis organizations and ESCO staff were asked to identify staff members involved in the operation of the selected dialysis facilities and in their facility's implementation of ESCO-related programs; staff members involved in the coordination of care within and beyond the dialysis facility;[1] and ESCO co-owner physicians engaged in ESCO implementation and in delivery of direct patient care. ESCO dialysis facility visits included 45- to 75-minute interview sessions with physician leaders, facility operations staff, and case managers. Corporate site visits included 90-minute interview sessions with executive leaders and data, quality, and financial management staff. The Fresenius Corporate visit also included interviews with representatives from the Care Navigation Unit (CNU), Fresenius's central telephonic nursing branch. CNU interviews were 90 minutes each and were separated into leadership and operations staff and case management staff. All interviews were audio recorded and transcribed.

C. Protocol Development

Separate interview protocols were developed for each type of respondent, as shown in **Exhibit C-2**. Separate protocols were used so that questions were framed appropriately for each interviewee type, to improve consistency in question delivery, and to facilitate comparison of interview findings across sites. Protocols were approved by the Centers for Medicare & Medicaid Services (CMS) prior to conducting the site visits.

[1] Coordination of care activities included but were not limited to scheduling dialysis treatments, scheduling outpatient physician visits, arranging transportation, delivering patient education, conducting post-hospitalization follow-up, and other related services.

Exhibit C-2. Main Interview Types and Content Addressed



Notes: * The Fresenius Corporate visit also included interviews with representatives from the CNU. The CNU Leadership and Operations interview addressed the structure and function of the CNU as well as changes in implementation, perspectives on impact, and perceptions of model sustainability. The CNU Case Management interview addressed CNU organization, roles of staff, training of staff, interaction of CNU staff with other stakeholders, and perceptions of impacts of the CNU on ESCOs.

D. Analysis

Site visit interview transcripts were managed and analyzed in ATLAS.ti version 7.5.16, a commercially available qualitative data analysis software package. An initial set of high-level or "parent" codes was developed using the logic model developed for this evaluation (shown in **Appendix B**), site visit protocols, and findings from site visits conducted in PY1 and PY2. As a first step in the coding process, the initial code list was applied to the same single transcript to evaluate and refine the initial set of codes and identify and resolve coding instructions in need of clarification. Following application of the high-level codes, a more detailed set of codes ("child codes") was then developed under each parent code and applied to all transcripts. Coders met regularly to discuss questions or issues that emerged during coding. Ultimately, coded material was reviewed to identify major patterns and themes in interviewees' responses as well as any differences among dialysis organization and/or associated ESCOs and facilities.

Appendix D: Beneficiary Focus Group Methodology

Between October 18, 2018 and December 6, 2018, we conducted focus groups with beneficiaries aligned to the CEC Model to assess the impact of the model on their experience of dialysis. Specifically, the research objectives were to:

- Obtain insights into beneficiaries' care experience, including
  - Perceptions of the dialysis facility
  - Communications with dialysis facility staff
  - Coordination of care for other health conditions
  - Access to care and other services offered by the dialysis facility, and
- Understand the impact of the CEC Model.

A. Selection Criteria and Beneficiary Recruitment

Beneficiary focus groups were held at four of the PY3 Wave 1 ESCO site visits (DaVita South Florida, Rogosin, DCI Metropolitan, and Fresenius Charlotte), as described in **Appendix C**. Two of the ESCOs (DaVita South Florida and Rogosin) previously hosted a focus group during PY1 site visits. Within each ESCO selected for a focus group in PY3, the location of the focus group was selected from a subset of dialysis facilities chosen for site visits. ESCO leadership determined which specific facility would host the focus group based on the availability of space to accommodate the group. Although each focus group was conducted at only one facility within an ESCO, beneficiary participants may have been from any ESCO-participating facility.

Because some attrition was anticipated due to changes in beneficiary interest/availability, we attempted to recruit 10 beneficiaries for each focus group, with the goal of hosting a total of 6-8 beneficiaries per group. To facilitate recruitment, an ESCO staff member provided a list of CEC beneficiaries who received in-center hemodialysis from the facility hosting the focus group or from a nearby CEC facility. Our focus group recruiter contacted the beneficiaries via telephone and used a screening questionnaire to solicit their eligibility for and interest in participating in the focus group. An attempt was made to schedule participants who were not having dialysis on the day of the focus group. Transportation to and from the focus group location was provided if needed.

B. Data Collection and Analysis

Each focus group session lasted approximately 90 minutes and was moderated by an experienced independent facilitator. Lewin research team members observed the focus groups from the periphery of the room and were given an opportunity to have the facilitator ask participants additional questions or obtain specific clarifications during the last 10 minutes of the focus group. Participants were offered breakfast or lunch (depending on the timing of the focus group) and were given a $75 gift card for their participation at the end of the focus group.

The structure of each beneficiary focus group session is displayed in **Exhibit D-1**.

Exhibit D-1. Beneficiary Focus Group Discussion Flow

Activity	Descriptions
Welcome and Moderator Introduction	The Facilitator explained that she was employed by an independent company and that information was being collected for research purposes. The facilitator also obtained participant informed consent and permission to record the session.
Ground Rules	The Facilitator encouraged maximum participation and reminded participants that there are no right or wrong answers, to speak one at a time, and that their anonymity would be preserved.
Participant Introductions (10 minutes)	Participants introduced themselves by first name only and provided brief information about their length of time on and location of dialysis.
Open Discussion (75 minutes)	The Facilitator encouraged participants to discuss their likes and dislikes about the dialysis care they receive, changes in care over time, and awareness of the ESCO. The focus group protocol was organized as follows: ▪ Part 1: Perceptions of Dialysis Facility ▪ Part 2: Communication and Relationship with Nephrologists ▪ Part 3: Communication and Relationship with Dialysis Facility Staff ▪ Part 4: Awareness of ESCO
Discussion Wrap-Up	The Facilitator ended the session by summarizing the key points heard during the discussion and offered an opportunity for participants to ask any final questions. The group was then closed.

All focus groups were audio-recorded. The facilitator reviewed and summarized focus group recordings to identify the main themes across the focus groups.

Appendix E: Kidney Disease Quality of Life (KDQOL) Analysis Supplement

The Kidney Disease Quality of Life Survey (KDQOL-36™) analysis combined data from the CEC beneficiary sample and a matched comparison group of beneficiaries.

A. CEC Beneficiary Sample

The KDQOL-36™ CEC beneficiaries sample was selected from the cohort of beneficiaries who were both aligned to a CEC facility and satisfied the CEC eligibility criteria as of March 31, 2018. Among ESCOs with less than 500 aligned beneficiaries, all aligned and eligible beneficiaries were included in the survey sample. Among ESCOs with 500 or more aligned beneficiaries, beneficiaries were sampled to ensure representativeness across select characteristics (i.e., age, race/ethnicity, ZIP code, and gender) relative to the population of aligned CEC beneficiaries in the ESCO.

B. Comparison Group Sample

The KDQOL-36™ comparison group sample was selected to minimize the differences between the pool of CEC and comparison beneficiaries receiving a survey and to maximize the number of comparison beneficiaries receiving a survey within the targeted limit of 18,122 comparison beneficiaries. The target number of comparison beneficiaries (n=18,122) was chosen to match the number of CEC beneficiaries surveyed.[2]

To select comparison beneficiaries for the KDQOL-36™ survey sample, we used propensity score matching (PSM) and Mahalanobis distance matching (MDM), both without replacement. Each CEC beneficiary was matched to one distinct CEC-eligible beneficiary who was not aligned to a CEC facility. The beneficiary-level PSM models were stratified by organizational alignment (DaVita, DCI, Fresenius, CDC, Rogosin, NKC, and Atlantic) and Medicare enrollment as of October 2017 (i.e., patients new to Medicare versus existing patients) to maximize the quality of comparison matches within each cohort. Each stratum used a separate matching model that included only the pool of CEC-eligible beneficiaries applicable to that strata (i.e., total of 14 models). For example, a CEC stratum included existing beneficiaries aligned to a given organization (e.g., DaVita) while the potential comparison pool for that cohort included existing beneficiaries aligned to a non-CEC facility from the same organization (e.g., DaVita), based on the simulated alignment.[3]

PSM models were used for each cohort except when the pool of CEC and comparison beneficiaries were small. Models for new patients for CDC, Rogosin, NKC, and Atlantic were small, so we applied MDM instead of PSM. The propensity score and Mahalanobis distance was based on beneficiary characteristics like demographics and comorbid conditions, facility characteristics, and market characteristics, as outlined in **Exhibits E-1** and **E-2**. The covariates for each model varied to accommodate strata with small sample sizes. In addition, we excluded

[2] Each of the five subscale models achieved the minimum sample size (n=10,500) required to detect an increase in the average score of five points based on the stated sample size calculation criteria (i.e., 80% power, type 1 error level of 10% for a one-sided hypothesis test).

[3] We simulated alignment based on CEC Model rules (see **Appendix F** for additional details).

characteristics from select models when there was little or no variation (e.g., no beneficiaries in a chronic condition category) that resulted in model convergence issues.

Exhibit E-1. Characteristics Included in Matching Models for Existing Beneficiaries

Model Type/Characteristics	DaVita PSM	DCI PSM	Fresenius PSM	Rogosin PSM	NKC PSM	Atlantic PSM	CDC PSM
Sex: Female	X	X	X	X	X	X	X
Age: 55 – 64	X	X	X	X	X	X	X
Age: 65 – 74	X	X	X	X	X	X	X
Age: 75+	X	X	X	X	X	X	X
Race/ Ethnicity: Black	X	X	X	X	X	X	X
Race/ Ethnicity: Hispanic	X	X	X	X	X	X	X
Race/ Ethnicity: Other	X	X	X	X	X	X	X
Hemodialysis Indicator	X	X	X	X	X	X	
Peritoneal Indicator	X	X	X	X	X		
Months on Dialysis	X	X	X	X	X		X
Alzheimer's Disease	X	X	X		X	X	X
Cancer	X	X	X		X	X	X
Diabetes	X	X	X		X	X	X
Glaucoma	X	X	X		X	X	X
Osteoporosis	X	X	X		X	X	X
Medicaid Indicator	X	X	X	X	X	X	X
Member Months (2017)	X	X	X	X	X	X	X
Original Reason for Entitlement Code (OREC): Aged into Medicare	X	X	X	X	X		X
OREC: ESRD into Medicare	X	X	X	X	X		X
OREC: Disabled into Medicare	X	X	X	X	X		X
OREC: Both ESRD & Disabled into Medicare	X	X	X	X	X		X
Facility: Patient Count	X	X	X		X	X	X
Facility: Profit Indicator	X	X	X				
Facility: Late Shift Indicator	X	X	X				X
Facility: Peritoneal Dialysis Indicator	X	X	X				
Facility: Home Hemodialysis Indicator	X	X	X				
Facility: Percent Hemoglobin less than 10	X	X	X				
Facility: Percent Patients with Fistula	X	X	X			X	
Facility: Standardized Hospitalization Ratio (SHR)	X	X	X			X	X
Facility: Standardized Readmission Ratio (SRR)	X	X	X			X	X
Core-Based Statistical Area (CBSA): Median Household Income	X	X	X				
CBSA: Primary Care Providers (PCPs) per 10,000	X	X	X				
CBSA: Dual Beneficiaries per 10,000	X	X	X				

Exhibit E-2. Characteristics Included in Matching Models for New Beneficiaries

Model Type/Characteristics	DaVita	DCI	Fresenius	Rogosin	NKC	Atlantic	CDC
	PSM	PSM	PSM	MDM	MDM	MDM	MDM
Sex: Female	X	X	X	X	X	X	X
Age: 55 – 64	X	X	X	X	X	X	X
Age: 65 – 74	X	X	X	X	X	X	X
Age: 75+	X	X	X	X	X	X	X
Race/ Ethnicity: Black	X	X	X	X	X	X	X
Race/ Ethnicity: Hispanic	X	X	X	X	X	X	X
Race/ Ethnicity: Other	X	X	X	X	X	X	X
Hemodialysis Indicator	X	X	X				
Peritoneal Indicator	X	X	X				
Months on Dialysis							
Alzheimer's Disease							
Cancer							
Diabetes							
Glaucoma							
Osteoporosis	X	X	X				
Medicaid Indicator	X	X	X				
Member Months (2017)		X					
OREC: Aged into Medicare	X	X	X				
OREC: ESRD into Medicare	X	X	X				
OREC: Disabled Into Medicare	X	X	X				
OREC: Both ESRD and Disabled into Medicare	X	X	X				
Facility: Patient Count	X	X	X				
Facility: Profit Indicator	X	X	X	X	X	X	X
Facility: Late Shift Indicator	X	X					
Facility: Peritoneal Dialysis Indicator		X	X				
Facility: Home Hemodialysis Indicator	X	X	X				
Facility: Percent Hemoglobin less than 10	X	X	X				
Facility: Percent Patients with Fistula	X	X	X				
Facility: SHR	X	X	X	X	X	X	X
Facility: SRR	X	X	X	X	X	X	X
CBSA: Median Household Income	X		X				
CBSA: PCPs per 10,000	X		X				
CBSA: Dual Beneficiaries per 10,000	X		X				

From the group of 18,122 CEC beneficiaries receiving the survey, we identified 16,531 CEC beneficiaries (91%) that could be used in our matching models. We required CEC beneficiaries to meet the following criteria: (1) non-missing beneficiary characteristics used in the matching models, (2) CEC-eligible as of March 2018, and (3) no evidence of death or kidney transplant through August 2018. Over all cohorts, we identified 158,827 beneficiaries eligible for the comparison pool. The potential comparison beneficiaries were aligned, based on simulated alignment, to non-CEC facilities and required to meet the same criteria.

To maximize the response rate, we favored comparison beneficiaries with a valid address. Our sampling method involved a number of steps. First, for each CEC beneficiary we identified the

three unique nearest neighbors based on PSM matching.[4] We selected 29,365 beneficiaries (93%) with a valid address and within a caliper of 1/2 of the standard deviation of the log-odds propensity score. Next, we ran PSM models to identify a unique comparison beneficiary with the same caliper restriction. In the end, 15,028 CEC beneficiaries (91%) were each matched to a unique comparison beneficiary.

From the remaining pool of 14,377 matched comparison beneficiaries with a valid address, we applied a selection approach to meet the target comparison sample of 18,222 comparison beneficiaries. We maintained the distribution of comparison beneficiaries across dialysis organizations from the original matched comparison sample. We selected 3,094 with a valid address within a caliper of 1/2 of the standard deviation of the log-odds propensity score. No caliper or distance restriction was applied to MDM models. Our final sample included 18,222 comparison beneficiaries. Each beneficiary had a valid address and 13,507 (75%) also had phone information. To assess the quality of the matching, we compared the standardized mean differences (SMDs) of the pool of CEC beneficiaries receiving the survey who were included in the matching models to the pool of selected comparison beneficiaries. The mean and standard deviation of the CEC and comparison groups, as well as the SMDs, are shown in **Exhibit E-3**. All but three of the characteristics (facility beneficiary count, facility peritoneal dialysis indicator, CBSA median household income, identified in **Exhibit E-3** below) used in matching had a small difference in means leading to absolute SMDs at or below 0.10.[5] The characteristic indicating the volume of beneficiaries at a facility, or generally facility size, was about 5% lower in the selected comparison group. The magnitude of the difference in facility size was not meaningful. The differences in peritoneal dialysis and median income were also of small magnitude. Overall, the survey recipients among each group were very similar.

Exhibit E-3. Standardized Mean Differences between CEC Beneficiaries Included in Matching Models and Sampled Non-CEC Comparison Beneficiaries

Characteristics	CEC Beneficiaries (N=15,028)		Comparison Beneficiaries (N=18,122)		Std. Mean Diff.
	Mean	Std. Dev.	Mean	Std. Dev.	
Sex: Female	0.44	0.50	0.44	0.50	-0.01
Age: 55-64	0.25	0.43	0.25	0.43	-0.01
Age: 65-74	0.27	0.44	0.27	0.44	0.01
Age: 75+	0.20	0.40	0.20	0.40	-0.02
Race/Ethnicity: Black	0.43	0.50	0.41	0.49	0.05
Race/Ethnicity: Hispanic	0.07	0.25	0.06	0.24	0.02
Race/Ethnicity: Other	0.08	0.28	0.08	0.28	0.00
Hemodialysis Indicator	0.94	0.23	0.94	0.24	0.03
Peritoneal Indicator	0.09	0.28	0.09	0.29	-0.01
Months on Dialysis	66.8	64.8	65.1	66.6	0.03
Alzheimer's Disease	0.02	0.14	0.02	0.14	0.00
Cancer	0.07	0.25	0.07	0.25	0.00

[4] We applied a caliper to exclude matches between CEC and comparison beneficiaries that had a difference in propensity score greater than 1/2 the standard deviation of the log-odds propensity score.

[5] In assessing the quality of the comparison group matching model, <0.2 was interpreted as a good match, and <0.1 was interpreted as a very good match.

Characteristics	CEC Beneficiaries (N=15,028)		Comparison Beneficiaries (N=18,122)		Std. Mean Diff.
	Mean	Std. Dev.	Mean	Std. Dev.	
Diabetes	0.67	0.47	0.67	0.47	0.00
Glaucoma	0.08	0.27	0.07	0.26	0.01
Osteoporosis	0.03	0.17	0.03	0.18	-0.01
Medicaid Indicator	0.55	0.50	0.54	0.50	0.01
Member Months (2017)	11.5	1.8	11.5	1.8	-0.01
OREC: Aged into Medicare	0.29	0.45	0.29	0.45	-0.02
OREC: ESRD into Medicare	0.29	0.46	0.29	0.45	0.00
OREC: Disabled Into Medicare	0.22	0.42	0.22	0.41	0.00
OREC: Both ESRD and Disabled into Medicare	0.20	0.40	0.20	0.40	0.01
Facility: Beneficiary Count	111.8	60.9	106.2	50.0	0.10*
Facility: Profit Indicator	0.82	0.38	0.81	0.39	0.03
Facility: Late Shift Indicator	0.31	0.46	0.29	0.46	0.03
Facility: Peritoneal Dialysis Indicator	0.46	0.50	0.53	0.50	-0.13*
Facility: Home Hemodialysis Indicator	0.31	0.46	0.35	0.48	-0.08
Facility: Percent Hemoglobin less than 10	0.13	0.07	0.14	0.09	-0.04
Facility: Percent Patients with Fistula	0.64	0.10	0.64	0.10	0.01
Facility: SHR	0.98	0.29	0.98	0.29	0.00
Facility: SRR	0.97	0.28	0.97	0.28	0.01
CBSA: Median Household Income	$56,732	$10,447	$55,169	$10,322	0.15*
CBSA: PCPs per 10,000	7.8	1.6	7.9	1.5	-0.01

Notes: * Indicates a standardized mean difference greater than 0.1 in absolute value. Any value below 0.1 is considered to be a negligible difference.

C. KDQOL-36™ Administration

The KDQOL-36™ survey was administered to two beneficiary groups by separate contractors following a similar protocol. The first group included a sample of beneficiaries who were aligned to a CEC facility by the end of March 2018 (i.e., including claims through March 2018 available in April 2018). These beneficiaries were surveyed by the CEC implementation contractor from May through August, 2018. The comparison group was surveyed by the CEC evaluation contractor following a similar survey protocol and included beneficiaries who were matched on clinical and demographic characteristics. The data collection for the 18,121 matched beneficiaries in the comparison group occurred from June through August, 2018 with 99% of the comparison group surveys completed by September 30, 2018.[6]

Survey data were collected via mail with telephone follow-up for non-responders. Beneficiaries received up to five mailings, beginning with an advance-notice letter that informed beneficiaries they would receive the KDQOL-36™ survey. The survey packet was then sent within roughly one week and included a postage-paid return envelope. Beneficiaries received a toll-free telephone number in the mailing for questions about the survey or to request a Spanish-language survey. A web address that permitted completion of the survey online was included. All cover letters were sent in both English and Spanish. A Spanish survey was included in mailings to

[6] One duplicate beneficiary was identified and removed bringing the final sample of comparison beneficiaries that were surveyed to 18,121.

beneficiaries whose ZIP code was in an area identified as having a higher probability of being Spanish-speaking. A second survey packet was sent about one month after the first survey packet. Computer-Assisted Telephone Interviews (CATI)—available in both English and Spanish—began approximately one month after the second survey was mailed. A maximum of six telephone attempts were made, staggered by time of day and day of week, before discontinuing further contact.

The KDQOL-36™ survey questions for the Physical Component Summary (PCS) and the Mental Component Summary (MCS) measures are displayed in **Exhibit E-4**. The SAS code, which is publicly available on the Research and Development Corporation (RAND) website,[7] was used for rescaling responses and deriving the scores.

Exhibit E-4. KDQOL-36™ Measures used in the PCS and the MCS Scores*

Question	Response
1. In general, would you say your health is:	(1) Excellent, (2) Very good (3) Good (4) Fair (5) Poor
The following items are about activities you might do during a typical day. *Does your health now limit you in these activities? If so, how much?* 2. Moderate activities such as moving a table, pushing a vacuum cleaner, bowling or playing golf 3. Climbing several flights of stairs	(1) Yes, limited a lot (2) Yes, limited a little (3) No, not limited at all
During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health? 4. Accomplished less than you would like 5. Were limited in the kind of work or other activities	(1) Yes (2) No
During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? 6. Accomplished less than you would like 7. Didn't do work or other activities as carefully as usual	(1) Yes (2) No
8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?	(1) Not at all (2) A little bit (3) Moderately (4) Quite a bit (5) Extremely
These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks… 9. Have you felt calm and peaceful 10. Did you have a lot of energy 11. Have you felt downhearted and blue	(1) All of the time (2) Most of the time (3) A good bit of the time (4) Some of the time (5) A little of the time (6) None of the time

[7] https://www.rand.org/health/surveys_tools/kdqol.html

Question	Response
12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?	(1) All of the time (2) Most of the time (3) Some of the time (4) A little of the time (5) None of the time

Notes: * The PCS and MCS measures both use the same twelve questions; different weights are applied to the responses to derive the two scores.

The KDQOL-36™ survey questions for the Burden of Kidney Disease, Symptoms and Problems, and Effects of Kidney Disease measures are shown in **Exhibit E-5**.

Exhibit E-5. KDQOL-36™ Measures used in the Burden of Kidney Disease, Symptoms and Problems, and Effects of Kidney Disease Scale Scores

Category	Question	Response
Burden of Kidney Disease Questions	*How true or false is each of the following statements for you?* 13. My kidney disease interferes too much with my life 14. Too much of my time is spent dealing with my kidney disease 15. I feel frustrated dealing with my kidney disease 16. I feel like a burden on my family	(1) Definitely true (2) Mostly true (3) Don't know (4) Mostly false (5) Definitely false
Symptoms and Problems Questions	*During the past 4 weeks, to what extent were you bothered by each of the following?* 17. Soreness in your muscles 18. Chest pain 19. Cramps 20. Itchy skin 21. Dry skin 22. Shortness of breath 23. Faintness of breath 24. Lack of appetite 25. Washed out or drained 26. Numbness in hands or feet 27. Nausea or upset stomach 28. 28a. Problems with your access site [Hemodialysis] 28b. Problems with your catheter site [Peritoneal dialysis]	(1) Not at all bothered (2) Somewhat bothered (3) Moderately bothered (4) Very much bothered (5) Extremely bothered
Effects of Kidney Disease Questions	*Some people are bothered by the effects of kidney disease on their daily life, while others are not. How much does kidney disease bother you in each of the following areas?* 29. Fluid restriction 30. Dietary restriction 31. Your ability to work around the house 32. Your ability to travel 33. Being dependent on doctors and other medical staff 34. Stress or worries caused by kidney disease 35. Your sex life 36. Your personal appearance	(1) Not at all bothered (2) Somewhat bothered (3) Moderately bothered (4) Very much bothered (5) Extremely bothered

D. Analysis

Associations between the KDQOL-36™ measures and the CEC Model were estimated for CEC beneficiaries, relative to the matched comparison group, on each of five composite scores (PCS, MCS, Burden of Kidney Disease, Symptoms and Problems, and Effects of Kidney Disease) using an ordinary least squares (OLS) regression. Composite scores with higher values represent better self-reported quality of life. To account for non-response bias, the analysis used sample-balancing weights that were based on age, sex, and race/ethnicity to ensure that the distribution of these characteristics among respondents was similar to those of the original surveyed sample.[8] In addition, models used clustering at the facility level to account for correlation among beneficiaries treated at the same facility and robust standard errors.[9] Models explored controls for beneficiary characteristics (e.g., age, sex, race/ethnicity, and select clinical conditions[10]), facility characteristics (e.g., if facility had a late shift), and select geographic characteristics (e.g., median household income).[11] The variable selection process contained multiple steps, including examining bivariate models and stepwise variable selection. Specifically, these characteristics were explored as covariates in the OLS models to assess independent relationships between each characteristic with each of the five composite scores. A characteristic was included in a final model when it was retained in the stepwise variable selection.[12] In addition, select characteristics were retained in the final models even when they were not retained via stepwise variable selection if the variable was important for research purposes (e.g., age, race/ethnicity, and sex). The coefficients and indicators for statistically significant associations are displayed in **Exhibit E-10**. The coefficients for the CEC Model in the final regression models show the independent associations of the CEC Model with the composite scores after adjusting for associations between all other covariates in the models. A positive coefficient would suggest the CEC Model is associated with better self-reported quality of life measured by a particular score, relative to the comparison group.

E. Results

Response rates for CEC and comparison beneficiaries by demographic characteristics are shown in **Exhibit E-6**.

[8] Deming, W.E. (1943). Statistical Adjustment of Data. New York: Wiley.
[9] Robust standard errors were derived using White's correction.
[10] Conditions were based on (1) the CMS Chronic Conditions Data Warehouse (CCW) condition indicators, which are claims-based algorithms that identify beneficiaries with select clinical conditions and (2) information collected in CMS' ESRD Medical Evidence Report Medicare Entitlement and/or Patient Registration (CMS Form 2728). Full criteria for all CCW conditions are available at https://www.ccwdata.org/web/guest/condition-categories. CMS Form 2728 is available at https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/downloads/CMS2728.pdf.
[11] https://datawarehouse.hrsa.gov/topics/ahrf.aspx
[12] The Schwarz Bayesian information criterion was used in the stepwise variable selection to include variables that improved the fit of the model.

Exhibit E-6. Response Rates by Demographic Characteristics

Characteristics		CEC (N=18,122)		Comparison (N=18,121)	
		N	%	N	%
Age	18 to 54	1,347	29.3	1,190	25.5
	55 to 64	1,807	40.5	1,540	34.5
	65 to 74	2,196	43.7	2,032	41.9
	75+	1,783	44.4	1,993	48.4
Race/ Ethnicity	Black	2,795	35.6	2,299	31.1
	Other	827	34.9	759	31.3
	White	3,399	44.9	3,630	45.0
Sex	Female	3,981	39.3	3,686	36.6
	Male	3,152	39.6	3,069	38.1
Total		7,135	39.4	6,756	37.3

Notes: Ns do not always sum to total due to missing values; Lewin computed CEC response rates from raw data provided by the CEC implementation contractor. Hispanic is included in the Other category in this table.

Characteristics of respondents by group and weighted respondents are displayed in **Exhibits E-7** and **E-8**.

Exhibit E-7. Characteristics by Respondent Group and Weighted Respondents

Characteristics		Total				CEC					Comparison				
		Surveyed (N=36,243)		Respondents (N=13,891)		Surveyed (N=18,122)		Respondents (N=7,135)			Surveyed (N=18,121)		Respondents (N=6,756)		
		N	%	N	%	N	%	N	%	%w	N	%	N	%	%w
Age	<65	18,209	50.2	5,884	42.4	9,067	50.0	3,154	44.2	50.1	9,142	50.4	2,730	40.4	50.5
	65 to 85	15,930	44.0	7,065	50.9	8,008	44.2	3,537	49.6	44.2	7,922	43.7	3,528	52.2	43.7
	85 +	2,081	5.7	939	6.8	1,029	5.7	442	6.2	5.7	1,052	5.8	497	7.4	5.8
Sex	Female	20,209	55.8	7,667	55.2	10,141	56.0	3,981	55.8	56.1	10,068	55.6	3,686	54.6	55.6
	Male	16,011	44.2	6,221	44.8	7,963	43.9	3,152	44.2	43.9	8,048	44.4	3,069	45.4	44.4
Race/ Ethnicity	Black	15,247	42.1	5,094	36.7	7,855	43.3	2,795	39.2	43.4	7,392	40.8	2,299	34.0	40.8
	White	15,642	43.2	7,029	50.6	7,574	41.8	3,399	47.6	41.8	8,068	44.5	3,630	53.7	44.5
	Hispanic	2,322	6.4	780	5.6	1,164	6.4	454	6.4	6.4	1,158	6.4	326	4.8	6.4
	Other	3,009	8.3	985	7.1	1,511	8.3	485	6.8	8.3	1,498	8.3	500	7.4	8.3
Conditions	Alzheimer's Disease and Related Conditions	6,365	17.6	1,854	13.3	3,274	18.1	965	13.5	12.7	3,091	17.1	889	13.2	11.9
	Ambulation	1,271	3.5	370	2.7	628	3.5	185	2.6	2.5	643	3.5	185	2.7	2.5
	Atrial Fibrillation	5,819	16.1	2,385	17.2	2,884	15.9	1,190	16.7	15.6	2,935	16.2	1,195	17.7	15.4
	Congestive Heart Failure (CHF)	22,095	61.0	8,070	58.1	11,047	61.0	4,190	58.7	57.8	11,048	61.0	3,880	57.4	55.8
	Depression	10,051	27.7	3,315	23.9	4,929	27.2	1,675	23.5	23.0	5,122	28.3	1,640	24.3	23.6
	Diabetes	25,544	70.5	9,622	69.3	12,803	70.6	4,998	70.0	69.5	12,741	70.3	4,624	68.4	68.0
	Ischemic Heart Disease	22,505	62.1	8,648	62.3	11,330	62.5	4,457	62.5	61.1	11,175	61.7	4,191	62.0	59.8
	Rheumatoid Arthritis and Osteoarthritis	13,370	36.9	5,293	38.1	6,761	37.3	2,725	38.2	36.9	6,609	36.5	2,568	38.0	35.8
	Smoking	2,411	6.7	789	5.7	1,211	6.7	404	5.7	5.9	1,200	6.6	385	5.7	6.0
	Stroke	3,689	10.2	1,192	8.6	1,984	10.9	644	9.0	8.9	1,705	9.4	548	8.1	7.9
Medicaid Status	Full	12,281	33.9	3,936	28.3	6,108	33.7	2,092	29.3	30.9	6,173	34.1	1,844	27.3	30.3
	Partial	3,785	10.4	1,466	10.6	1,842	10.2	775	10.9	11.6	1,943	10.7	691	10.2	11.4
	None	20,177	55.7	8,489	61.1	10,172	56.1	4,268	59.8	57.5	10,005	55.2	4,221	62.5	58.3

Characteristics		Total				CEC					Comparison				
		Surveyed (N=36,243)		Respondents (N=13,891)		Surveyed (N=18,122)		Respondents (N=7,135)			Surveyed (N=18,121)		Respondents (N=6,756)		
		N	%	N	%	N	%	N	%	%W	N	%	N	%	%W
Medicare Entitlement	Age	10,569	29.2	4,911	35.4	5,295	29.2	2,410	33.8	30.0	5,274	29.1	2,501	37.0	30.1
	Disability	8,004	22.1	2,791	20.1	4,021	22.2	1,467	20.6	20.6	3,983	22.0	1,324	19.6	19.8
	ESRD	10,460	28.9	3,671	26.4	5,203	28.7	1,958	27.4	29.8	5,257	29.0	1,713	25.4	29.2
	ESRD + Disability	7,170	19.8	2,512	18.1	3,572	19.7	1,297	18.2	19.6	3,598	19.9	1,215	18.0	20.9
Facility	For Profit	28,953	79.9	11,045	79.5	14,333	79.1	5,639	79.0	79.2	14,620	80.7	5,406	80.0	80.3

Notes: Ns do not always sum to total due to missing values. The W subscript (i.e., %W and Mean W) denote weighted responses; the analysis used sample-balancing weights to ensure the distribution of these characteristics (e.g., age, sex, and race/ ethnicity) was similar to the original surveyed samples to account for non-response. Conditions were based on (1) the Chronic Conditions Data Warehouse (CCW) condition indicators, which are claims-based algorithms that identify beneficiaries with select clinical conditions and (2) CMS' ESRD Medical Evidence Report Medicare Entitlement and/or Patient Registration (CMS Form 2728). Full CCW criteria are available at https://www.ccwdata.org/web/guest/condition-categories. CMS-2728 is available at https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/downloads/CMS2728.pdf.

Exhibit E-8. Characteristics by Respondent Group and Weighted Respondents

Characteristic	Total				CEC					Comparison				
	Surveyed (N=36,243)		Respondents (N=13,891)		Surveyed (N=18,122)		Respondents (N=7,135)			Surveyed (N=18,121)		Respondents (N=6,756)		
	N	Mean	N	Mean	N	Mean	N	Mean	Mean	N	MeanW	N	Mean	MeanW
Hierarchical Condition Category (HCC) Score	35,761	1.1	13,696	1.1	17,647	1.1	6,942	1.1	1.1	18,114	1.1	6,754	1.1	1.0

Notes: Ns do not always sum to total due to missing values. The W subscript (i.e., %W and Mean W) denote weighted responses; the analysis used sample-balancing weights to ensure the distribution of these characteristics (e.g., age, sex, and race/ ethnicity) was similar to the original surveyed samples to account for non-response. Hierarchical Condition Category (HCC) scores were derived based on version 21 of CMS' ESRD risk adjustment model.

The five main KDQOL-36™ composite scores and the samples used for each measure in the final weighted regression models are depicted in **Exhibit E-9**.

Exhibit E-9. Summary Statistics for KDQOL-36™ Outcomes Based on Regression Sample (Weighted)

Measure	N	Mean	SD	Min	Max
Physical Component Summary (PCS)	10,273	33.8	16.2	11.0	64.0
Mental Component Summary (MCS)	10,273	47.7	18.1	10.8	72.3
Symptoms and Problems	13,423	71.5	29.6	0.0	100.0
Effect of Kidney Disease	13,402	63.2	39.0	0.0	100.0
Burden of Kidney Disease	13,443	43.6	47.5	0.0	100.0

Regression results for the five main KDQOL-36™ measures are displayed in **Exhibit E-10**.

Exhibit E-10. Regression Results for the Five KDQOL-36™ Measures

Explanatory Variable	Category	Estimate+				
		PCS (N=10,273)	MCS (N=10,273)	Burden of Kidney Disease (N=13,443)	Effects of Kidney Disease (N=13,402)	Symptoms and Problems (N=13,423)
Intercept		40.7***	52.4***	54.1***	70.1***	81.5***
CEC (vs. Comparison)	CEC	0.9***	0.2	0.6	2.8***	1.4***
Age (vs. < 65)	65 to 84	0.1	1.1***	4.5***	6.3***	3.2***
	85 +	-1.3***	0.4	3.4***	9.2***	4.1***
Sex (vs. Male)	Female	-1.1***	0.2	3.8***	3.6***	-1.0***
Race/Ethnicity (vs. White)	Black	2.1***	0.7***	5.9***	4.2***	0.3
	Hispanic	1.1**	-2.4***	-7.9***	-5.3***	-3.8***
	Other	1.5***	-1.3***	-6.2***	-4.2***	-2.4***
HCC Score	Continuous	-3.3***	-2.8***	-8.4***	-7.9***	-5.2***
Conditions (vs. Not Having Select Condition)	Alzheimer's and Related Conditions	n/a	n/a	-3.3***	n/a	n/a
	Ambulation	-2.1***	n/a	n/a	n/a	n/a
	Atrial Fibrillation	-0.9***	n/a	n/a	n/a	n/a
	CHF	-0.9***	n/a	n/a	-1.9***	-1.7***
	Depression	-1.5***	n/a	-10.2***	-8.2***	-5.3***
	Diabetes	-1.8***	n/a	-2.1***	-1.8***	n/a
	Ischemic Heart Disease	-0.8***	n/a	n/a	n/a	-1.4***
	Rheumatoid Arthritis and Osteoarthritis	-2.5***	-1.1***	-2.3***	-2.7***	-3.1***
	Smoking	n/a	-1.9***	n/a	n/a	n/a
	Stroke	n/a	-1.6***	n/a	n/a	n/a
Medicaid Status (vs. None)	Partial	n/a	-0.2	n/a	1.7**	-1.2**
	Full	n/a	-1.6**	n/a	-1.4***	-2.9***
Medicare Entitlement (vs. Age)	ESRD	-0.3	-0.8**	n/a	n/a	n/a
	Disability	-1.8***	-1.8***	n/a	n/a	n/a
	Disability + ESRD	-0.9***	-1.2***	n/a	n/a	n/a

Explanatory Variable	Category	Estimate+				
		PCS (N=10,273)	MCS (N=10,273)	Burden of Kidney Disease (N=13,443)	Effects of Kidney Disease (N=13,402)	Symptoms and Problems (N=13,423)
For Profit (vs. Not for Profit)	Yes	n/a	n/a	-2.1***	n/a	n/a

Notes: * = p≤0.1, ** = p≤0.05, *** p≤0.01. (+) Estimates are the OLS regression coefficients. N/A denotes a variable that was not in a given model. The models retained characteristics selected via stepwise variable selection; demographic characteristics (i.e., age, race/ethnicity, and sex) and CEC were retained in all models for descriptive purposes. Conditions were based on (1) the CCW condition indicators, which are claims-based algorithms that identify beneficiaries with select clinical conditions and (2) CMS' ESRD Medical Evidence Report Medicare Entitlement and/or Patient Registration (CMS Form 2728). Full CCW criteria are available at https://www.ccwdata.org/web/guest/condition-categories. CMS Form 2728 is available at https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/downloads/CMS2728.pdf. HCC scores were derived based on version 21 of CMS' ESRD risk adjustment model.

Among respondents, higher PCS measure scores were associated with CEC participation, Black race, Hispanic ethnicity, and Other race/ethnicity (not White, Black, or Hispanic). Lower PCS measure scores were associated with older age (≥85 years); female sex; higher comorbidity (higher Hierarchical Conditional Category [HCC] score); being unable to ambulate, atrial fibrillation, congestive heart failure (CHF), depression, diabetes, ischemic heart disease, and rheumatoid arthritis or osteoarthritis; and having Medicare entitlement that originated from a disability and ESRD and disability.

Higher MCS measure scores were found in respondents 65 to 84 years of age and Black race. Lower MCS measure scores were associated with Hispanic ethnicity; Other race/ethnicity (not White, Black, or Hispanic); higher comorbidity; smoking, rheumatoid arthritis or osteoarthritis, and stroke; having full Medicaid benefits; and having Medicare entitlement that originated from disability and/or ESRD.

Being age 65 years or older, female sex, and Black race were associated with greater Burden of Kidney Disease measure scores. Lower Burden of Kidney Disease measure scores were associated with Hispanic ethnicity; Other race/ethnicity (not White, Black, or Hispanic); higher comorbidity (higher HCC score); Alzheimer's disease and related disorders, depression, diabetes, and rheumatoid arthritis or osteoarthritis; and being aligned to a for-profit facility.

Larger Effects of Kidney Disease measure scores were associated with CEC participation, age 65 years and older, female sex, Black race, and having partial Medicaid benefits. Smaller Effects of Kidney Disease measure scores were associated with Hispanic ethnicity; Other race/ethnicity (not White, Black, or Hispanic); higher comorbidity (higher HCC score); CHF, depression, diabetes, and rheumatoid arthritis or osteoarthritis; and having full Medicaid benefits.

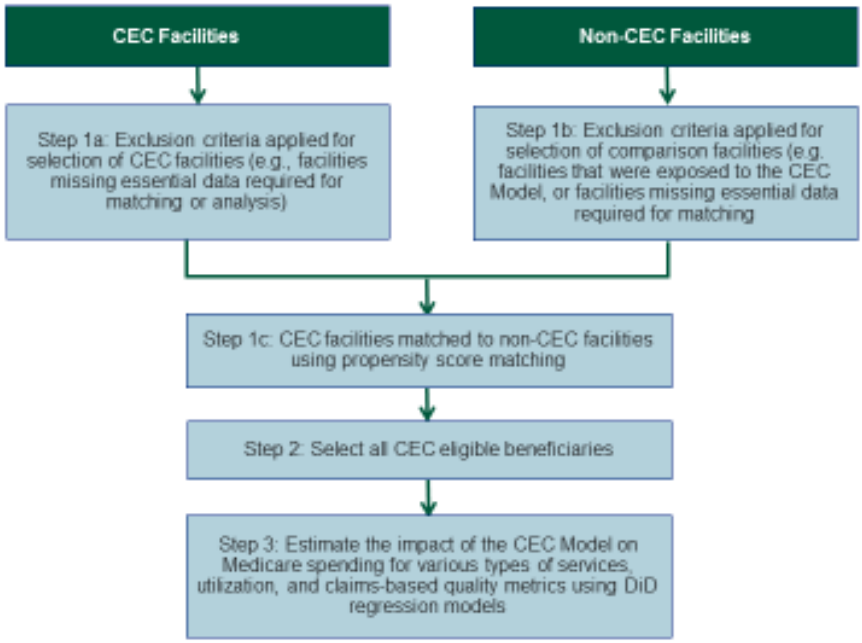
Higher Symptoms and Problems measure scores were associated with CEC participation and age 65 years and older. Lower Symptoms and Problems measure scores were associated with female sex; Hispanic ethnicity; Other race/ethnicity (not White, Black, or Hispanic); higher comorbidity (higher HCC score); CHF, depression, ischemic heart disease, and rheumatoid arthritis and osteoarthritis; and having full and partial Medicaid benefits.

Appendix F: Difference-in-Differences (DiD) Approach

The evaluation model relies on a non-experimental design, which uses a comparison group of non-CEC facilities and beneficiaries who would have been aligned to them under CEC rules, to infer counterfactual outcomes for CEC beneficiaries. The difference-in-differences (DiD) approach used in the evaluation is a statistical technique that quantifies the impact of an intervention by comparing changes in the intervention group (CEC beneficiaries) to changes in the comparison group.

The DiD approach was implemented in several steps, as shown in the flow chart in **Exhibit F-1**. First, we identified the pool of treatment and potential comparison facilities and used one-to-one PSM without replacement to select a comparison group of non-CEC facilities that is similar to the CEC facilities with respect to provider and market characteristics. Second, we applied the CEC Model rules to align eligible beneficiaries to both CEC and matched comparison facilities and assess their CEC eligibility status on a monthly basis. Beneficiaries aligned to either CEC participating or matched comparison facilities were included in our study population for every month they were also eligible for CEC. Finally, we used DiD regression models to identify the impact of the CEC Model on payments, utilization, and quality measures.

Exhibit F-1. DiD Implementation Steps



A. Data and Outcome Measures

Data used to evaluate the CEC Model are listed in **Exhibit F-2**.

Exhibit F-2. Data Sources

Data Source	Data Contents
▪ CEC Model Data	▪ CEC Participating Dialysis Facilities
▪ Master Data Management tool	▪ Beneficiary alignment to other shared savings programs (SSPs)
▪ CCW Virtual Research Data Center (VRDC) • Data from the CCW include Medicare claims for services provided between 1/1/2012 and 12/31/2018 that were processed by 4/5/2019[13]	▪ Claims for Medicare covered services
▪ Master Beneficiary Summary File (MBSF)	▪ Beneficiary characteristics, demographics, enrollment status, and chronic condition indicators[14,15]
▪ Consolidated Renal Operations in a Web-enabled Network (CROWNWeb)	▪ Complete patient histories at incidence of dialysis including: • Cause of ESRD • Information on dialysis care • Date of first dialysis • Pre-ESRD care
▪ Dialysis Facility Compare 2014-2018	▪ Facility Organization characteristics and quality metrics[16]
▪ Area Health Resource File (AHRF) (aggregated to CBSA defined by CMS Office of Management and Budget[17])	▪ Market Characteristics: ▪ Population size ▪ Economic and health care supply indicators
▪ The In-Center Hemodialysis Consumer Assessment of Healthcare Providers and Systems (ICH CAHPS)	▪ Patient experience with in-center hemodialysis care
▪ KDQOL-36™ Questionnaire	▪ Quality of life metrics

All the outcome measures evaluated in the report using a DiD methodology are defined in **Exhibit F-3**.

[13] Kidney transplants are an exception, which also included claims that ended in 2011 to assess the kidney transplant exclusion criterion in 2012 (i.e., excluded in the 12 months following the month of a transplant).
[14] The CCW condition indicators are claims-based algorithms that identify beneficiaries with select clinical conditions (e.g., diabetes, hyperlipidemia, hypertension, etc.): https://www.ccwdata.org/web/guest/condition-categories.
[15] The MBSF originates from the Common Medicare Environment (CME) tables.
[16] To minimize missing values, a facility's most recent Dialysis Facility Compare characteristics were used if a facility had no Dialysis Facility Compare data in a given year.
[17] We used the most recent version dated July 2016.

Exhibit F-3. DiD Measure Outcomes and Definitions

Outcome	Definition of the Outcomes
Admissions for CHF	Monthly beneficiary flag indicating acute care hospital (ACH) admission(s) with a principal diagnosis for CHF. ACH admissions are defined by Part A claims with claim type 60 or 61 and the 3rd digit of the CCN was 0, or the 3rd/4th digit of the CCN was 13. This measure follows the AHRQ specifications for PQI 08. ICD-10 codes are based on PQI 08 v7.0 AHRQ specifications, and ICD-9 codes are based on v6.0 AHRQ specifications. This measure is restricted to beneficiaries who were identified with CHF and at least 18 years old. CHF was defined using the CCW CHF_END variable having a value of 1 or 3 (i.e., satisfied claims criteria to identify condition by the end of the CY). Admissions are assigned to the month on the claim thru date. See https://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V70/TechSpecs/PQI_08_Heart_Failure_Admission_Rate.pdf
Admissions for Long-Term Diabetes Complications	Monthly beneficiary flag indicating ACH admission(s) with a principal diagnosis for long-term diabetes complications. ACH admissions are defined by Part A claims with claim type 60 or 61 and the 3rd digit of the CCN was 0, or the 3rd/4th digit of the CCN was 13. This measure follows the AHRQ specifications for PQI 03. ICD-10 codes are based on PQI 03 v7.0 AHRQ specifications, and ICD-9 codes are based on v6.0 AHRQ specifications. This measure is restricted to beneficiaries who were identified with diabetes and at least 18 years old. Diabetes was defined using the CCW DIAB_END variable having a value of 1 or 3 (i.e., satisfied claims criteria to identify condition by the end of the CY). Admissions are assigned to the month on the claim thru date. See https://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V70/TechSpecs/PQI_03_Diabetes_Long-term_Complications_Admission_Rate.pdf
Admissions for Short-Term Diabetes Complications	Monthly beneficiary flag indicating ACH admission(s) with a principal diagnosis for short-term diabetes complications. ACH admissions are defined by Part A claims with claim type 60 or 61 and the 3rd digit of the CCN was 0, or the 3rd/4th digit of the CCN was 13. This measure follows the AHRQ specifications for PQI 01. ICD-10 codes are based on PQI 01 v7.0 AHRQ specifications, and ICD-9 codes are based on v6.0 AHRQ specifications. This measure is restricted to beneficiaries who were identified with diabetes and at least 18 years old. Diabetes was defined using the CCW DIAB_END variable having a value of 1 or 3 (i.e., satisfied claims criteria to identify condition by the end of the CY). Admissions are assigned to the month on the claim thru date. See https://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V70/TechSpecs/PQI_01_Diabetes_Short-term_Complications_Admission_Rate.pdf
Arteriovenous (AV) Fistula Use	Monthly beneficiary flag indicating a beneficiary used an AV fistula for vascular access. This outcome is restricted beneficiaries who had been 90 days or longer on dialysis and requires hemodialysis to be the most recent dialysis modality in the month.
Catheter Use	Monthly beneficiary flag indicating a beneficiary had used catheter for 90 days or longer. This outcome is restricted to only hemodialysis beneficiaries with at least 90 days of hemodialysis.
Contraindicated Medications	Monthly beneficiary flag indicating a beneficiary was prescribed a medication that is contraindicated in patients with ESRD. The list of contraindicated medications includes: Narcotic Analgesics and Narcotic Antagonists (Meperidine, Propoxyphene), Antihypertensive and Cardiovascular Agents (Nitroprusside, Acetazolamide, Amiloride, Indapamide, Chlorothiazide, Chlorthalidone, Ethacrinic acid, Hydrochlorthiazide, Hydroflumethiazide, Polythiazide, Spironolactone, Thiazides, Triamterene, Mecamylamine, Phenoxybenzamine), Antimicrobial Agents (Methenamine mandelate, Nitrofurantoin, Nalidixic acid, Intravenous Itraconazole, Trimetrexate, Abacavir/Lamivudine, Cidofovir, Emtricitabine/Tenofovir, Lamivudine/Zidovudine, Ribavirin, Tenofovir, Valgancyclovir), Antineoplastic Agents (Carmustine, Topotecan), Medications for Arthritis and Gout (Penicillamine), Hypoglycemic Agents (Chlorpropamide, Gliclazide, Metformin), Hypolipidemic Agents (Bezafibrate, Clofibrate), Neuromuscular Agents (Gallamine, Pancuronium, Tubocurarine) Sedatives, Hypnotics and Other Drugs Used in Psychiatry (Ehtchlorvynol), and Miscellaneous Drugs (Acetohydroxamic acid, Cisapride, Clodronate, Desferoxamine, Anistreplase, Sulfinpyrazone, Tranexamic acid, Methsuximide, Quinine sulfate). This list was provided by nephrologists at the University of Michigan, who based their analysis on *Drug Dosing in Renal Failure*, Brier Michael E. and Aronoff, George R., eds., 5th Ed., American College of Physicians, 2007.

Outcome	Definition of the Outcomes
Dialysis Payments	Monthly standardized payments for dialysis services included under Medicare Part B. Includes claim type 40 and bill type 72X (Part B Institutional dialysis) and claim types 71, 72 and first two digits of Berenson-Eggers Type of Services (BETOS)=P9 (Part B non-institutional dialysis).
Dilated Eye Exam	Yearly beneficiary flag restricted to diabetic beneficiaries with ESRD that indicates a beneficiary had at least one diabetic retinal eye exam. This indicator is based on Part B institutional and non-institutional claims with a diagnosis or procedure code for the exam. Month is based on the last expense date for non-institutional claims and revenue center date for institutional claims. These methods are intended to align with the US Renal Data System (USRDS) methods and are based on codes listed in the USRDS Annual Reports (2012+) Volume 2 ESRD Analytic Methods.
Number of ED Visits	Monthly beneficiary count of outpatient ED claims/visits (i.e., did not result in inpatient hospitalization). Based on Part B Institutional claims that have a claim line with a revenue center code starting with 045. ED visit counted in the month of the revenue center date on the claim line.
ED Visits within 30-days of an Acute Hospitalization	Beneficiary flag indicating a beneficiary had at least one outpatient ED claim/visit (i.e., did not result in inpatient hospitalization) within 30-days of an acute inpatient hospital stay. The 30-days is based on the difference between the discharge date on the inpatient hospitalization and the claim from date of the outpatient claim. When an ED visit occurred within 30-days of an inpatient hospitalization, the event is counted in the month of the claim thru date of the hospitalization. This outcome applies only to beneficiaries who had an inpatient hospitalization.
Emergency Dialysis	Monthly beneficiary flag indicating that a beneficiary received at least one outpatient emergency dialysis service. These are identified on Part B Institutional claim lines with a G0257 procedure code (unscheduled or emergency dialysis treatment for a patient with ESRD in a hospital outpatient department that is not certified as an ESRD facility). Each claim line with the G0257 code is counted as one service.
Hospitalization for ESRD Complications	Monthly beneficiary flag indicating that a beneficiary had at least one admission with a principal diagnosis for ESRD complication. Admission was based on an inpatient claim (i.e., all claim types 60/61). Complications include volume depletion, hyperpotassemia, fluid overload, heart failure, and pulmonary edema. An ESRD complication was based on ICD-9 diagnosis codes 27650, 27651, 27652, 2767, 27669, 40403, 40413, 40493, 5184, 514, 4281, 428x (i.e., first three digits are 428) and ICD-10 diagnosis codes E860, E861, E869, E875, E8770, E8779, I132, J810, J811, I50x (i.e., first three digits are I50).
Payments for Hospitalization for ESRD Complications	Monthly standardized payments from inpatient admissions (i.e., all claim types 60/61) with a principal diagnosis for ESRD complication. Complications include volume depletion, hyperpotassemia, fluid overload, heart failure, and pulmonary edema. An ESRD complication was based on ICD-9 diagnosis codes 27650, 27651, 27652, 2767, 27669, 40403, 40413, 40493, 5184, 514, 4281, 428x (i.e., first three digits are 428) and ICD-10 diagnosis codes E860, E861, E869, E875, E8770, E8779, I132, J810, J811, I50x (i.e., first three digits are I50).
Flu Vaccination	Seasonal beneficiary influenza vaccination flag that indicates a beneficiary had at least one influenza vaccination during the flu season months (i.e., August through April). Influenza vaccinations are based on Part B institutional and non-institutional claims with a with a CPT or HCPCS code. Healthcare Common Procedure Coding System (HCPCS).
Hemoglobin A1c (HbA1c) Test	Yearly indicator restricted to diabetic beneficiaries with ESRD that indicates a beneficiary had at least one HbA1c test. This indicator is based on Part B institutional and non-institutional claims with a procedure code for the test. Month is based on the last expense date for non-institutional claims and revenue center date for institutional claims. These methods are intended to align with the USRDS methods and are based on codes listed in the USRDS Annual Reports (2012+) Volume 2 ESRD Analytic Methods.
Hemodialysis	Monthly beneficiary flag indicating that a beneficiary received at least one inpatient and or home hemodialysis services and is based on positive non-standardized hemodialysis dialysis payments.

Outcome	Definition of the Outcomes
Home Dialysis	Monthly beneficiary flag indicating a beneficiary had at least one home dialysis service. Home dialysis is based on a Part B Institutional claim with a related condition sequence code of 74, 75, or 80. 74 = Home - Billing is for a patient who received dialysis services at home. 75 = Home 100% reimbursement - (not to be used for services after 4/15/90) The billing is for home dialysis patient using a dialysis machine that was purchased under the 100% program. 80 = Home Dialysis - Nursing Facility - Home dialysis furnished in a skilled nursing facility (SNF) or nursing facility. (eff. 4/4/05) [Source: https://www.resdac.org/cms-data/variables/claim-related-condition-code]
Home Health Payments	Monthly standardized payments for home health services (claim type 10).
Home Hemodialysis	Monthly beneficiary flag that indicates a beneficiary received at least one home hemodialysis services. The outcome is conditional on the beneficiary receiving hemodialysis services in the month and is based on positive non-standardized hemodialysis dialysis payments.
Hospice Payments	Monthly standardized payments for hospice services (claim type 50).
Hospital Outpatient Payments	Monthly standardized payments for Part B outpatient services. This measure includes all claim type 40 that are not imaging (P_B_IMG), dialysis (P_B_DIALYSIS), or therapy (P_B_THERAPY); this includes hospital outpatient (bill type 13x, 85x), clinics (bill type 71x, 73x, 77x), and all other Part B institutional services (services covered under Part B for inpatients that exhausted Part A coverage [bill type 12x], SNF [22x, 23x], community mental health center [76x], other Part B home health services [34x], home health services [14x], and Indian health services [83x]).
Number of Hospitalizations	Monthly beneficiary count of inpatient hospital stays in the month. Includes all inpatient claims based on claim type 60.
Low-Density Lipoprotein (LDL) Cholesterol Test	Yearly beneficiary indicator restricted to diabetic beneficiaries with ESRD that indicates a beneficiary had at least one LDL cholesterol test. This indicator is based on Part B institutional and non-institutional claims with a procedure code for the test. Month is based on the last expense date for non-institutional claims and revenue center date for institutional claims. These methods are intended to align with the USRDS methods and are based on codes listed in the USRDS Annual Reports (2012+) Volume 2 ESRD Analytic Methods.
Observation Stays	Monthly beneficiary count of the number of observation stays in the month. The outpatient observation is based on a Part B Institutional claim with a HCPCS code of G0378 or G0379.
Office Visits Payments	Monthly Part B non-institutional E/M standardized payments. Includes claim types 71, 72 (Part B Non-Institutional) or 81, 82 (DME) and first digit of BETOS is M, and HCPCS code was any of the following: 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215.
Opioid Overutilization	Monthly beneficiary flag that indicates a beneficiary was taking an average morphine milligram equivalent (MME) dose greater than 50mg for active opioid prescription, adjusting for early refills (same generic name, strength, dosage, form). Excludes beneficiaries who are not covered under Medicare Part D, as well as cancer patients, and beneficiaries on hospice.
Number of Outpatient Dialysis Sessions	Monthly beneficiary count of dialysis services. This outcome is restricted to beneficiaries who are only on hemodialysis and have had at least 12 months of dialysis.
Hospice	Monthly beneficiary flag that indicates a beneficiary was receiving at least one hospice service in the month (claim type 50).
No Prior Nephrology Care	Monthly beneficiary flag that indicates a beneficiary had no prior nephrology care prior to the beneficiary's first month of dialysis. The month of first dialysis was based on data from the Renal Management Information System (REMIS). Prior dialysis care was based on CMS Form 2728 (i.e., Medical Evidence Report) data for Question 18 (prior erythropoietin in 6+ months, prior nephrologist care in 6+ months, prior kidney dietician care in 6+ months, first access type was a graft or fistula, first access type was not a fistula and had maturing fistula or maturing graft). A "no" response on any of the six questions and no "yes" responses defined no prior care. A "yes" response on any of the six questions defined prior care.
Peritoneal Dialysis	Monthly beneficiary flag that indicates a beneficiary received at least one peritoneal dialysis service in the month and is based on positive non-standardized peritoneal dialysis payments.

Outcome	Definition of the Outcomes
Phosphate Binder Adherence	Monthly beneficiary indicator identifying a beneficiary who received at least two phosphate binder prescriptions in a given year and had a proportion of days covered greater than or equal to 80%, adjusting for early refills (same generic name, strength, dosage, form). Proportion of days covered is defined as the number of days per month that a beneficiary is covered by Medicare Part D prescription drug claims for the same medication or another phosphate binder, divided by the number of days in a given month. This measure does not include over-the-counter vitamins and supplements which may also be used as phosphate binders.
Readmission within 30-days of an Index Hospitalization Stay	Monthly beneficiary flag that indicates a beneficiary had at least one unplanned readmission hospitalization stay within 30-days of an index hospitalization stay. Hospitalization claims are based on select Part A claim type 60 (i.e., inpatient) claims; long-term care facilities (i.e., CCN between 2000 and 2299) and inpatient rehabilitation facilities (i.e., CCN between 3025 and 3099) are excluded.
Acute Inpatient Payments	Monthly standardized payments for acute inpatient includes claim types 60/61 where 3rd digit of the CCN=0 (inpatient prospective payment system) or 3rd/4th digit of CCN=13 (critical access hospital).
Medicare Part A and Part B Payments	Monthly standardized payments included under Medicare Part A and Part B. Payments are counted in the month of the claim thru date for all Part A claims (i.e., acute, home health, hospice, SNFs, institutional rehabilitation facilities, long-term care hospitals, and other inpatient facilities) and Part B Institutional claims (i.e., hospital outpatient, imaging, therapy, and total dialysis). Payments are counted in the month of the last expense date for all Part B non-institutional claims (i.e., E/M services, Part B covered drugs, durable medical equipment, etc.). In addition, payments are standardized to remove the effects of wage differences and for teaching status and other policy adjustments.
Part B Medicare Payments	Monthly standardized payments included under Part B actual amounts. Payments are counted in the month of the last expense date for all Part B Institutional claims and non-institutional claims. For a given CY's Part B payments, payments were included when the claim thru date (i.e., year of annual RIF file) is in the given year and +/- 1 year and the last expense date were in the same year.
Part B Drug Payments	Monthly standardized payments of Part B non-institutional drug amounts. Includes claim types 71, 72 (Part B non-Institutional) and first two digits of BETOS is O1C, O1D, O1E, or O1G.
Part D Drug Cost	Sum of drug costs (i.e., ingredient costs, dispensing fee, sales tax, and vaccination fee if applicable) for all prescription drug events with date of service in the month. These costs are counted only for Medicare beneficiaries who are enrolled in Part D during the month.
Institutional Post-Acute Care (PAC) Payments	Monthly standardized payments for services incurred during that month at inpatient rehabilitation facilities, SNF, and long-term care hospitals. These correspond to claim types 60/61 where last 4 digits of the CCN are between 3025-3099 or 3rd digit of CCN is R or T, 20/30, 60/61 where 3rd/4th digits of CCN are 20, 21, 22.
Readmission Payments	Monthly standardized payments for services related to all cause hospital readmissions. A readmission occurs when a beneficiary had a claim from date of a subsequent inpatient stay that was less than or equal to 30-days after the claim through date of a prior stay (i.e., an index hospitalization). A hospitalization with a discharge status code of 07 (left against medical advice) or 20 (died) is excluded from being an index admission; hospitalizations that occur within the 30-day period following an excluded index admission are not counted as a readmission.
Hospitalization for Vascular Access Complications	Monthly beneficiary flag indicating admission(s) with a principal diagnosis for a vascular access complication. Admission was based on an inpatient claim (i.e., all claim types 60/61). A vascular access complication was based on ICD-9 diagnosis codes 9961, 99656, 99673 and ICD-10 diagnosis codes T82318A, T82319A, T82328A, T82329A, T82338A, T82339A, T82398A, T82399A, T8241XA, T8242XA, T8243XA, T8249XA, T82510A, T82511A, T82518A, T82520A, T82521A, T82528A, T82529A, T82530A, T82531A, T82538A, T82590A, T82591A, T82598A, T85611A, T85621A, T85631A, T85691A, T82818A, T82828A, T82838A, T82848A, T82858A, T82868A, T82898A.

Outcome	Definition of the Outcomes
Number of Primary Care E/M Office/Outpatient Visits[18]	Monthly beneficiary count of evaluation and management (E/M) office/outpatient services from primary care providers. E/M services are identified based on Part B non-institutional claim lines where the first character of the BETOS code is 'M' and HCPCS codes are used to identify office/outpatient services for new (99201-99205) and established patients (99211-99215). Primary care providers are identified based on Medicare provider specialty codes. A visit is a unique revenue center date with an E/M service (i.e., two lines with same date are counted as one visit). The month is based on the last expense date from the claim line.
Number of Specialty Care E/M Office/Outpatient Visits[19]	Monthly beneficiary count of evaluation and management (E/M) office/outpatient services from specialist. E/M services are based on Part B non-institutional claim lines where the first character of the BETOS code is 'M' and HCPCS codes are used to identify office/outpatient services for new (99201-99205) and established patients (99211-99215). Specialist providers are identified with Medicare provider specialty codes. A visit is a unique revenue center date with an E/M service (i.e., two lines with same date are counted as one visit). The month is based on the last expense date from the claim line.
Admissions for Venous Catheter Bloodstream Infections	Monthly beneficiary count of inpatient claims (i.e., all claim type 60/61) with a principal diagnosis code for venous catheter bloodstream infection. Note: this includes ACHs, inpatient psychiatric hospitals, long-term care hospitals, inpatient rehabilitation facilities, and other inpatient (e.g., cancer hospitals) as long as the principal diagnosis criterion is met. Month is based on the claim thru date. ICD-9 Code: 999.32: Bloodstream infection due to central venous catheter ICD-10 Code: T80.211: (including A/D/S) Bloodstream infection due to central venous catheter
Admission for Sepsis Infections	Monthly beneficiary count of inpatient claims (i.e., all claim type 60/61) with a principal diagnosis code for sepsis. Note: this includes ACHs, inpatient psychiatric hospitals, long-term care hospitals, inpatient rehabilitation facilities, and other inpatient (e.g., cancer hospitals) as long as the principal diagnosis criterion is met. Month is based on the claim thru date. ICD-9 Code: 038x (i.e., any starting with 038): Septicemia (includes specified and unspecified organisms); 995.91: Sepsis ICD-10 Code: A41x (i.e., any starting with A41): Other sepsis (includes specified and unspecified organisms); A40x (i.e., any starting with A40): Streptococcal sepsis
Admissions for Peritonitis	Monthly beneficiary count of inpatient claims (i.e., all claim type 60/61) with a principal diagnosis code for peritoneal dialysis catheter infection. Note: this includes ACHs, inpatient psychiatric hospitals, long-term care hospitals, inpatient rehabilitation facilities, and other inpatient (e.g., cancer hospitals) as long as the principal diagnosis criterion is met. Month is based on the claim thru date. ICD-9 Code: 996.68: Infection and inflammatory reaction due to peritoneal dialysis catheter ICD-10 Code: T85.71X (i.e., including A/D/S): Infection and inflammatory reaction due to peritoneal dialysis catheter

[18] AR2 included the effect of the CEC Model on E/M visits, where the outcome measure included a wide range of E/M services, not restricted by office/outpatient visits or by primary or specialty provider type. For AR3, we refined the measure to include only office/outpatient services (based on the HCPCS code). We also use the Medicare provider specialty codes to identify Primary Care E/M Visits.

[19] The Specialty Care E/M Visits measure is new in AR3. We include only office/outpatient services (based on the HCPCS code) and use the Medicare provider specialty codes to identify Specialty Care E/M Visits.

Outcome	Definition of the Outcomes
Number of Endocrine/ Metabolic Inpatient Hospitalizations	Monthly beneficiary count of inpatient ACH claims with a principal diagnosis for an endocrine/metabolic condition. The diagnosis codes are based on USRDS methods used to define cause of hospitalizations (see the 2018 USRDS Annual Data Report, Table 13.16). ACH claims are based on claim types 60/61 where the 3rd digit of the CCN=0 (inpatient prospective payment system [IPPS]) or 3rd/4th digit of CCN=13 (critical access hospital [CAH]). Note: this excludes other inpatient claims such as inpatient psychiatric facilities, long-term care hospitals, and inpatient rehabilitation facilities. Month is based on the claim thru date. ICD-9 Codes: 240-279 ICD-10 Codes: C880, C965, C966, D472, E7521, E7522, E753, M359, N200, N981, D800-D849, D890-D899, E000-E034, E038-E071, E0789-E35, E40-E749, E75240-E75249, E755-E7870, E7879-E789, E791-E8319, E8330-E896, H49811-H49819, M1000-M109, M1A00X0-M1A09X0, M1A20X0-M1A9XX1, M830-M839
Number of Circulatory Inpatient Hospitalizations	Monthly beneficiary count of inpatient ACH claims with a principal diagnosis for a circulatory condition. The diagnosis codes are based on USRDS methods used to define cause of hospitalizations (see the 2018 USRDS Annual Data Report, Table 13.16). ACH claims are based on claim types 60/61 where the 3rd digit of the CCN=0 (inpatient prospective payment system [IPPS]) or 3rd/4th digit of CCN=13 (critical access hospital [CAH]). Note: this excludes other inpatient claims such as inpatient psychiatric facilities, long-term care hospitals, and inpatient rehabilitation facilities. Month is based on the claim thru date. ICD-9 Codes: 390-459 ICD-10 Codes: A1883, E0851, E0852, E0951, E0952, E1051, E1052, E1151, E1152, E1351, E1352, I998, I999, M3211, M3212, N262, R001, R58, T800XXA, T811718A, T8173XA, T82817A, T82818A, G450-G452, G454-G468, I00-I672, I674-I6782, I67841-I879, I890-I959, I970-I972, K640-K649, M300-M319
Number of Infectious Inpatient Hospitalizations	Monthly beneficiary count of inpatient ACH claims with a principal diagnosis for an infectious condition. The diagnosis codes are based on USRDS methods used to define cause of hospitalizations (see the 2018 USRDS Annual Data Report, Table 13.16). ACH claims are based on claim types 60/61 where the 3rd digit of the CCN=0 (inpatient prospective payment system [IPPS]) or 3rd/4th digit of CCN=13 (critical access hospital [CAH]). Note: this excludes other inpatient claims such as inpatient psychiatric facilities, long-term care hospitals, and inpatient rehabilitation facilities. Month is based on the claim thru date. ICD-9 Codes: 001-139 ICD-10 Codes: G02, G14, H32, I32, I39, I673, J020, J0300, J0301, J17, K9081, L081, L444, L946, M60009, N341, R1111, A000-A329, A35-A480, A482-B447, B4489-B780, B787-B999, D860-D869, J200-J207, M0000-M0089, M0230-M0239
Average standardized payments PBPM for outpatient	Monthly beneficiary sum of Part B institutional allowed (i.e., both CMS and beneficiary payments) hospital outpatient (HOP) and other Part B service amounts.

Notes: Payments, besides total Part D, are standardized and capped at the 99th percentile of all positive expenditure values associated with the outcome.

B. Comparison Group Construction

The construction of the comparison group was performed in two steps. First, we identified eligible comparison facilities and excluded those that were missing essential data or that were exposed to the intervention. Second, we used propensity score matching (PSM) to select the final group of matched comparison facilities. Descriptions of these steps are detailed below.

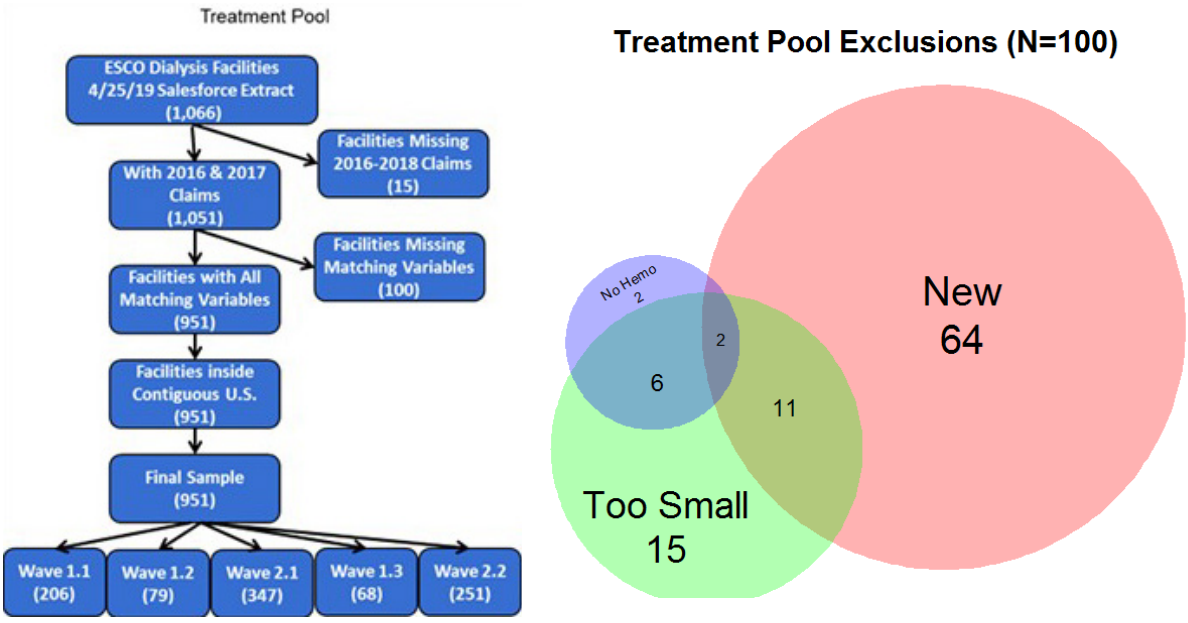
1. Identifying CEC Facilities

We identified 1,066 dialysis facilities participating through ESCOs on or prior to January 1, 2018 using a Salesforce extract of participation data from April 25, 2019. Salesforce is a web-based

database that reposts the CEC participation data maintained by the Center for Medicare & Medicaid Innovation (CMMI).

We evaluated and applied a series of eligibility criteria to determine whether the dialysis facilities could be included in the matching model. The criteria and number of exclusions are outlined in **Exhibit F-4**. A total of 115 facilities were excluded because they were missing data; 15 facilities had no dialysis claims in at least one year from 2016-2018, and 100 facilities did not have key matching characteristics, which are required to estimate matching models in subsequent steps.[1] The remaining 951 facilities that met the eligibility criteria formed the treatment pool used in matching.

Exhibit F-4. CEC Facility Identification and Exclusions



The 100 facilities with missing key matching variables were either too small, new since 2014, and/or without hemodialysis services (see the breakdown in the Venn diagram in **Exhibit F-4**).

CEC facility exclusions were not associated with a single organization and were generally proportional to the number of CEC facilities within each organization (see **Exhibit F-5**). The 115 unmatched facilities were comparable to the 951 matched facilities included in the analysis (i.e., there were no meaningful differences in the market and facility-level characteristics for which data was available).

[1] **Exhibit F-7** details the data used for the selection of the comparison group of facilities.

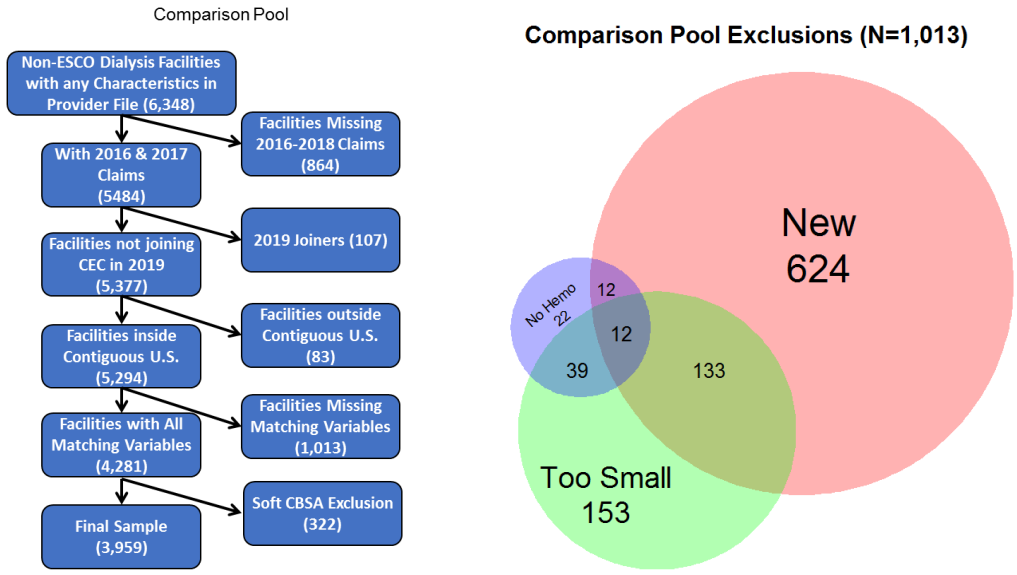
Exhibit F-5. Excluded Facilities by Organization

Organization	Number of CEC Facilities	Number of Excluded CEC Facilities
DaVita	118	14
DCI	85	10
Fresenius	838	89
CDC	7	0
Atlantic	9	1
NKC	6	0
Rogosin	2	0
Total	1,065	114

2. Selecting Facilities Eligible to be Included in the Comparison Group Pool

The preliminary comparison pool consisted of 6,348 dialysis facilities after removal of the 1,066 dialysis facilities participating in CEC on or prior to January 1, 2018. We applied the same series of eligibility criteria to ensure the comparison facilities could be included in the matching model and would have had limited exposure to the CEC Model. The criteria and number of exclusions are outlined in **Exhibit F-6**.

Exhibit F-6. Comparison Facility Identification and Exclusions



A number of potential comparison facilities (N=864) were excluded from matching because they did not have claims in calendar years (CYs) 2016-2018. Claims were not observed either because the facility changed ownership and CMS Certification Number (CCN), the unit at which facilities are identified and associated with claims; the facility was no longer providing care to Medicare patients; or the facility was new to Medicare in 2017 or later.

An additional 107 dialysis facilities were removed from the comparison pool due to potential bias. These facilities joined CEC on January 1, 2019, and it is possible that they began

implementing changes in 2018 in anticipation of joining, which could have biased the CEC impact estimate.

We examined the remaining potential comparison facilities for missing data relevant to the analysis and excluded 1,013 facilities who were missing important facility characteristics used in the matching process.[21] The missing data were mainly for facilities without claims in 2014, facilities without hemodialysis, or other facilities that did not regularly perform dialysis (see the Venn diagram in **Exhibit F-6**). Because ESCO facilities were not observed in Alaska, Hawaii,

Puerto Rico, or U.S. Territories, 83 potential facilities in these areas were identified and excluded from the comparison pool.

To limit selection bias, we excluded dialysis facilities from the comparison group pool if an ESCO from their organization was operating in the same Medicare Core-Based Statistical Area (CBSA).[22] Facilities joining in 2019 were counted as CEC participants for the purpose of implementing this exclusion. For example, because Fresenius had ESCO facilities in the Chicago, IL CBSA, we excluded from the comparison pool all other Fresenius facilities in the Chicago CBSA. This exclusion could result in reducing the number of comparison facilities in urban areas where CEC facilities are frequently located. However, by matching on a variety of market characteristics, we minimize market characteristics imbalances that could be impacted by this exclusion. This exclusion reduced the facilities that could potentially be included in the comparison group by 322 out of the remaining non-ESCO facilities. The final comparison pool included 3,959 dialysis facilities.

3. Statistical Matching Approach

The next step in developing the comparison group involved implementing matching methods to identify the set of facilities in the comparison pool that are representative of CEC facilities and their beneficiaries. For most CEC facilities that joined in PY1 or PY2, we kept the same matched comparison group facility as detailed in the second annual report (AR2). We preserved the matches for 625 out of the 632 CEC facilities included in the AR2 sample. However, we were unable to preserve the matches for CEC facilities that matched to a CEC facility joining in 2019 (N=6) or that were missing claims in 2018 (N=1). We used PSM to match these 7 PY1 and PY2 joiners and the 319 PY3 joiners.

We selected provider and market characteristics that were associated with CEC participation, and we then used matching methods to identify comparison facilities that had similar values in those characteristics. The data used to construct the characteristics for the selection of the comparison group of facilities are shown in **Exhibit F-7**.

[21] Eighteen facilities had an error code in the Dialysis Facility Compare data that indicates missing data for an undisclosed or unknown reason. These facilities were excluded from the comparison pool and are included in the N=1,013.

[22] Medicare CBSAs are Metropolitan CBSAs, with each CBSA Division separated, from the CMS Office of Management and Budget CBSA definition.

Exhibit F-7. Data Used for the Selection of the Comparison Group of Facilities

Dataset Name	Date Range	Dataset Contents	Use
Area Health Resources File (AHRF)	2012 – 2015	County-level data on population, environment, geography, health care facilities, and health care professionals	Used for descriptive analysis of CEC and non-CEC market characteristics (Predictors/characteristics were included in the comparison group selection modeling.)
CEC Participant List	Extracted 1/3/2018; Facilities participating through ESCOs on or prior to 1/1/2017	ESCO names, IDs, provider names, National Provider Identifiers (NPIs), Taxpayer Identification Numbers (TINs), addresses, start dates, and stop dates	Used to identify ESCO facilities and locations
Chronic Conditions Data Warehouse (CCW)	January 2012 – December 2017	Medicare Part A and Part B claims and beneficiary and enrollment information (Master Beneficiary Summary File, Enrollment Data Base, Common Medicare Environment [CME]), including beneficiary unique identifier, address, date of birth/death, sex, race, age, and Medicare enrollment status	Used to create outcome measures such as ED visits and total Medicare Part A and Part B standardized payments and identify eligibility for alignment, beneficiary demographic characteristics, and beneficiary eligibility for inclusion in the denominator for each of the outcome measures
Consolidated Renal Operations in a Web-enabled Network (CROWNWeb)	January 2012 – December 2017	Primary cause of renal failure, cause of renal failure groupings, height, race, dry weight, physician name, dialysis type, and incident comorbidities	Used to obtain patient demographic and medical information extracted from the CMS ESRD Medical Evidence Report form (CMS-2728)
Dialysis Facility Compare	2012 – 2017	Dialysis facilities' organizational characteristics and quality measures published on the CMS website	Used to identify facility characteristics incorporated into the DiD models and comparison groups
Long-Term Care Minimum Data Set (MDS)	2012 – 2017	Information about residence in nursing home	Used to create indicators for long-term institutional status used in risk adjustment
Master Data Management	2012 – 2017	Provider- and beneficiary-level information on participation in CMMI payment demonstration programs	Used to identify providers who are involved in accountable care organizations (ACOs) and Medicare Shared Savings Program
The ZIP Code File-SAS	Jan-17	ZIP codes and CBSAs	Used to link ZIP codes to CBSAs

The matching methods used to select a comparison group for CEC facilities were guided by the literature and informed by the empirical analysis. We explored many options for matching methods, including Mahalanobis distance, coarsened exact matching, entropy balancing, and PSM.[23] Ultimately, we selected the PSM approach because it performed best according to multiple balance diagnostics. In the remainder of this section, each methodological consideration for PSM is discussed, including a description of the estimated model.

[23] Gu, X.S., Rosenbaum, P.R. (1993). Comparison of multivariate matching methods: Structures, distances, and algorithms. *Journal of Computational and Graphical Statistics*, 2(4):405-420.

Matching Method. The goal of matching both market- and facility-level characteristics led to the inclusion of many covariates in the matching model. The literature indicates that, when matching on many covariates, PSM leads to better balance than other matching techniques.[24,25] In our testing, we also determined that a carefully selected PSM would yield strong diagnostic values. With these considerations and a series of model testing, we decided to proceed with PSM.

Propensity scores, defined as the probability of receiving treatment, conditional on a set of characteristics, are estimated using a logistic model. For the evaluation of the CEC Model, the key characteristics of interest in the logistic model are defined at the facility and market levels. Using the coefficients from the logistic regression model, the propensity score for each facility was then constructed as the log odds of the predicted probability of participating in CEC. Each CEC participant facility was matched to a single facility in the comparison group that was the closest in terms of propensity score and not yet matched to another CEC participant facility.

Pooled vs. Stratified Models. The sizes of the treatment and control pools that enter the model are important determinants of the success of PSM. Stratifying models by organization yielded smaller treatment and control pools and generated weaker overall matches. However, given different practice patterns and cultures across organizations, it was necessary to use organization/organization type as a matching variable. This approach resulted in the construction of a pooled dataset for matching models that combined facilities across organization type and ownership (i.e., DaVita, Fresenius, and DCI).

In PY3, additional dialysis facilities joined the model through existing ESCOs: Wave 1 PY3 joiners (N=68) and Wave 2 PY2 joiners (N=251). To provide a sufficient number of CEC facilities for matching, these cohorts were pooled into one matching model. This model ignores unique selection bias apparent in each cohort but provides a more straightforward approach to estimating the overall impact of CEC.

Caliper Selection. For distance matching models, calipers can be applied to limit the absolute distance in propensity scores between matches (i.e., if a neighbor is outside of the caliper, it is not considered a good match). There is no consensus regarding a standard caliper and many caliper widths have been used in literature.[26] For propensity score modeling, many studies use a caliper that is proportional to the standard deviation of the predicted propensity score. After the propensity score model estimation, all participants could be matched to a unique neighbor that was closer than 0.87 standard deviations of the estimated propensity score.

Diagnostic Tests. The final step in selecting the comparison group involved using the results from PSM to conduct a series of diagnostic tests for the matched comparison samples to assess whether facilities were similar on observed covariates. Diagnostics included defining the range of common support for the propensity score and for each covariate, evaluating standardized mean differences (SMDs) for all covariates, and examining covariate distributions in quantile-quantile

[24] Ibid

[25] Stuart, E.A. (2010). Matching methods for causal inference: A review and a look forward. Statistical science: a review journal of the *Institute of Mathematical Statistics*, 25(1), 1-21.

[26] Austin, P.C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, 46(3), 399-424.

(QQ) plots. Results of the diagnostic tests between the CEC facilities and comparison group are shown below.

The PSM model we estimated achieved a lower average SMD than the average SMD before matching. The selected comparison group had mean values that were more similar to the CEC facilities than the entire group of non-CEC facilities and also had tighter variation of characteristics. The average SMD was considerably smaller after matching, decreasing by 0.11 (see **Exhibit F-8**).

Exhibit F-8. Average SMD Before and After Matching

Average SMD Before Matching	Average SMD After Matching
0.21	0.10

The SMDs for characteristics used in matching are displayed in **Exhibit F-9**. They are generally small, although 14 matching characteristics are above 0.10. Focusing on these, the absolute mean differences are small.[27] For example, the percent of the population over 65 years of age is 0.13 for the matched comparison group and 0.14 for the matched CEC facilities, but the SMD is -0.26.

[27] Austin, P.C (2009) Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. *Statistics in Medicine*, 28.25, 3083-3107.

Exhibit F-9. Means and SMD for Variables Included in the Matching Model[28]

Characteristics		1. CEC Participating Facilities (N=951)		2. Non-CEC Comparison Pool (N=3,959)		3. Std Diff Before Matching	4. Selected Comparison Group Facilities (N=951)		5. Std Diff After Matching
		Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Beneficiary Characteristics	ESRD Beneficiary Population >350 Indicator	0.95	0.22	0.79	0.40	0.48*	0.89	0.32	0.23*
	Percent 65 and Older	0.13	0.02	0.13	0.03	-0.18	0.14	0.03	-0.26*
	Percent Race White	0.60	0.15	0.63	0.19	-0.15	0.62	0.18	-0.13
	Percent Race Black	0.18	0.10	0.14	0.11	0.34*	0.16	0.12	0.19
	Percent No High School Diploma	0.14	0.04	0.15	0.05	-0.16	0.14	0.04	-0.06
	Percent Single Parent Households with Children	0.34	0.05	0.34	0.06	0.04	0.34	0.06	-0.08
	Percent ESRD	0.00	0.00	0.00	0.00	-0.02	0.00	0.00	-0.04
	Percent Duals	0.03	0.01	0.03	0.01	-0.25*	0.03	0.01	-0.24*
	Percent ESRD Duals	0.50	0.08	0.52	0.10	-0.18	0.51	0.10	-0.08
	Median Household Income	$54,729	$9,846	$52,325	$10,532	0.24*	$52,595	$11,757	0.20*
	Medicare Advantage (MA) Penetration (percent)	0.28	0.15	0.27	0.13	0.02	0.28	0.12	-0.02
	PCPs per 10,000	7.7	1.46	7.62	1.71	0.02	7.71	1.56	-0.03
	SNF Beds per 10,000	48.3	19.0	51.1	20.6	-0.14	51.4	20.5	-0.16
	Specialists per 10,000	11.2	4.6	10.2	4.7	0.22*	10.7	4.7	0.11
	Hospitals with Kidney Transplant Services per 10,000	0.01	0.01	0.01	0.01	0.02	0.01	0.01	-0.05
	Rural Indicator	0.13	0.33	0.15	0.36	-0.09	0.16	0.37	-0.10
	Extra-Rural Indicator	0.00	0.08	0.05	0.23	-0.28*	0.01	0.12	-0.08

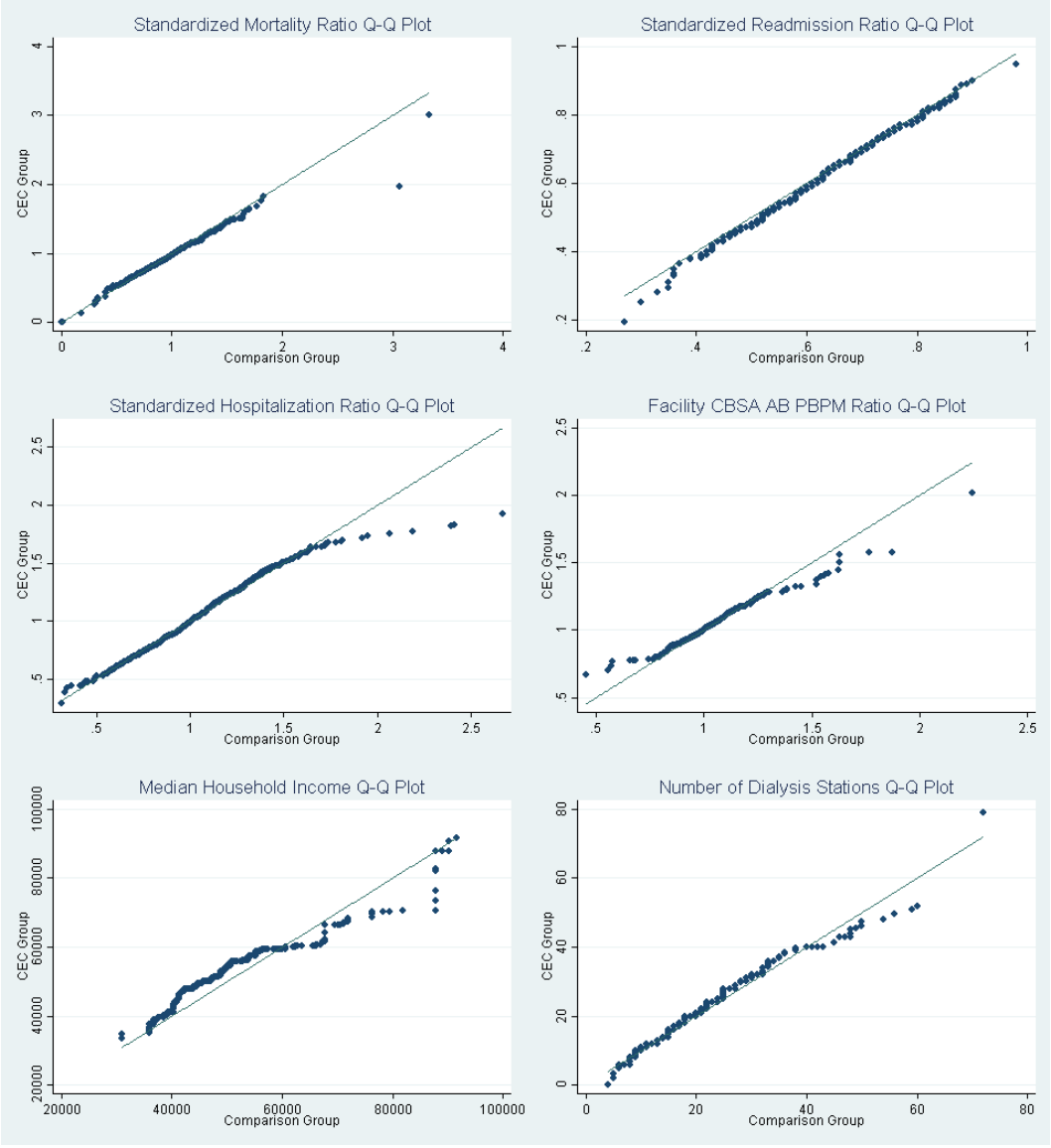
[28] The post-matching means and SMDs for variables included in the matching model tables (see **Exhibit E-1** and **E-3**) provide information on the variation of characteristics used in the PSM models. The mean and standard deviation (Std Dev) are included to provide a higher degree of comparability between CEC facilities and their selected comparison.

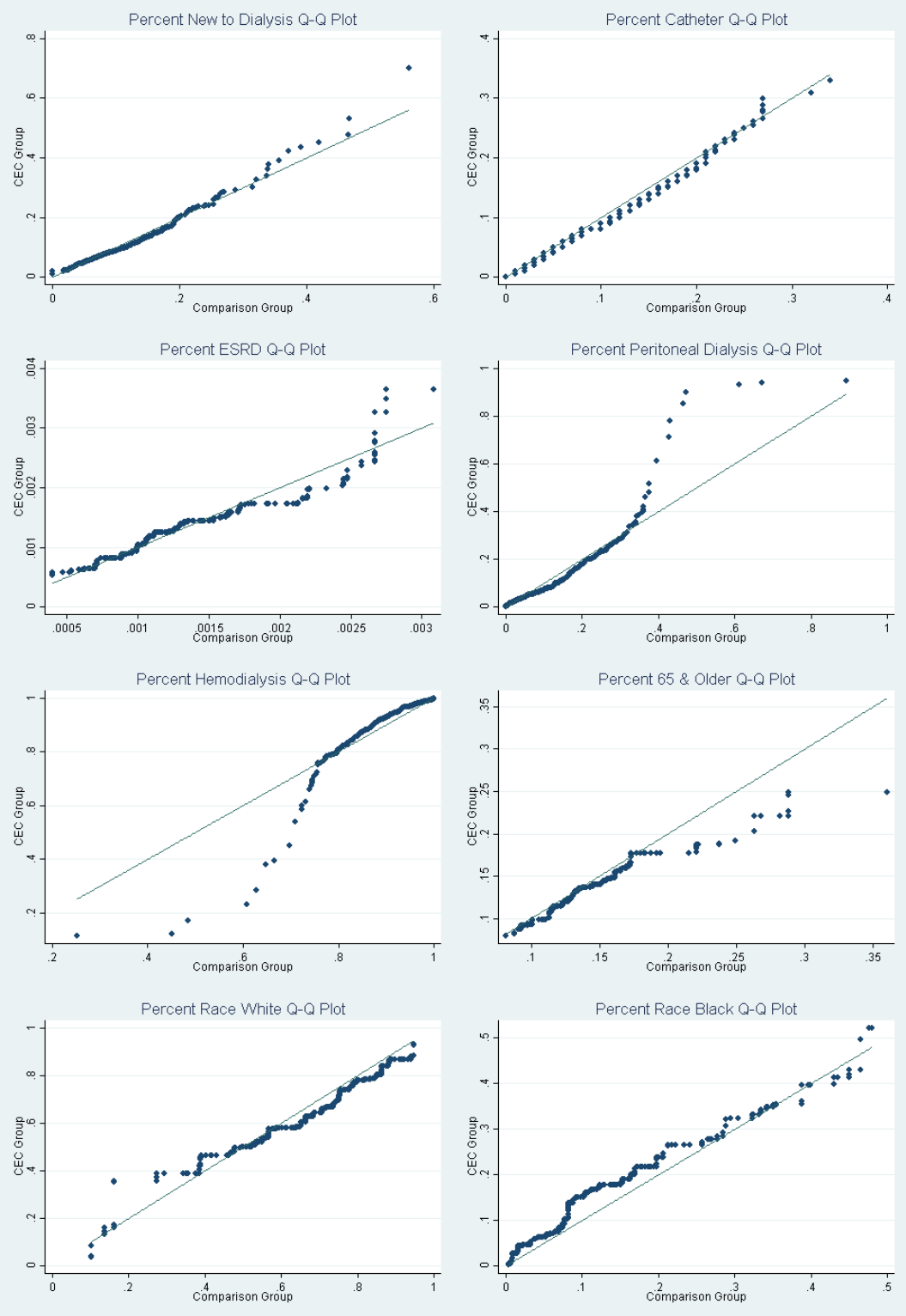
Characteristics		1. CEC Participating Facilities (N=951)		2. Non-CEC Comparison Pool (N=3,959)		3. Std Diff Before Matching	4. Selected Comparison Group Facilities (N=951)		5. Std Diff After Matching
		Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Facility Characteristics	Number of Dialysis Stations	20.0	7.7	18.3	7.7	0.22*	19.6	7.6	0.06
	Late Shift Indicator	0.21	0.41	0.18	0.39	0.07	0.21	0.41	-0.01
	Peritoneal Indicator	0.47	0.50	0.60	0.49	-0.26*	0.54	0.50	-0.14
	Percent Hemodialysis	0.96	0.09	0.95	0.09	0.16	0.96	0.08	0.04
	Percent Peritoneal Dialysis	0.06	0.11	0.08	0.12	-0.17	0.07	0.10	0.05
	Percent Patients with Vascular Catheter	0.10	0.05	0.11	0.07	-0.20*	0.10	0.06	-0.17
	Percent Patients with AV Fistula	0.63	0.11	0.64	0.11	-0.09	0.63	0.10	-0.08
	SHR	1.01	0.26	0.99	0.27	0.06	1.01	0.27	-0.02
	SRR	0.97	0.28	0.97	0.30	-0.03	0.97	0.28	-0.03
	SMR	0.97	0.24	1.01	0.28	-0.16	0.99	0.26	-0.10
	DaVita Indicator	0.11	0.31	0.45	0.50	-0.82*	0.17	0.37	-0.17
	DCI Indicator	0.08	0.27	0.03	017	0.22*	0.08	0.27	0.00
	Fresenius Indicator	0.79	0.41	0.23	0.42	1.34*	0.72	0.45	0.15
	Total Medicare Part A and Part B PBPM (2012-2014)	$6,556	$899	$6,500	$1,162	0.05	$6,525	$1,055	0.03
	Percent Ever Crashed Into Dialysis	0.45	0.12	0.46	0.15	-0.06	0.45	0.13	0.03
	Percent New To Dialysis	0.10	0.06	0.12	0.09	-0.31*	0.11	0.06	-0.15
	Facility CBSA PBPM Ratio	1.01	0.11	1.02	0.15	-0.07	1.01	0.13	0.01

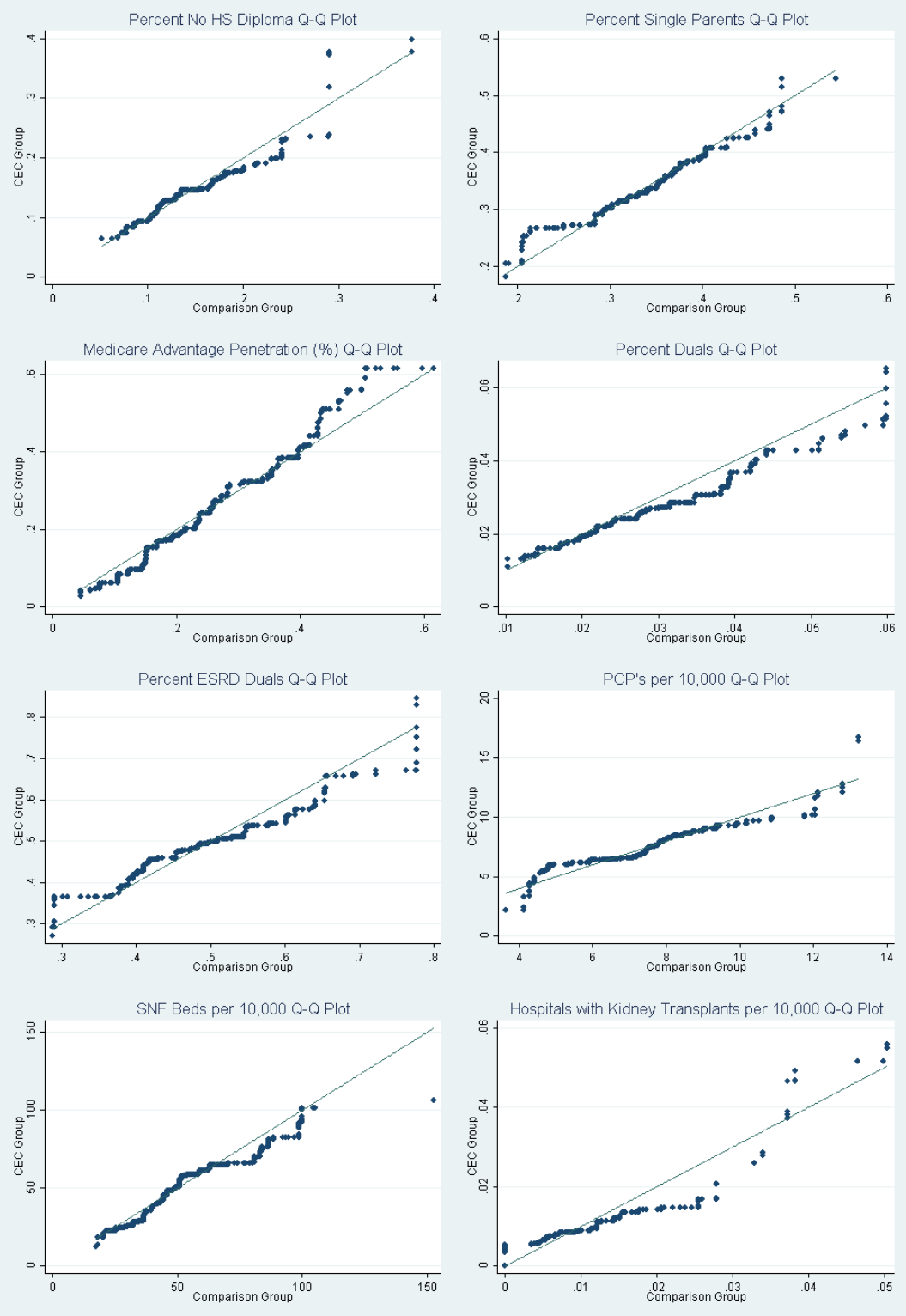
Notes: The standardized difference is calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$ Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Additional diagnostic information used to assess the quality of the match between the comparison and CEC treatment groups for each wave is provided in **Exhibit F-10**. The QQ plots in **Exhibit F-10** offer graphical descriptions that help determine if two data sets contain similar distribution for a continuous characteristic. Points along the 45-degree diagonal reference line indicate that the two groups follow a similar distribution. If most points on the plot are near the diagonal, we consider the distributions to be similar. These plots reveal that, for the majority of characteristics, the distribution falls near the ideal 45-degree diagonal. However, for a few characteristics, the tails of the distribution stray from the ideal 45-degree line. These cases are infrequent and due to outlier characteristics among facilities.

Exhibit F-10. Quantile-Quantile (QQ) Plots




Percent New to Dialysis Q-Q Plot
Percent Catheter Q-Q Plot
Percent ESRD Q-Q Plot
Percent Peritoneal Dialysis Q-Q Plot
Percent Hemodialysis Q-Q Plot
Percent 65 & Older Q-Q Plot
Percent Race White Q-Q Plot
Percent Race Black Q-Q Plot
CEC Group
Comparison Group


Percent No HS Diploma Q-Q Plot
Percent Single Parents Q-Q Plot
Medicare Advantage Penetration (%) Q-Q Plot
Percent Duals Q-Q Plot
Percent ESRD Duals Q-Q Plot
PCP's per 10,000 Q-Q Plot
SNF Beds per 10,000 Q-Q Plot
Hospitals with Kidney Transplants per 10,000 Q-Q Plot
CEC Group
Comparison Group

4. Comparison Group Changes between the Second Annual Report and the Third Annual Report

The comparison group described in the third annual report (AR3) changed from the comparison group used in the second annual report (AR2) to accommodate the growth in CEC facilities over time; the number of CEC facilities increased from 216 in PY1 to 685 in PY2, and then to 1,066 in PY3. For most CEC facilities that joined in PY1 or PY2, we kept the same matched comparison group in AR3. Matches for 625 out of 632 CEC facilities included in AR2 were preserved. However, we were unable to preserve the matches for CEC facilities that matched to a CEC facility joining in 2019 (N=6) or missing claims in 2018 (N=1). We used PSM to match these 7 PY1 and PY2 joiners and the 319 PY3 joiners.

C. Beneficiary Alignment and Eligibility

To identify comparison beneficiaries for inclusion in this analysis, we simulated alignment based on the CEC Model rules. We started by applying the CEC eligibility criteria (see **Exhibit F-11**) to construct monthly eligibility indicators, which required data from the Common Medicare Environment (CME), the Master Data Management database, and the Chronic Conditions Data Warehouse (CCW). Then we combined the monthly eligibility indicators with ESRD dialysis facility (Type of Bill 72X) claims to align eligible beneficiaries to ESCOs and comparison group facilities using a two-step approach.

Step One. Each month starting in January 2012, CEC eligible beneficiaries were aligned to an ESCO if the "first touch" dialysis service belonged to an ESCO and the beneficiary satisfied the eligibility criteria in that month. The first touch dialysis service is the earliest dialysis service based on the claim thru date provided on the dialysis facility claims. Beneficiaries were prospectively aligned through December 2018.[29] Beneficiaries could subsequently become unaligned in the second step of the alignment process (reconciliation) if they no longer meet the criteria to be aligned. The first step was repeated every month through December 2018 to align new beneficiaries who had their first touch dialysis after January 2012; each monthly alignment was run among beneficiaries not currently aligned. Beneficiaries were also aligned to a comparison group facility if the first touch provider was in a facility in the matched comparison group.[30]

Step Two. We simulated the CEC reconciliation process by which beneficiaries were de-aligned from their ESCO due to death, kidney transplant, the 50% CBSA rule, alignment to another shared savings program (SSP), and/or no longer receiving treatment at an ESCO (see **Exhibit F-12**).[31] We applied annual de-alignments after each CY using claims processed through March 31, 2019. Beneficiaries who were de-aligned could be

[29] We simulate alignment of beneficiaries prior to the start of the CEC. This provides information on beneficiaries who would have been aligned—based on identical methods—during this earlier period and allows us to assess changes in ESCOs from before and after CEC implementation.

[30] It was possible for the first step to result in an ESCO alignment and comparison facility alignment at the same time. We subsequently applied rules to prevent such overlaps. To maintain ESCO prioritization, an ESCO alignment was retained and the comparison facility alignment was disregarded in any month a beneficiary was aligned to an ESCO. In addition, to minimize any potential contamination effect from ESCOs, any comparison facility alignment was disregarded in any month or within 12 months after a beneficiary was treated or aligned to an ESCO facility.

[31] The simulated reconciliation was applied to CYs 2012 through 2018. We apply the simulated reconciliation to these previous years to ensure consistency with the program methods (e.g., remove a beneficiary from alignment if they received less than 50% of their dialysis services in the aligned facility's market in that year).

realigned to any ESCO or facility in the comparison group at a later time if they met the eligibility criteria at the time of first touch.

Exhibit F-11. Monthly Eligibility Criteria

- ***Alive (inclusion criterion).*** If a beneficiary had no death date or a validated death date that was on or after the 1st of the month, the beneficiary met the alive criterion for the month of interest.
- ***Enrolled in Medicare Part A and Part B (inclusion criterion)***. A beneficiary met this criterion if he/she was enrolled in both Medicare Part A and Part B in the month.
- ***Not enrolled in Medicare Advantage (MA) (i.e., Health Maintenance Organization [HMO], managed care, or Medicare Part C) (exclusion criterion)***. A beneficiary met this exclusion criterion if he/she was enrolled in a MA plan during the month.
- ***Over age 18 (inclusion criterion).*** A beneficiary met this criterion if he/she was at least 18 years of age prior to the first day of the month.
- ***Kidney transplant (exclusion criterion).*** A beneficiary met this exclusion criterion during the month of a kidney transplant and the 12 months following that month.
- ***Resided in US (inclusion criterion***). A beneficiary met this criterion for the month of interest if he/she did not have a residential Social Security Administration state code—based on the CME address history table—outside of the United States at any time in the month.
- ***Not enrolled in a designated SSP (exclusion criterion).*** A beneficiary met this exclusion criterion if he/she was aligned with another SSP in a given month, as noted in the Master Data Management database. The SSP criteria differed prior to CY 2016. For the pre-2016 period, this exclusion encompassed alignment with the Independence at Home (IAH) Demonstration (i.e., program code 01), Pioneer ACO Model (i.e., program code 07), and the Medicare-Medicaid Coordination Office Financial Alignment Initiative (FAI) (i.e., program code 11). For the 2016 and later period, this exclusion encompassed alignment with the IAH Demonstration, Pioneer ACO Model, Medicare SSP (i.e., program code 08) when the beneficiary was categorized as Track 3, FAI, and the NGACO Model (i.e., program code 21). SSP beneficiaries were identified as Track 3 when they were aligned with a Track 3 SSP ACO. Starting in January 2018, this exclusion also included Medicare SSP beneficiaries identified as Track 1+.
- ***Medicare as a secondary payer (exclusion criterion).*** A beneficiary met this exclusion criterion if he/she had Medicare as a secondary payer at any time during the month.

Exhibit F-12. Reasons for De-alignment

- ***Death.*** An aligned beneficiary who died in the CY was de-aligned at the end of the CY (i.e., alignment ended on December 31 of the CY). For example, a beneficiary who was aligned in January 2012 and died in October 2012 would have an alignment start date of January 1, 2012 and an alignment end date of December 31, 2012. However, this beneficiary will be aligned and CEC eligible from January 2012 through October 2012.
- ***First touch at non-ESCO facility.*** For each beneficiary CY, we evaluated if the beneficiary had a first touch at a facility that belonged to the ESCO to which they were aligned. If the beneficiary did not have a first touch in the CY at a facility that belonged to the ESCO, then the beneficiary was de-aligned from the CY. We applied the rule similarly to the comparison group based solely on the aligned facility (i.e., no comparison group ESCOs).
- ***Kidney transplant.*** An aligned beneficiary who had a kidney transplant in the CY was de-aligned at the end of the CY (i.e., alignment ended on December 31 of the CY). For example, a beneficiary who was aligned in January 2012 and had a kidney transplant in October 2012 would have an alignment start date of January 1, 2012 and an alignment end date of December 31, 2012.
- ***SSP.*** If a beneficiary was aligned to a Medicare SSP that can take beneficiaries from CEC (i.e., only IAH) following the start of the CEC alignment, then the beneficiary was de-aligned from CEC for the CY.
- ***Dialysis in provider market (CBSA Rule).*** If a beneficiary had at least one dialysis service in a CY and less than 50% of dialysis services in the CY were from the market of the ESCO, then the beneficiary was de-aligned from the CY. The percentage of dialysis services per CY that occurred in the ESCO's market was computed based on (1) the total number of dialysis services with claim thru date in that CY after alignment started (i.e., denominator) and (2) the total number of dialysis services after alignment started that were provided in the ESCO market (i.e., numerator); that is, the dialysis service occurred in a CBSA that belonged to the ESCO's market, or if not in a CBSA (i.e., rural), the county belonged to the ESCO's market. We applied the rule similarly to the comparison group based on the aligned facility (i.e., no ESCO market).

D. CEC and Comparison Group Populations

Patient characteristics for aligned and CEC eligible beneficiaries from ESCOs and matched comparison facilities (for the first month the beneficiary is aligned) are compared in **Exhibit F-13.**

Although there are more beneficiaries aligned and eligible in the CEC group than in the comparison group, CEC and comparison beneficiaries are very similar on average. They differ only on a few characteristics. For example, the percent of White CEC beneficiaries is 8 percentage points lower for Wave 1 and 3 percentage points lower for Wave 2, relative to the comparison group. Likewise, the percent of Black CEC beneficiaries is higher relative to the comparison group (5 percentage points higher for Wave 1 and 3 percentage points higher for Wave 2). The average CEC facility beneficiary count for Wave 1 is about 11 beneficiaries higher and the average count for Wave 2 facilities is 10 beneficiaries higher, relative to the comparison group. We also see differences in the large dialysis organizations (LDOs) to which beneficiaries are aligned. About 65% of Wave 1 CEC beneficiaries are aligned to Fresenius facilities and 26% are aligned to DaVita facilities. About 87% of Wave 2 CEC beneficiaries are aligned to Fresenius facilities, while none are aligned to DaVita facilities. In the comparison group, 71% of beneficiaries are aligned to Fresenius facilities and 19% to DaVita facilities. These organizational indicators are also included as control variables in the DiD regression model.

Exhibit F-13. CEC and Comparison Population Average Characteristics

Characteristics		Wave 1 CEC (Mean) N=48,622	Wave 2 CEC (Mean) N=68,564	Comparison (Mean) N=103,581
Beneficiary Characteristics	Age	63.3	63.0	63.6
	Female	43%	44%	44%
	BMI (kg/m^2)	29.7	30.1	29.9
	White	42%	47%	50%
	Black	42%	40%	37%
	Other	16%	12%	13%
	Aged into Medicare	35%	33%	35%
	Disabled into Medicare	23%	23%	22%
	ESRD into Medicare	24%	25%	24%
	Disabled & ESRD into Medicare	19%	19%	19%
	Full Dual Eligibility	38%	34%	35%
	Partial Dual Eligibility	8%	10%	10%
	ESRD Cause: Diabetes	44%	45%	45%
	ESRD Cause: Hypertension	33%	31%	30%
	ESRD Cause: Other	20%	21%	21%
	ESRD Cause: Unknown	3%	3%	3%
	Months on Dialysis	43.2	42.6	41.5
	Hemodialysis	93%	93%	92%
	Peritoneal Dialysis	7%	7%	8%
	Both Hemodialysis/Peritoneal Dialysis	1%	1%	1%
	Other Dialysis	1%	0%	1%

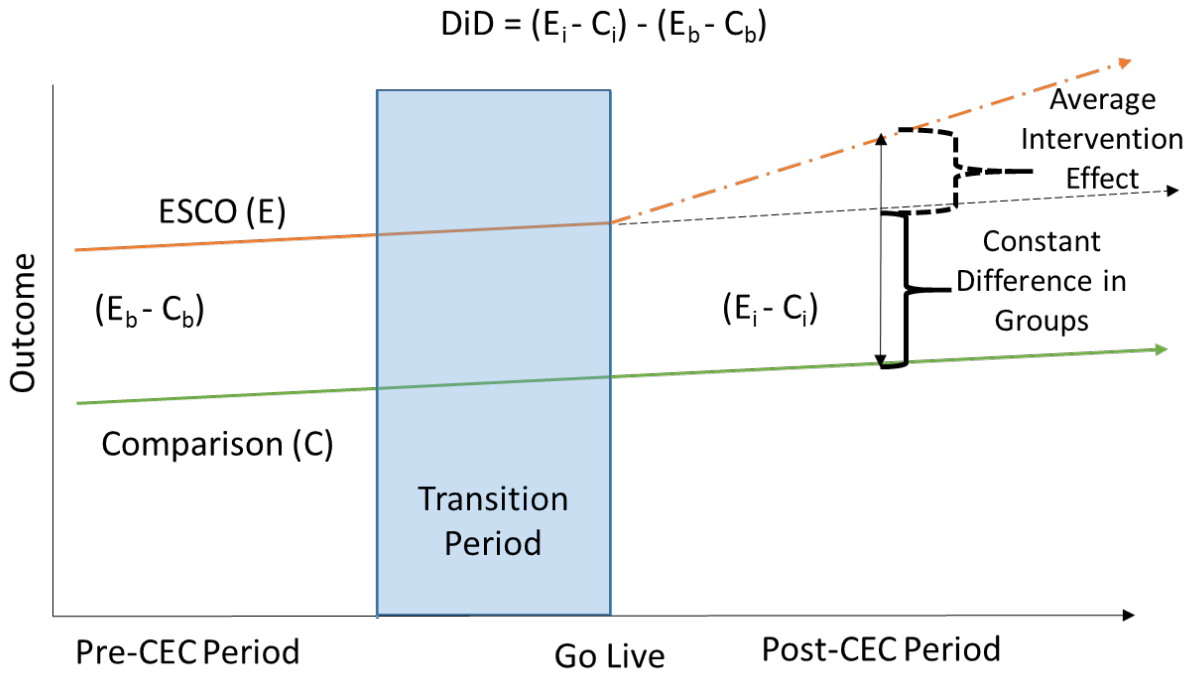
Characteristics		Wave 1 CEC (Mean) N=48,622	Wave 2 CEC (Mean) N=68,564	Comparison (Mean) N=103,581
Facility Characteristics	Beneficiary Count	121	119	110
	Late Shift Indicator	22%	33%	27%
	For Profit Indicator	91%	90%	92%
	CDC	0%	2%	0%
	DaVita	26%	0%	19%
	DCI	7%	6%	7%
	Fresenius	65%	87%	71%
	Atlantic	0%	2%	0%
	NKC	0%	3%	0%
	Other	0%	0%	4%
	Rogosin	2%	0%	0%
Market Characteristics	Median Household Income	$59,381	$59,237	$57,248
	MA Penetration	29.6	32.3	31.6
	Dual Per 10,000	305.6	296.0	326.6
	PCPs Per 10,000	7.8	7.7	7.9

Notes: Additional controls such as seasonal, region, and CBSA costs decile indicators are not presented in this table.

E. DiD Regression Model and Estimated CEC Impacts

The DiD approach quantifies the impact of the CEC Model by comparing changes in outcomes for the CEC population before and after CEC with changes in outcomes for the comparison population before and after CEC. This approach eliminates biases from time invariant differences between the CEC and comparison populations, and controls for common trends in both groups. The DiD method applied to our outcomes of interest is presented visually in **Exhibit F-14**.

Exhibit F-14. DiD Method Illustration



The DiD model uses data over time from beneficiaries with ESRD aligned to facilities in the comparison group to obtain an appropriate counterfactual of what would happen to patients with ESRD at ESCO facilities if their aligned facility was not participating in CEC. To estimate a casual effect of the CEC Model, the DiD contrasts changes in outcomes among CEC beneficiaries against this counterfactual. As seen in the exhibit, the DiD model first evaluates the difference between the ESCO (E) and comparison (C) groups over the pre-CEC period (E_b-C_b), depicted by the green and orange lines, for each outcome of interest. The DiD model assumes that if the CEC Model did not exist, the two groups would continue to follow the same parallel trends during the post-CEC period (shown by the black dotted (E) and orange line (C), respectively). Therefore, any observed difference in outcomes between the pre-CEC period (E_b-C_b) and post-CEC period (E_i-C_i) is driven by the CEC Model. Thus, the resulting DiD estimate of the average intervention effect is (E_i-C_i) - (E_b-C_b).

Waves, Pre-CEC, Transition, and Post-CEC Periods. In PY3, the CEC evaluation introduced additional facilities participating in the CEC Model through existing ESCOs. To identify the overall impact of the CEC Model and the impact for each wave, we estimated one DiD model which includes separate indicators for each wave and performance year to identify wave specific intervention effects for the original 13 ESCOs (Wave 1) in PY1, PY2, and PY3, and the additional 24 ESCOs (Wave 2) in PY2 and PY3.

The two waves of ESCOs comprise participating facilities with varying start dates. Wave 1 ESCOs include facilities that started participating in PY1 and new participating facilities that

were added in PY2 or PY3.[32] Wave 2 ESCOs include facilities that started participating in new ESCOs in PY2 and new participating facilities that were added in PY3. Participating facilities are designated pre-CEC, transition, and post-CEC periods depending on their start date. The periods of analysis for all groups are described in **Exhibit F-15**. Specifically, Q1 2014 represent the first calendar quarter of the baseline period, i.e., January 2014 for all participating facilities. The baseline period ends in March 2015 for participating facilities starting in PY1 and in June 2016 (2017, respectively) for participating facilities starting in PY2 (PY3, respectively). For participating facilities starting in PY1, the transition period takes into consideration the delayed start of the CEC Model, which was originally scheduled for April 2015. The transition period for participating facilities starting in PY2 includes months from the application deadline (July 2016) to the start of PY2. The transition period for participating facilities starting in PY3 includes July 2017 through the start of PY3. The transition periods are represented by the two yellow quarters for each group. Finally, the area shaded in orange represents the intervention period for each group.

[32] In PY3, Wave 1 and 2 ESCOs added 82 and 298 facilities, respectively. Of the PY3 joiners, 68 Wave 1 and 251 Wave 2 facilities were included in the matched analytic sample for the impact analysis. Additionally, 33 facilities terminated their participation in the CEC model after December 2015; 28 of these 33 facilities are in the analytic sample. Sixteen of these facilities have rejoined or will rejoin by PY4. Facilities who stopped participating continue to remain in the analytic sample as long as the facility remains open. New beneficiaries cannot be aligned to facilities that left the model, but existing beneficiaries remain aligned as long as they had a first touch at a participating facility in the ESCO. One ESCO facility closed in December 2017; this facility and its match were removed from the analytic sample for PY3.

Exhibit F-15. Waves, Pre-CEC, Transition, and Post-CEC Periods

Facility Group	Performance Year 1	Performance Year 2	Performance Year 3
Wave 1, PY1 Joiners	Pre-CEC | Transition	Post-CEC	
Wave 1, PY2 Joiners	Pre-CEC	Transition	Post-CEC
Wave 2, PY2 Joiners	Pre-CEC	Transition	Post-CEC
Wave 1, PY3 Joiners	Pre-CEC	Transition	Post-CEC
Wave 2, PY3 Joiners	Pre-CEC	Transition	Post-CEC
Matched Comparison Group	Pre-CEC		

	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018

Model Specification. Our generalized DiD estimates the impact of the CEC Model for all ESCOs allowing for different start times for each participating facility. We illustrate the DiD regression framework used to estimate the CEC Model effects for each ESCO wave and PY.

$$Y_{ijt} = b_0 + b_1 Quarter_{it} + b_2 ESCO_{ij} + b_3 ESCO\_Post\_PY1\_W1_{ijt} + b_4 ESCO\_Post\_PY2\_W1_{ijt} + b_5 ESCO\_Post\_PY3\_W1_{ijt} + b_6 ESCO\_Post\_PY2\_W2_{ijt} + b_7 ESCO\_Post\_PY3\_W2_{ijt} + \lambda' X_{ijt} + e_{ijt}$$

Subscripts *i*, *j*, and *t* denote individuals, facilities, and time, respectively. *Quarter* (0,1) is a vector of calendar quarter dummies that captures aggregate factors that could cause changes in outcome *Y* over time that are common across CEC and comparison beneficiaries. *ESCO* (0,1) is a time-invariant treatment group identifier which identifies the group of CEC eligible beneficiaries aligned at an ESCO in a given month.[33] The post-treatment indicators, represented by *ESCO_Post_PY1_W1, ESCO_Post_PY2_W1, ESCO_Post_PY3_W1, ESCO_Post_PY2_W2,* and *ESCO_Post_PY3_W2*, separate CEC beneficiaries by wave and by PY. For example, *ESCO_Post_PY1_W1* (0,1) is indexed to *i*, *j*, and *t*, takes the value of 0 for beneficiaries in the pre-CEC and transition period and switches to =1 for CEC beneficiaries aligned to a Wave 1.1

[33] Rather than using the list of aligned beneficiaries produced by the implementation contractor, we simulate alignment using the program rules described above. This allows us to align beneficiaries during the pre-CEC period and apply the same methods for CEC and comparison beneficiaries.

facility when their aligned facility starts participating in PY1. *ESCO_Post_PY1_W1* is always 0 for the comparison group. [34]

The DiD designs control for time-varying changes that are common to all beneficiaries and that occur during the implementation of the CEC Model, as well as time-invariant unmeasured differences between beneficiaries not otherwise captured by the model. The variables we specified in the DiD models to control for time-invariant and time-varying differences in patients, markets, and facilities that are outside the control of ESCOs, are detailed in **Exhibit F-16**. Market and facility variables are representative of the facility to which the beneficiary was assigned based on first-touch assignment. The regression model includes only beneficiary health conditions that are not likely to be affected by the CEC Model (i.e., cancer, reason for ESRD) since their inclusion would bias estimates of the impact the CEC Model had on ESRD care. Furthermore, we estimated stratified DiD models similar to the specification described by equation (1), but observations were restricted to our stratified samples of interest. Specifically, we investigated the extent to which the CEC Model had a differential impact on subgroups of Medicare beneficiaries with ESRD varying in their demographic characteristics and their time in dialysis.

Exhibit F-16. Control Variables Included in the DiD Model

Beneficiary Level	Facility Level	Market Level
OREC: Age, Disabled, ESRD, ESRD and Disabled Reason for ESRD: Hypertension, diabetes, or other Female Age BMI at ESRD incidence Months on dialysis Cancer indicator (annual) Type of dialysis indicator: Hemodialysis, peritoneal dialysis, other (monthly) Race indicators: White, Black, Other Medicaid status indicators: None, full, or partial (monthly)	Facility indicators for Wave 1.1, Wave 1.2, Wave 1.3, Wave 2.1, and Wave 2.2 LDO Facilities indicators: Fresenius, DCI, and DaVita Small Dialysis Facility (SDO/ non-LDO) indicator Facility beneficiary count (annual) Profit: For profit, not for profit Late shift indicator (facility offers dialysis after 5PM) Rural Urban indicators (Metro, Urban, Rural)	CBSA median household income (annual) CBSA Dual enrollees (Medicaid & Medicare) per 100,000 population in CBSA (annual) CBSA MA penetration (annual) CBSA geographic rate of PCPs per 10,000 population (annual) Region indicators Percent of ACO beneficiaries in a market

[34] The DiD regression frameworks also include an indicator that identifies the treatment transition period observations. This indicator controls the transition period effect on outcomes and effectively exclude this time period from the DiD estimate. For brevity, the indicator was omitted from the equations.

Computation of Standard Errors. In general, estimated standard errors of the DiD estimate are calculated using two-way clusters at beneficiary and service facility levels.[35,36] Two-way clusters account for intra-cluster correlation among beneficiaries receiving services from the same facility (service facility cluster) and correlation across observations from the same beneficiary across time (beneficiary cluster).

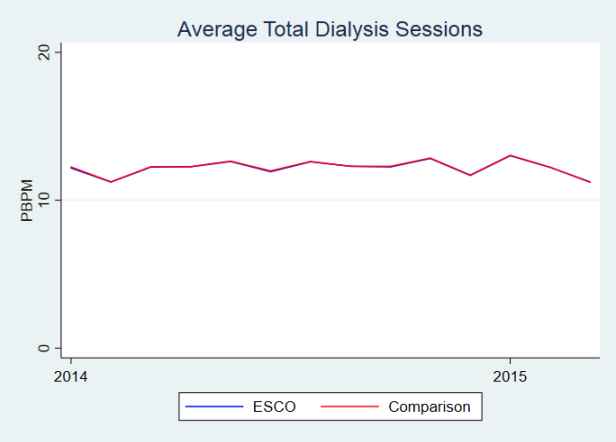
Parallel Trends Tests. A pivotal assumption of the DiD model is that the ESCO and comparison groups have the same trend in outcomes prior to the intervention. (See **Exhibit F-14** for the illustration of the parallel trends assumption during the pre-CEC period). Formally, the parallel trend tests involved assessing the significance of the coefficient corresponding to the time and treatment dummy interaction term at $p \leq 0.05$, using data prior to the start of the CEC Model. If the outcome trends between treatment and comparison group are the same prior to the start of the CEC Model, then the interaction coefficient should be near zero and insignificant (i.e., the difference in trends is not significantly different between the two groups in the pre-CEC period). Similar to equation (1) and (2), the parallel trend test for each DiD estimate includes a full set of patient, facility, and market risk adjusters that are included in the DiD specification. We test trends over the common period where all treatment and matched comparison groups are within the pre-CEC period (i.e., the first five quarters of data January 2014 through March 2015).[37] We conducted parallel trend tests for every outcome and every group of CEC facilities evaluated in this report (i.e., All ESCOs, Wave 1 ESCOs, and Wave 2 ESCOs). DiD estimates that failed parallel trend test are identified in **Exhibits F-18** through **F-30** with the symbol ‡. Three outcomes measures are presented and discussed in the report despite failing parallel trends test. We present the baseline trend graphs in **Exhibit F-17**. All three measures have visually parallel trends between the ESCO and comparison groups.

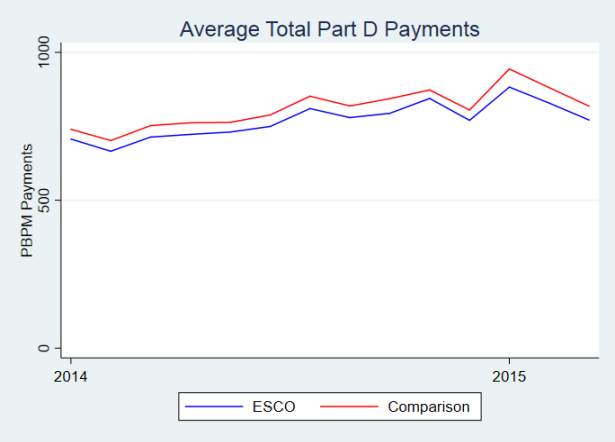
[35] Cameron, A., Gelbach, J.B., Miller, D.L. (2012). Robust inference with multiway clustering. *Journal of Business & Economic Statistics*, 29(2):238-49.

[36] Two-part expenditure models apply one-way cluster methods. Standard errors for these models are clustered by service facility.

[37] Trend tests for the overall all ESCO DiD result compare trends of the pooled treatment and comparison groups, whereas, trend test for the wave specific DiD estimate compare each wave specific treatment group (Wave 1 and Wave 2) relative to the trends of the pooled comparison group.

Exhibit F-17: Baseline Trend Graphs for Select Outcome Measures that Fail Statistical Trend Tests





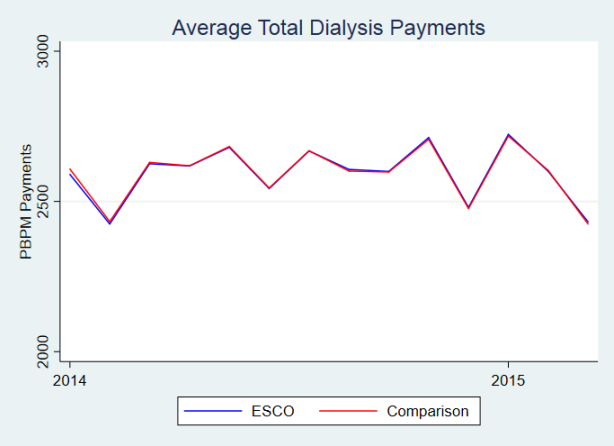


Exhibit F-18. Impact of the CEC Model on Dialysis Care, All ESCOs

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care	Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	PY1-PY3	65.3%	64.8%	65.4%	64.7%	0.25	-0.35	0.84	0.38%
		PY1	65.3%	64.7%	65.4%	64.9%	-0.05	-1.2	1.1	-0.07%
		PY2	65.3%	64.8%	65.4%	64.5%	0.46	-0.20	1.1	0.70%
		PY3	65.3%	64.7%	65.4%	64.6%	0.20	-0.42	0.82	0.31%
	Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	PY1-PY3	9.4%	9.9%	11.2%	12.3%	-0.69 ***	-1.05	-0.33	-7.4%
		PY1	9.4%	9.1%	11.2%	12.0%	-1.2 ***	-1.9	-0.56	-13.0%
		PY2	9.4%	9.8%	11.2%	12.3%	-0.72 ***	-1.1	-0.30	-7.6%
		PY3	9.4%	10.4%	11.2%	12.6%	-0.48 **	-0.88	-0.08	-5.1%
	Hemodialysis (percent with at least one)	PY1-PY3	92.5%	91.5%	91.8%	91.0%	-0.27	-0.80	0.26	-0.30%
		PY1	92.5%	91.9%	91.8%	91.0%	0.20	-0.94	1.34	0.22%
		PY2	92.5%	91.5%	91.8%	91.2%	-0.33	-0.91	0.24	-0.36%
		PY3	92.5%	91.2%	91.8%	90.9%	-0.40	-0.92	0.12	-0.43%
	Peritoneal Dialysis (percent with at least one)	PY1-PY3	5.9%	6.6%	6.5%	7.0%	0.26	-0.28	0.79	4.3%
		PY1	5.9%	6.2%	6.5%	6.9%	-0.05	-1.2	1.1	-0.90%
		PY2	5.9%	6.7%	6.5%	7.1%	0.28	-0.30	0.86	4.7%
		PY3	5.9%	6.8%	6.5%	7.1%	0.35	-0.15	0.84	5.9%
	Home Hemodialysis (percent with at least one)	PY1-PY3	1.5%	1.7%	1.4%	1.5%	0.09	-0.19	0.37	5.5%
		PY1	1.5%	1.7%	1.4%	1.5%	0.11	-0.40	0.63	7.4%
		PY2	1.5%	1.7%	1.4%	1.5%	-0.0004	-0.30	0.30	-0.03%
		PY3	1.5%	1.8%	1.4%	1.5%	0.14	-0.13	0.41	8.9%
	Home Dialysis (percent with at least one)	PY1-PY3	7.9%	8.0%	7.7%	7.8%	0.10	-0.16	0.35	1.2%
		PY1	7.9%	8.1%	7.7%	7.8%	0.13	-0.35	0.60	1.6%
		PY2	7.9%	8.0%	7.7%	7.9%	0.01	-0.27	0.28	0.09%
		PY3	7.9%	8.1%	7.7%	7.8%	0.15	-0.09	0.40	1.9%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care (cont.)	Emergency Dialysis (percent with at least one)	PY1-PY3	2.0%	2.0%	1.9%	2.0%	-0.14 **	-0.23	-0.05	-7.1%
		PY1	2.0%	2.0%	1.9%	2.0%	-0.12	-0.30	0.06	-6.1%
		PY2	2.0%	1.9%	1.9%	2.1%	-0.27 ***	-0.37	-0.16	-13.6%
		PY3	2.0%	2.0%	1.9%	2.0%	-0.06	-0.16	0.04	-2.8%
	Number of Outpatient Dialysis Sessions per 1,000 Beneficiaries per Month	PY1-PY3	12,238.4	12,280.5	12,262.3	12,252.5	51.8 ***	26.5	77.2	0.42%
		PY1	12,238.3	12,346.1	12,262.3	12,308.5	61.5 ** ‡	12.9	110.2	0.50%
		PY2	12,238.4	12,270.7	12,262.3	12,231.7	62.8 ***	34.4	91.3	0.51%
		PY3	12,238.4	12,224.9	12,262.3	12,208.3	40.4 **	13.4	67.4	0.33%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-19. Impact of the CEC Model on Dialysis Care, Wave 1

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care	Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	PY1-PY3	65.3%	64.6%	65.4%	64.7%	0.02	-0.91	0.95	0.03%
		PY1	65.3%	64.7%	65.4%	64.9%	-0.05	-1.2	1.1	-0.07%
		PY2	65.3%	64.8%	65.4%	64.5%	0.44	-0.55	1.4	0.67%
		PY3	65.3%	64.2%	65.4%	64.6%	-0.27	-1.2	0.69	-0.41%
	Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	PY1-PY3	9.4%	9.6%	11.2%	12.3%	-0.99 ***	-1.5	-0.44	-10.5%
		PY1	9.4%	9.1%	11.2%	12.0%	-1.2 ***	-1.9	-0.56	-13.0%
		PY2	9.4%	9.4%	11.2%	12.3%	-1.2 ***	-1.8	-0.56	-12.5%
		PY3	9.4%	10.3%	11.2%	12.6%	-0.64 *	-1.2	-0.04	-6.8%
	Hemodialysis (percent with at least one)	PY1-PY3	92.5%	91.5%	91.8%	91.0%	-0.20	-1.1	0.72	-0.22%
		PY1	92.5%	91.9%	91.8%	91.0%	0.20	-0.94	1.3	0.22%
		PY2	92.5%	91.5%	91.8%	91.1%	-0.35	-1.3	0.63	-0.38%
		PY3	92.5%	91.2%	91.8%	90.9%	-0.41	-1.3	0.44	-0.44%
	Peritoneal Dialysis (percent with at least one)	PY1-PY3	5.9%	6.7%	6.5%	7.0%	0.35	-0.60	1.3	5.9%
		PY1	5.9%	6.2%	6.5%	6.9%	-0.05	-1.2	1.1	-0.90%
		PY2	5.9%	6.9%	6.5%	7.1%	0.44	-0.56	1.4	7.5%
		PY3	5.9%	7.1%	6.5%	7.1%	0.61	-0.26	1.5	10.3%
	Home Hemodialysis (percent with at least one)	PY1-PY3	1.5%	1.8%	1.4%	1.5%	0.16	-0.32	0.64	10.3%
		PY1	1.5%	1.7%	1.4%	1.5%	0.11	-0.40	0.63	7.4%
		PY2	1.5%	1.8%	1.4%	1.5%	0.11	-0.42	0.64	7.3%
		PY3	1.5%	1.9%	1.4%	1.5%	0.24	-0.27	0.74	15.3%
	Home Dialysis (percent with at least one)	PY1-PY3	7.9%	8.1%	7.7%	7.8%	0.18	-0.26	0.63	2.3%
		PY1	7.9%	8.1%	7.7%	7.8%	0.13	-0.35	0.60	1.6%
		PY2	7.9%	8.1%	7.7%	7.9%	0.14	-0.35	0.63	1.8%
		PY3	7.9%	8.2%	7.7%	7.8%	0.26	-0.20	0.73	3.3%
	Emergency Dialysis (percent with at least one)	PY1-PY3	2.0%	2.0%	1.9%	2.0%	-0.11	-0.25	0.02	-5.9%
		PY1	2.0%	2.0%	1.9%	2.0%	-0.12	-0.30	0.06	-6.1%
		PY2	2.0%	2.0%	1.9%	2.1%	-0.16 *	-0.31	-0.01	-8.3%
		PY3	2.0%	2.0%	1.9%	2.0%	-0.07	-0.22	0.08	-3.7%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care (cont.)	Number of Outpatient Dialysis Sessions per 1,000 Beneficiaries per Month	PY1-PY3	12,238.4	12,303.9	12,262.3	12,256.7	71.1 *** ‡	31.9	110.3	0.58%
		PY1	12,238.3	12,346.1	12,262.3	12,308.5	61.5 ** ‡	12.9	110.2	0.50%
		PY2	12,238.4	12,289.0	12,262.3	12,236.5	76.4 *** ‡	33.1	119.7	0.62%
		PY3	12,238.4	12,257.9	12,262.3	12,207.4	74.3 *** ‡	35.1	113.6	0.61%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-20. Impact of the CEC Model on Dialysis Care, Wave 2

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care	Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	PY2 & PY3	65.1%	65.0%	65.2%	64.6%	0.53	-0.14	1.2	0.81%
		PY2	65.1%	64.9%	65.2%	64.5%	0.48	-0.32	1.3	0.74%
		PY3	65.1%	65.0%	65.2%	64.6%	0.55	-0.16	1.3	0.85%
	Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	PY2 & PY3	9.7%	10.4%	11.4%	12.5%	-0.33	-0.73	0.08	-3.4%
		PY2	9.7%	10.3%	11.4%	12.3%	-0.27	-0.75	0.22	-2.7%
		PY3	9.7%	10.5%	11.4%	12.6%	-0.37	-0.82	0.09	-3.8%
	Hemodialysis (percent with at least one)	PY2 & PY3	92.3%	91.4%	91.6%	91.0%	-0.36	-0.98	0.26	-0.39%
		PY2	92.3%	91.6%	91.6%	91.2%	-0.32	-1.1	0.45	-0.34%
		PY3	92.3%	91.2%	91.6%	90.9%	-0.39	-1.1	0.30	-0.42%
	Peritoneal Dialysis (percent with at least one)	PY2 & PY3	6.0%	6.6%	6.6%	7.1%	0.14	-0.46	0.75	2.4%
		PY2	6.0%	6.6%	6.6%	7.1%	0.12	-0.64	0.88	2.0%
		PY3	6.0%	6.6%	6.6%	7.1%	0.15	-0.47	0.78	2.6%
	Home Hemodialysis (percent with at least one)	PY2 & PY3	1.6%	1.7%	1.4%	1.5%	-0.01	-0.30	0.28	-0.38%
		PY2	1.6%	1.6%	1.4%	1.5%	-0.11	-0.45	0.22	-7.1%
		PY3	1.6%	1.7%	1.4%	1.5%	0.06	-0.24	0.36	4.0%
	Home Dialysis (percent with at least one)	PY2 & PY3	7.9%	8.0%	7.8%	7.8%	-0.01	-0.27	0.25	-0.09%
		PY2	7.9%	7.9%	7.8%	7.9%	-0.12	-0.43	0.18	-1.6%
		PY3	7.9%	8.0%	7.8%	7.8%	0.07	-0.20	0.34	0.86%
	Emergency Dialysis (percent with at least one)	PY2 & PY3	2.0%	1.9%	1.9%	2.0%	-0.17 ***	-0.27	-0.07	-8.5%
		PY2	2.0%	1.8%	1.9%	2.1%	-0.37 ***	-0.50	-0.24	-18.4%
		PY3	2.0%	2.0%	1.9%	2.0%	-0.04	-0.16	0.07	-2.1%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Dialysis Care (cont.)	Number of Outpatient Dialysis Sessions per 1,000 Beneficiaries per Month	PY2 & PY3	12,252.3	12,223.9	12,276.1	12,219.8	28.0	-1.4	57.4	0.23%
		PY2	12,252.2	12,257.4	12,276.1	12,231.9	49.4 **	15.4	83.4	0.40%
		PY3	12,252.3	12,198.6	12,276.1	12,208.0	14.4	-18.0	46.9	0.12%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-21. Impact of the CEC Model on Coordination of Care beyond Dialysis, All ESCOs

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis	Percent of Beneficiaries Receiving Flu Vaccinations (Wave 1.1, 1.2, and 2.1 only)	PY1-PY2	64.8%	68.1%	62.4%	63.9%	1.9 ***	0.97	2.8	2.9%
		PY1	64.8%	64.4%	62.4%	62.4%	-0.36	-2.2	1.5	-0.55%
		PY2	64.8%	70.1%	62.4%	65.0%	2.7 ***	1.8	3.6	4.2%
	Percent of Beneficiaries Receiving at Least One Dilated Eye Exam in a Given Year	PY1-PY3	39.7%	41.4%	40.3%	40.4%	1.6 ***	0.87	2.4	4.1%
		PY1	39.7%	41.2%	40.3%	40.9%	0.94	-0.35	2.2	2.4%
		PY2	39.7%	40.8%	40.3%	40.2%	1.3 **	0.34	2.2	3.2%
		PY3	39.7%	41.7%	40.3%	40.3%	2.1 ***	1.2	3.0	5.2%
	Percent of Beneficiaries Receiving at Least One LDL Cholesterol Test in a Given Year	PY1-PY3	58.5%	57.8%	54.7%	52.0%	2.1 ***	0.76	3.4	3.5%
		PY1	58.5%	60.9%	54.7%	53.4%	3.8 **	1.2	6.3	6.4%
		PY2	58.5%	56.8%	54.7%	51.6%	1.5	-0.04	3.0	2.5%
		PY3	58.5%	57.2%	54.7%	51.5%	2.0 **	0.70	3.3	3.5%
	Percent of Beneficiaries Receiving at Least One HbA1c Test in a Given Year	PY1-PY3	77.9%	76.4%	77.6%	75.2%	0.86 *	0.01	1.7	1.1%
		PY1	77.9%	75.2%	77.6%	74.8%	-0.01	-1.9	1.9	-0.01%
		PY2	77.9%	76.5%	77.6%	74.8%	1.38 **	0.39	2.4	1.8%
		PY3	77.9%	76.8%	77.6%	75.8%	0.74	-0.14	1.6	0.95%
	Percent of Beneficiaries Receiving Hospice Services in a Given Month	PY1-PY3	0.89%	0.85%	0.82%	0.75%	0.02	-0.03	0.07	2.7%
		PY1	0.89%	0.86%	0.82%	0.77%	0.02	-0.06	0.09	2.0%
		PY2	0.89%	0.84%	0.82%	0.78%	-0.01	-0.07	0.06	-0.94%
		PY3	0.89%	0.83%	0.82%	0.70%	0.05	-0.02	0.11	5.5%
	Percent of Beneficiaries with Greater than 50 mg Average MME in a Given Month	PY1-PY3	6.2%	5.5%	6.2%	5.7%	-0.32 *	-0.60	-0.05	-5.2%
		PY1	6.2%	5.8%	6.2%	6.5%	-0.73 **	-1.20	-0.26	-11.7%
		PY2	6.2%	5.6%	6.2%	5.8%	-0.25	-0.57	0.07	-4.0%
		PY3	6.2%	4.6%	6.2%	4.7%	-0.23	-0.53	0.06	-3.7%
	Percent of Beneficiaries with Greater than 80% of Days Covered for Phosphate Binder Prescription in a Given Month	PY1-PY3	34.1%	36.8%	34.1%	35.3%	1.3 ***	0.76	1.9	3.9%
		PY1	34.1%	36.5%	34.1%	35.4%	1.03 *	0.13	1.9	3.0%
		PY2	34.1%	35.7%	34.1%	34.8%	0.76 **	0.14	1.4	2.2%
		PY3	34.1%	37.7%	34.1%	35.8%	1.8 ***	1.1	2.5	5.4%
	Percent of Beneficiaries with at Least One Contraindicated Medication Prescription Fill in a Given Month	PY1-PY3	3.5%	3.7%	3.6%	3.7%	0.11	-0.08	0.31	3.3%
		PY1	3.5%	3.7%	3.6%	3.7%	0.09	-0.22	0.39	2.5%
		PY2	3.5%	3.7%	3.6%	3.7%	0.10	-0.13	0.32	2.7%
		PY3	3.5%	3.8%	3.6%	3.7%	0.14	-0.08	0.36	4.0%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis (cont.)	Percent of Beneficiaries Starting Dialysis with No Prior Nephrology Care	PY1-PY3	26.3%	24.1%	28.1%	26.4%	-0.51	-2.5	1.5	-1.9%
		PY1	26.3%	23.2%	28.1%	27.1%	-2.1	-5.5	1.4	-7.9%
		PY2	26.3%	23.8%	28.1%	26.8%	-1.2	-3.9	1.4	-4.7%
		PY3	26.3%	23.8%	28.1%	24.5%	1.1	-1.7	3.8	4.0%
	Number of Primary Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY1-PY3	235.3	231.4	229.9	216.9	9.1 ***	5.0	13.1	3.8%
		PY1	235.4	235.3	229.9	224.2	5.6	-2.0	13.2	2.4%
		PY2	235.3	235.4	229.9	216.7	13.3 ***	8.4	18.2	5.6%
		PY3	235.2	220.0	229.9	207.7	7.0 ***	2.8	11.2	3.0%
	Number of Specialty Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY1-PY3	436.3	435.0	430.1	425.1	3.7	-2.7	10.0	0.84%
		PY1	436.4	433.9	430.1	430.2	-2.6	-14.7	9.6	-0.59%
		PY2	436.4	438.3	430.1	426.6	5.5	-1.8	12.8	1.3%
		PY3	436.3	427.5	430.1	416.8	4.5	-2.2	11.3	1.0%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-22. Impact of the CEC Model on Coordination of Care beyond Dialysis, Wave 1

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis	Percent of Beneficiaries Receiving Flu Vaccinations (Wave 1.1, 1.2, and 2.1 only)	PY1-PY2	64.8%	67.8%	62.4%	63.7%	1.7 **	0.54	2.9	2.7%
		PY1	64.8%	64.4%	62.4%	62.4%	-0.36	-2.2	1.5	-0.55%
		PY2	64.8%	70.7%	62.4%	65.0%	3.4 ***	2.2	4.5	5.2%
	Percent of Beneficiaries Receiving at Least One Dilated Eye Exam in a Given Year	PY1-PY3	39.7%	42.0%	40.3%	40.5%	2.2 ***	1.2	3.2	5.6%
		PY1	39.7%	41.2%	40.3%	40.9%	0.94	-0.35	2.23	2.36%
		PY2	39.7%	42.4%	40.3%	40.2%	2.8 ***	1.6	4.0	7.1%
		PY3	39.7%	42.2%	40.3%	40.3%	2.5 ***	1.3	3.7	6.3%
	Percent of Beneficiaries Receiving at Least One LDL Cholesterol Test in a Given Year	PY1-PY3	58.5%	60.6%	54.7%	52.1%	4.7 ***	2.7	6.7	8.1%
		PY1	58.5%	60.9%	54.7%	53.4%	3.7 **	1.17	6.33	6.41%
		PY2	58.5%	61.2%	54.7%	51.6%	5.8 ***	3.6	8.1	10.0%
		PY3	58.5%	59.6%	54.7%	51.5%	4.4 ***	2.4	6.5	7.6%
	Percent of Beneficiaries Receiving at Least One HbA1c Test in a Given Year	PY1-PY3	77.9%	76.8%	77.6%	75.1%	1.3 *	0.01	2.6	1.7%
		PY1	77.9%	75.2%	77.6%	74.8%	-0.01	-1.87	1.85	-0.01%
		PY2	77.9%	77.5%	77.6%	74.8%	2.4 ***	0.96	3.9	3.1%
		PY3	77.9%	77.4%	77.6%	75.8%	1.3	-0.02	2.6	1.7%
	Percent of Beneficiaries Receiving Hospice Services in a Given Month	PY1-PY3	0.89%	0.82%	0.82%	0.75%	-0.003	-0.06	0.05	-0.38%
		PY1	0.89%	0.86%	0.82%	0.77%	0.02	-0.06	0.09	2.0%
		PY2	0.89%	0.78%	0.82%	0.78%	-0.06	-0.14	0.01	-7.3%
		PY3	0.89%	0.81%	0.82%	0.70%	0.03	-0.04	0.10	3.4%
	Percent of Beneficiaries with Greater than 50 mg Average MME in a Given Month	PY1-PY3	6.2%	5.2%	6.2%	5.7%	-0.57 **	-0.95	-0.19	-9.1%
		PY1	6.2%	5.8%	6.2%	6.5%	-0.73 **	-1.2	-0.26	-11.7%
		PY2	6.2%	5.3%	6.2%	5.8%	-0.59 **	-1.0	-0.16	-9.4%
		PY3	6.2%	4.4%	6.2%	4.7%	-0.42 *	-0.83	-0.02	-6.8%
	Percent of Beneficiaries with Greater than 80% of Days Covered for Phosphate Binder Prescription in a Given Month	PY1-PY3	34.1%	36.7%	34.1%	35.3%	1.3 ***	0.48	2.0	3.7%
		PY1	34.1%	36.5%	34.1%	35.4%	1.0 *	0.13	1.9	3.0%
		PY2	34.1%	36.0%	34.1%	34.8%	1.1 **	0.24	2.0	3.3%
		PY3	34.1%	37.4%	34.1%	35.8%	1.6 ***	0.59	2.5	4.6%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis (cont.)	Percent of Beneficiaries with at Least One Contraindicated Medication Prescription Fill in a Given Month	PY1-PY3	3.5%	3.8%	3.6%	3.7%	0.17	-0.10	0.43	4.8%
		PY1	3.5%	3.7%	3.6%	3.7%	0.09	-0.22	0.39	2.5%
		PY2	3.5%	3.9%	3.6%	3.7%	0.25	-0.06	0.56	7.2%
		PY3	3.5%	3.8%	3.6%	3.7%	0.16	-0.14	0.46	4.6%
	Percent of Beneficiaries Starting Dialysis with No Prior Nephrology Care	PY1-PY3	26.3%	24.2%	28.1%	26.4%	-0.46	-3.1	2.2	-1.7%
		PY1	26.3%	23.2%	28.1%	27.1%	-2.1	-5.5	1.4	-7.9%
		PY2	26.3%	23.8%	28.1%	26.8%	-1.2	-4.7	2.3	-4.6%
		PY3	26.3%	25.3%	28.1%	24.5%	2.6	-1.1	6.3	9.9%
	Number of Primary Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY1-PY3	235.3	228.7	229.9	216.9	6.4 *	0.30	12.5	2.7%
		PY1	235.4	235.3	229.9	224.2	5.6	-2.0	13.2	2.4%
		PY2	235.3	232.8	229.9	216.4	11.0 **	3.9	18.0	4.7%
		PY3	235.2	216.3	229.9	207.7	3.2	-3.2	9.6	1.4%
	Number of Specialty Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY1-PY3	436.3	430.7	430.1	425.0	-0.47	-10.5	9.5	-0.11%
		PY1	436.4	433.9	430.1	430.2	-2.6	-14.7	9.6	-0.59%
		PY2	436.4	435.7	430.1	426.1	3.5	-7.7	14.6	0.80%
		PY3	436.3	421.0	430.1	416.9	-2.0	-12.5	8.5	-0.45%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-23. Impact of the CEC Model on Coordination of Care beyond Dialysis, Wave 2

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis	Percent of Beneficiaries Receiving Flu Vaccinations (Wave 1.1, 1.2, and 2.1 only)	PY2	64.8%	69.5%	62.4%	65.0%	2.1 ***	0.94	3.3	3.3%
	Percent of Beneficiaries Receiving at Least One Dilated Eye Exam in a Given Year	PY2 & PY3	39.8%	40.6%	40.4%	40.3%	0.97 *	0.06	1.9	2.4%
		PY2	39.8%	39.3%	40.4%	40.2%	-0.30	-1.4	0.85	-0.74%
		PY3	39.8%	41.4%	40.4%	40.3%	1.8 ***	0.71	2.8	4.4%
	Percent of Beneficiaries Receiving at Least One LDL Cholesterol Test in a Given Year	PY2 & PY3	58.2%	54.3%	54.4%	51.5%	-0.97	-2.4	0.50	-1.7%
		PY2	58.2%	52.6%	54.4%	51.6%	-2.8 ***	-4.6	-1.0	-4.8%
		PY3	58.2%	55.4%	54.4%	51.5%	0.21	-1.3	1.8	0.36%
	Percent of Beneficiaries Receiving at Least One HbA1c Test in a Given Year	PY2 & PY3	77.3%	75.9%	76.9%	75.3%	0.33	-0.67	1.3	0.43%
		PY2	77.3%	75.4%	76.9%	74.8%	0.35	-0.88	1.6	0.46%
		PY3	77.3%	76.4%	76.9%	75.8%	0.32	-0.74	1.4	0.41%
	Percent of Beneficiaries Receiving Hospice Services in a Given Month	PY2 & PY3	0.88%	0.87%	0.80%	0.74%	0.06	-0.01	0.13	6.5%
		PY2	0.88%	0.90%	0.80%	0.78%	0.05	-0.04	0.13	5.3%
		PY3	0.88%	0.84%	0.80%	0.70%	0.06	-0.02	0.15	7.3%
	Percent of Beneficiaries with Greater than 50 mg Average MME in a Given Month	PY2 & PY3	6.3%	5.3%	6.3%	5.2%	-0.02	-0.33	0.29	-0.31%
		PY2	6.3%	5.9%	6.3%	5.8%	0.09	-0.28	0.46	1.4%
		PY3	6.3%	4.7%	6.3%	4.7%	-0.09	-0.42	0.24	-1.4%
	Percent of Beneficiaries with Greater than 80% of Days Covered for Phosphate Binder Prescription in a Given Month	PY2 & PY3	34.6%	36.8%	34.5%	35.3%	1.4 ***	0.74	2.1	4.1%
		PY2	34.6%	35.3%	34.5%	34.8%	0.40	-0.30	1.1	1.2%
		PY3	34.6%	37.9%	34.5%	35.8%	2.0 ***	1.3	2.8	5.9%
	Percent of Beneficiaries with at Least One Contraindicated Medication Prescription Fill in a Given Month	PY2 & PY3	3.5%	3.7%	3.6%	3.7%	0.05	-0.18	0.28	1.4%
		PY2	3.5%	3.5%	3.6%	3.7%	-0.06	-0.33	0.21	-1.8%
		PY3	3.5%	3.7%	3.6%	3.7%	0.12	-0.14	0.38	3.4%
	Percent of Beneficiaries Starting Dialysis with No Prior Nephrology Care	PY2 & PY3	25.9%	23.5%	27.7%	25.9%	-0.58	-3.1	1.9	-2.2%
		PY2	25.9%	23.8%	27.7%	26.8%	-1.2	-4.4	2.0	-4.8%
		PY3	25.9%	22.7%	27.7%	24.5%	0.0001	-3.1	3.1	0.0003%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Coordination of Care beyond Dialysis (cont.)	Number of Primary Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY2 & PY3	233.5	229.5	228.2	212.1	12.1 ***	7.3	16.9	5.2%
		PY2	233.6	237.6	228.2	216.7	15.5 ***	9.3	21.7	6.6%
		PY3	233.5	222.9	228.2	207.7	9.9 ***	4.7	15.1	4.2%
	Number of Specialty Care E/M Office/Outpatient Visits per 1,000 Beneficiaries per Month	PY2 & PY3	436.5	436.6	430.3	421.6	8.7 **	1.7	15.8	2.0%
		PY2	436.5	440.2	430.3	426.6	7.5	-1.8	16.7	1.7%
		PY3	436.4	432.5	430.3	416.9	9.5 **	1.9	17.1	2.2%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-24. Impact of the CEC Model on Hospitalizations and Emergency Department (ED) Visits, All ESCOs

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits	Number of Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	133.2	129.8	131.8	133.2	-4.8 ***	-7.0	-2.6	-3.6%
		PY1	133.2	127.0	131.8	132.3	-6.7 ***	-10.6	-2.8	-5.0%
		PY2	133.2	129.7	131.8	133.2	-4.9 ***	-7.6	-2.3	-3.7%
		PY3	133.2	131.8	131.8	134.5	-4.0 ***	-6.6	-1.4	-3.0%
	Number of ED Visits per 1,000 Beneficiaries per Month	PY1-PY3	141.3	151.3	148.1	158.8	-0.74	-3.8	2.3	-0.52%
		PY1	141.4	147.8	148.1	157.3	-2.7	-8.2	2.7	-1.9%
		PY2	141.3	155.0	148.1	161.5	0.36	-3.5	4.2	0.25%
		PY3	141.3	150.8	148.1	158.3	-0.80	-4.2	2.6	-0.56%
	Number of Observation Stays per 1,000 Beneficiaries per Month	PY1-PY3	25.4	26.9	24.0	26.4	-0.86	-1.8	0.10	-3.4%
		PY1	25.4	28.3	24.0	26.2	0.65	-1.1	2.4	2.6%
		PY2	25.4	26.5	24.0	26.4	-1.3 *	-2.5	-0.20	-5.3%
		PY3	25.4	26.9	24.0	26.5	-1.0	-2.2	0.14	-4.1%
	Number of Endocrine/Metabolic Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	16.6	14.2	15.8	14.0	-0.50	-1.0	0.01	-3.0%
		PY1	16.6	13.6	15.8	13.2	-0.37	-1.2	0.44	-2.2%
		PY2	16.6	14.7	15.8	14.4	-0.45	-1.1	0.24	-2.7%
		PY3	16.6	14.7	15.8	14.6	-0.61	-1.3	0.08	-3.7%
	Number of Circulatory Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	38.3	40.5	37.7	42.1	-2.3 ***	-3.3	-1.3	-6.0%
		PY1	38.3	38.4	37.7	40.8	-3.0 ***	-4.6	-1.4	-7.9%
		PY2	38.3	41.5	37.7	43.0	-2.1 ***	-3.2	-0.84	-5.3%
		PY3	38.3	41.5	37.7	43.1	-2.3 ***	-3.5	-1.0	-5.9%
	Number of Infectious Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	14.1	14.3	15.1	16.2	-0.86 ***	-1.4	-0.36	-6.1%
		PY1	14.2	13.8	15.1	15.7	-0.97 *	-1.8	-0.14	-6.8%
		PY2	14.1	14.4	15.1	16.4	-0.98 **	-1.6	-0.34	-7.0%
		PY3	14.1	14.8	15.1	16.5	-0.74 *	-1.4	-0.12	-5.3%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Hospitalization for Vascular Access Complications in a Given Month	PY1-PY3	0.58%	0.60%	0.63%	0.65%	-0.01	-0.04	0.02	-1.2%
		PY1	0.58%	0.59%	0.63%	0.66%	-0.02	-0.08	0.03	-4.2%
		PY2	0.58%	0.60%	0.63%	0.64%	0.01	-0.03	0.05	1.2%
		PY3	0.58%	0.61%	0.63%	0.67%	-0.01	-0.05	0.03	-1.9%
	Percent of Beneficiaries with at Least One Hospitalization for ESRD Complications in a Given Month	PY1-PY3	1.8%	2.0%	1.8%	2.0%	-0.12 ***	-0.18	-0.06	-6.5%
		PY1	1.8%	1.7%	1.8%	1.8%	-0.15 ***	-0.24	-0.05	-8.0%
		PY2	1.8%	2.1%	1.8%	2.1%	-0.11 **	-0.19	-0.03	-6.2%
		PY3	1.8%	2.1%	1.8%	2.2%	-0.11 **	-0.19	-0.03	-6.2%
	Percent of Beneficiaries with at Least One Hospitalization for Catheter-related Bloodstream Infection in a Given Month	PY1-PY3	0.14%	0.08%	0.15%	0.09%	-0.0004	-0.01	0.01	-0.31%
		PY1	0.14%	0.07%	0.15%	0.09%	-0.01	-0.02	0.01	-5.5%
		PY2	0.14%	0.09%	0.15%	0.09%	0.004	-0.01	0.02	2.9%
		PY3	0.14%	0.09%	0.15%	0.10%	-0.001	-0.02	0.01	-0.79%
	Percent of Beneficiaries with at Least One Hospitalization for Peritonitis in a Given Month	PY1-PY3	0.10%	0.09%	0.10%	0.09%	0.01	-0.004	0.02	5.8%
		PY1	0.10%	0.11%	0.10%	0.10%	0.02 ‡	-0.002	0.03	16.5%
		PY2	0.10%	0.09%	0.10%	0.09%	0.001	-0.01	0.01	1.1%
		PY3	0.10%	0.08%	0.10%	0.08%	0.01	-0.01	0.02	5.3%
	Percent of Beneficiaries with at Least One Hospitalization for Sepsis in a Given Month	PY1-PY3	1.1%	1.2%	1.2%	1.4%	-0.09 ***	-0.13	-0.04	-7.6%
		PY1	1.1%	1.1%	1.2%	1.3%	-0.07	-0.15	0.002	-6.3%
		PY2	1.1%	1.2%	1.2%	1.4%	-0.09 ***	-0.15	-0.04	-8.1%
		PY3	1.1%	1.2%	1.2%	1.4%	-0.09 **	-0.14	-0.03	-7.7%
	Percent of Beneficiaries with at Least One Admission for Diabetes Short-Term Complications in a Given Month	PY1-PY3	0.12%	0.11%	0.13%	0.11%	0.01	-0.01	0.03	6.8%
		PY1	0.12%	0.09%	0.13%	0.10%	0.01	-0.02	0.03	7.8%
		PY2	0.12%	0.12%	0.13%	0.11%	0.02 *	0.001	0.04	17.7%
		PY3	0.12%	0.12%	0.13%	0.13%	-0.001	-0.02	0.02	-1.2%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Admission for Diabetes Long-Term Complications in a Given Month	PY1-PY3	0.77%	0.68%	0.74%	0.68%	-0.03	-0.06	0.01	-3.3%
		PY1	0.77%	0.62%	0.74%	0.58%	0.01	-0.05	0.07	1.8%
		PY2	0.77%	0.74%	0.74%	0.76%	-0.05 *	-0.11	-0.002	-7.0%
		PY3	0.77%	0.74%	0.74%	0.73%	-0.02	-0.07	0.03	-2.4%
	Percent of Beneficiaries with at Least One Admission for Congestive Heart Failure (CHF) in a Given Month	PY1-PY3	1.5%	1.7%	1.5%	1.9%	-0.13 ***	-0.20	-0.06	-8.4%
		PY1	1.5%	1.4%	1.5%	1.6%	-0.18 ***	-0.28	-0.07	-11.8%
		PY2	1.5%	1.9%	1.5%	2.1%	-0.15 ***	-0.24	-0.06	-9.7%
		PY3	1.5%	2.0%	1.5%	2.1%	-0.10 *	-0.19	-0.01	-6.4%
	Percent of Beneficiaries with at Least One Readmission within 30-days of an Index Hospitalization Stay in a Given Month~	PY1-PY3	29.9%	29.1%	29.6%	29.8%	-0.93 ***	-1.5	-0.39	-3.1%
		PY1	29.9%	28.7%	29.6%	29.5%	-0.97 *	-1.8	-0.11	-3.3%
		PY2	29.9%	29.1%	29.6%	29.9%	-1.0 **	-1.7	-0.33	-3.4%
		PY3	29.9%	29.6%	29.6%	30.2%	-0.83 *	-1.6	-0.10	-2.8%
	Percent of Beneficiaries with at Least One ED Visit within 30-days of an Acute Hospitalization in a Given Month	PY1-PY3	20.1%	21.2%	20.8%	21.8%	0.08	-0.35	0.50	0.38%
		PY1	20.1%	21.0%	20.8%	21.7%	-0.0002	-0.71	0.71	-0.001%
		PY2	20.1%	21.6%	20.8%	22.1%	0.12	-0.44	0.68	0.59%
		PY3	20.1%	21.0%	20.8%	21.6%	0.08	-0.47	0.62	0.37%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-25. Impact of the CEC Model on Hospitalizations and Emergency Department (ED) Visits, Wave 1

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits	Number of Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	133.2	128.2	131.8	133.2	-6.4 ***	-9.6	-3.2	-4.7%
		PY1	133.2	127.0	131.8	132.3	-6.7 ***	-10.6	-2.8	-5.0%
		PY2	133.2	127.8	131.8	133.2	-6.8 ***	-10.6	-3.0	-5.1%
		PY3	133.2	130.1	131.8	134.5	-5.8 ***	-9.4	-2.2	-4.4%
	Number of ED Visits per 1,000 Beneficiaries per Month	PY1-PY3	141.3	150.5	148.1	158.9	-1.6	-6.1	2.9	-1.1%
		PY1	141.4	147.8	148.1	157.3	-2.7	-8.2	2.7	-1.9%
		PY2	141.3	153.5	148.1	161.6	-1.3	-6.6	4.0	-0.93%
		PY3	141.3	150.8	148.1	158.3	-0.80	-5.9	4.3	-0.57%
	Number of Observation Stays per 1,000 Beneficiaries per Month	PY1-PY3	25.4	28.0	24.0	26.4	0.14	-1.2	1.5	0.56%
		PY1	25.4	28.3	24.0	26.2	0.65	-1.1	2.4	2.6%
		PY2	25.4	28.0	24.0	26.4	0.06	-1.5	1.6	0.24%
		PY3	25.4	27.7	24.0	26.5	-0.21	-1.9	1.5	-0.81%
	Number of Endocrine/Metabolic Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	16.6	14.3	15.8	14.0	-0.45	-1.1	0.20	-2.7%
		PY1	16.6	13.6	15.8	13.2	-0.37	-1.2	0.44	-2.2%
		PY2	16.6	14.9	15.8	14.4	-0.20	-1.1	0.69	-1.2%
		PY3	16.6	14.6	15.8	14.6	-0.74	-1.6	0.14	-4.5%
	Number of Circulatory Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	38.3	39.8	37.7	42.1	-3.0 ***	-4.3	-1.7	-7.8%
		PY1	38.3	38.4	37.7	40.8	-3.0 ***	-4.6	-1.4	-7.9%
		PY2	38.3	40.8	37.7	43.0	-2.8 ***	-4.3	-1.2	-7.2%
		PY3	38.3	40.5	37.7	43.1	-3.2 ***	-4.7	-1.6	-8.3%
	Number of Infectious Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY1-PY3	14.1	14.2	15.1	16.1	-0.94 **	-1.6	-0.30	-6.7%
		PY1	14.2	13.8	15.1	15.7	-0.97 *	-1.8	-0.14	-6.8%
		PY2	14.1	14.3	15.1	16.3	-1.0 **	-1.8	-0.18	-7.1%
		PY3	14.1	14.6	15.1	16.5	-0.88 *	-1.7	-0.08	-6.2%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Hospitalization for Vascular Access Complications in a Given Month	PY1-PY3	0.58%	0.59%	0.63%	0.66%	-0.02	-0.06	0.02	-3.5%
		PY1	0.58%	0.59%	0.63%	0.66%	-0.02	-0.08	0.03	-4.2%
		PY2	0.58%	0.58%	0.63%	0.64%	-0.01	-0.07	0.04	-2.2%
		PY3	0.58%	0.60%	0.63%	0.67%	-0.02	-0.07	0.03	-3.9%
	Percent of Beneficiaries with at Least One Hospitalization for ESRD Complications in a Given Month	PY1-PY3	1.8%	1.9%	1.8%	2.0%	-0.15 ***	-0.23	-0.07	-8.0%
		PY1	1.8%	1.7%	1.8%	1.8%	-0.15 ***	-0.24	-0.05	-8.0%
		PY2	1.8%	2.0%	1.8%	2.1%	-0.15 **	-0.25	-0.04	-8.0%
		PY3	1.8%	2.1%	1.8%	2.2%	-0.15 **	-0.25	-0.04	-8.1%
	Percent of Beneficiaries with at Least One Hospitalization for Catheter-related Bloodstream Infection in a Given Month	PY1-PY3	0.14%	0.08%	0.15%	0.09%	-0.003	-0.02	0.01	-2.1%
		PY1	0.14%	0.07%	0.15%	0.09%	-0.01	-0.02	0.01	-5.5%
		PY2	0.14%	0.08%	0.15%	0.09%	-0.002	-0.02	0.01	-1.4%
		PY3	0.14%	0.09%	0.15%	0.10%	0.0002	-0.02	0.02	0.14%
	Percent of Beneficiaries with at Least One Hospitalization for Peritonitis in a Given Month	PY1-PY3	0.10%	0.10%	0.10%	0.09%	0.01 ‡	-0.001	0.02	11.7%
		PY1	0.10%	0.11%	0.10%	0.10%	0.02 ‡	-0.002	0.03	16.5%
		PY2	0.10%	0.10%	0.10%	0.09%	0.01 ‡	-0.01	0.03	9.0%
		PY3	0.10%	0.09%	0.10%	0.08%	0.01 ‡	-0.01	0.03	10.0%
	Percent of Beneficiaries with at Least One Hospitalization for Sepsis in a Given Month	PY1-PY3	1.1%	1.2%	1.2%	1.4%	-0.09 **	-0.15	-0.03	-7.7%
		PY1	1.1%	1.1%	1.2%	1.3%	-0.07	-0.15	0.002	-6.3%
		PY2	1.1%	1.2%	1.2%	1.4%	-0.10 **	-0.17	-0.02	-8.5%
		PY3	1.1%	1.2%	1.2%	1.4%	-0.09 **	-0.17	-0.02	-8.2%
	Percent of Beneficiaries with at Least One Admission for Diabetes Short-Term Complications in a Given Month	PY1-PY3	0.12%	0.10%	0.13%	0.11%	0.005	-0.02	0.03	4.1%
		PY1	0.12%	0.09%	0.13%	0.10%	0.01	-0.02	0.03	7.8%
		PY2	0.12%	0.12%	0.13%	0.11%	0.03	-0.0003	0.05	22.4%
		PY3	0.12%	0.10%	0.13%	0.13%	-0.02	-0.04	0.01	-13.9%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Admission for Diabetes Long-Term Complications in a Given Month	PY1-PY3	0.77%	0.71%	0.74%	0.68%	0.002	-0.04	0.05	0.29%
		PY1	0.77%	0.62%	0.74%	0.58%	0.01	-0.05	0.07	1.8%
		PY2	0.77%	0.76%	0.74%	0.76%	-0.03	-0.10	0.03	-4.1%
		PY3	0.77%	0.78%	0.74%	0.73%	0.02	-0.04	0.08	2.7%
	Percent of Beneficiaries with at Least One Admission for Congestive Heart Failure (CHF) in a Given Month	PY1-PY3	1.5%	1.7%	1.5%	1.9%	-0.19 ***	-0.28	-0.10	-12.6%
		PY1	1.5%	1.4%	1.5%	1.6%	-0.18 ***	-0.28	-0.07	-11.8%
		PY2	1.5%	1.8%	1.5%	2.1%	-0.24 ***	-0.35	-0.12	-15.8%
		PY3	1.5%	1.9%	1.5%	2.1%	-0.16 **	-0.28	-0.04	-10.6%
	Percent of Beneficiaries with at Least One Readmission within 30-days of an Index Hospitalization Stay in a Given Month~	PY1-PY3	29.9%	29.0%	29.6%	29.8%	-1.0 ***	-1.7	-0.39	-3.5%
		PY1	29.9%	28.7%	29.6%	29.5%	-0.97 *	-1.8	-0.11	-3.3%
		PY2	29.9%	29.1%	29.6%	29.9%	-1.0 **	-1.9	-0.18	-3.5%
		PY3	29.9%	29.3%	29.6%	30.2%	-1.1 **	-2.0	-0.20	-3.7%
	Percent of Beneficiaries with at Least One ED Visit within 30-days of an Acute Hospitalization in a Given Month	PY1-PY3	20.1%	21.2%	20.8%	21.8%	0.05	-0.49	0.60	0.25%
		PY1	20.1%	21.0%	20.8%	21.7%	-0.0002	-0.71	0.71	-0.001%
		PY2	20.1%	21.4%	20.8%	22.2%	-0.04	-0.76	0.69	-0.18%
		PY3	20.1%	21.1%	20.8%	21.6%	0.16	-0.54	0.87	0.81%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-26. Impact of the CEC Model on Hospitalizations and Emergency Department (ED) Visits, Wave 2

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits	Number of Hospitalizations per 1,000 Beneficiaries per Month	PY2 & PY3	133.4	132.4	131.9	133.8	-2.8 *	-5.4	-0.31	-2.1%
		PY2	133.4	131.5	131.9	133.2	-3.1	-6.3	0.08	-2.3%
		PY3	133.4	133.2	131.9	134.5	-2.7	-5.6	0.26	-2.0%
	Number of ED Visits per 1,000 Beneficiaries per Month	PY2 & PY3	144.3	153.4	151.1	160.0	0.28	-3.2	3.8	0.20%
		PY2	144.2	156.7	151.1	161.6	2.0	-2.8	6.8	1.4%
		PY3	144.3	150.8	151.1	158.4	-0.79	-4.7	3.1	-0.55%
	Number of Observation Stays per 1,000 Beneficiaries per Month	PY2 & PY3	26.1	25.9	24.7	26.4	-2.0 ***	-3.2	-0.87	-7.8%
		PY2	26.1	25.2	24.7	26.4	-2.6 ***	-4.0	-1.2	-10.1%
		PY3	26.1	26.3	24.7	26.5	-1.7 **	-3.0	-0.30	-6.3%
	Number of Endocrine/Metabolic Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY2 & PY3	15.7	14.7	14.9	14.5	-0.58	-1.2	0.08	-3.7%
		PY2	15.7	14.4	14.9	14.4	-0.69	-1.5	0.16	-4.4%
		PY3	15.7	14.8	14.9	14.6	-0.51	-1.3	0.27	-3.3%
	Number of Circulatory Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY2 & PY3	39.3	42.2	38.7	43.0	-1.5 **	-2.6	-0.27	-3.7%
		PY2	39.3	42.3	38.7	42.9	-1.3	-2.8	0.12	-3.4%
		PY3	39.3	42.2	38.7	43.1	-1.5 *	-3.0	-0.10	-3.9%
	Number of Infectious Inpatient Hospitalizations per 1,000 Beneficiaries per Month	PY2 & PY3	14.3	14.7	15.3	16.4	-0.77 **	-1.4	-0.16	-5.4%
		PY2	14.3	14.4	15.3	16.4	-0.96 *	-1.8	-0.15	-6.7%
		PY3	14.3	14.9	15.3	16.5	-0.64	-1.3	0.06	-4.5%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Hospitalization for Vascular Access Complications in a Given Month	PY2 & PY3	0.59%	0.62%	0.64%	0.65%	0.01	-0.03	0.05	1.5%
		PY2	0.59%	0.62%	0.64%	0.64%	0.03	-0.02	0.08	4.5%
		PY3	0.59%	0.62%	0.64%	0.67%	-0.003	-0.05	0.04	-0.45%
	Percent of Beneficiaries with at Least One Hospitalization for ESRD Complications in a Given Month	PY2 & PY3	1.8%	2.1%	1.8%	2.2%	-0.08 *	-0.16	-0.004	-4.6%
		PY2	1.8%	2.1%	1.8%	2.1%	-0.08	-0.18	0.02	-4.4%
		PY3	1.8%	2.2%	1.8%	2.2%	-0.09	-0.18	0.01	-4.7%
	Percent of Beneficiaries with at Least One Hospitalization for Catheter-related Bloodstream Infection in a Given Month	PY2 & PY3	0.12%	0.09%	0.13%	0.10%	0.003	-0.01	0.02	2.2%
		PY2	0.12%	0.09%	0.13%	0.09%	0.01	-0.01	0.03	8.4%
		PY3	0.12%	0.09%	0.13%	0.10%	-0.002	-0.02	0.01	-1.7%
	Percent of Beneficiaries with at Least One Hospitalization for Peritonitis in a Given Month	PY2 & PY3	0.10%	0.08%	0.10%	0.08%	-0.001	-0.01	0.01	-1.4%
		PY2	0.10%	0.08%	0.10%	0.09%	-0.01	-0.02	0.01	-6.5%
		PY3	0.10%	0.08%	0.10%	0.08%	0.002	-0.01	0.02	1.8%
	Percent of Beneficiaries with at Least One Hospitalization for Sepsis in a Given Month	PY2 & PY3	1.2%	1.2%	1.3%	1.4%	-0.09 **	-0.14	-0.03	-7.4%
		PY2	1.2%	1.2%	1.3%	1.4%	-0.09 **	-0.16	-0.02	-7.7%
		PY3	1.2%	1.3%	1.3%	1.4%	-0.08 **	-0.15	-0.02	-7.1%
	Percent of Beneficiaries with at Least One Admission for Diabetes Short-Term Complications in a Given Month	PY2 & PY3	0.11%	0.12%	0.12%	0.12%	0.01	-0.01	0.03	11.4%
		PY2	0.11%	0.11%	0.12%	0.11%	0.02	-0.01	0.04	14.5%
		PY3	0.11%	0.13%	0.12%	0.13%	0.01	-0.02	0.04	9.4%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Hospitalizations and Emergency Department Visits (cont.)	Percent of Beneficiaries with at Least One Admission for Diabetes Long-Term Complications in a Given Month	PY2 & PY3	0.72%	0.72%	0.69%	0.75%	-0.06 **	-0.11	-0.01	-8.3%
		PY2	0.72%	0.72%	0.69%	0.76%	-0.08 **	-0.14	-0.01	-10.7%
		PY3	0.72%	0.71%	0.69%	0.73%	-0.05	-0.10	0.01	-6.8%
	Percent of Beneficiaries with at Least One Admission for Congestive Heart Failure (CHF) in a Given Month	PY2 & PY3	1.5%	2.0%	1.6%	2.1%	-0.05	-0.14	0.04	-3.3%
		PY2	1.5%	2.0%	1.6%	2.1%	-0.06	-0.17	0.06	-3.6%
		PY3	1.5%	2.0%	1.6%	2.1%	-0.05	-0.15	0.06	-3.1%
	Percent of Beneficiaries with at Least One Readmission within 30-days of an Index Hospitalization Stay in a Given Month~	PY2 & PY3	29.8%	29.5%	29.6%	30.0%	-0.77 * ‡	-1.5	-0.09	-2.6%
		PY2	29.8%	29.1%	29.6%	29.9%	-0.98 * ‡	-1.8	-0.14	-3.3%
		PY3	29.8%	29.8%	29.6%	30.2%	-0.60 ‡	-1.4	0.24	-2.0%
	Percent of Beneficiaries with at Least One ED Visit within 30-days of an Acute Hospitalization in a Given Month	PY2 & PY3	20.4%	21.3%	21.1%	21.9%	0.11	-0.41	0.63	0.54%
		PY2	20.4%	21.7%	21.1%	22.1%	0.27	-0.42	0.96	1.3%
		PY3	20.4%	21.0%	21.1%	21.6%	0.01	-0.61	0.63	0.04%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-27. Impact of the CEC Model on Medicare Payments across the Continuum of Care, All ESCOs

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care	Total Part A and Part B PBPM	PY1-PY3	$6,396	$6,421	$6,370	$6,488	- $93 ***	-$147	-$39	-1.5%
		PY1	$6,396	$6,289	$6,370	$6,405	- $143 **	-$240	-$46	-2.2%
		PY2	$6,396	$6,315	$6,370	$6,404	- $116 ***	-$180	-$52	-1.8%
		PY3	$6,396	$6,640	$6,370	$6,672	-$59	-$120	$3	-0.92%
	Acute Inpatient PBPM	PY1-PY3	$1,668	$1,677	$1,670	$1,739	- $59 ***	-$87	-$31	-3.5%
		PY1	$1,668	$1,648	$1,670	$1,738	- $88 ***	-$137	-$39	-5.3%
		PY2	$1,668	$1,666	$1,670	$1,746	- $77 ***	-$112	-$43	-4.6%
		PY3	$1,668	$1,694	$1,670	$1,732	- $35 *	-$69	-$1	-2.1%
	Readmissions PBPM~	PY1-PY3	$583	$585	$579	$614	- $33 ***	-$51	-$14	-5.6%
		PY1	$583	$565	$579	$605	- $43 **	-$73	-$14	-7.5%
		PY2	$583	$579	$579	$614	- $38 ***	-$61	-$16	-6.6%
		PY3	$583	$610	$579	$628	-$22	-$46	$2	-3.7%
	Home Health PBPM	PY1-PY3	$173	$169	$170	$165	$1	-$4	$6	0.63%
		PY1	$173	$181	$170	$166	$12 *	$2	$22	6.9%
		PY2	$173	$165	$170	$163	-$1	-$7	$5	-0.62%
		PY3	$173	$167	$170	$165	-$1	-$6	$4	-0.60%
	Hospice PBPM	PY1-PY3	$24	$23	$22	$20	$1	-$1	$2	2.9%
		PY1	$24	$24	$22	$21	$0	-$2	$3	0.84%
		PY2	$24	$23	$22	$21	$0	-$3	$2	-2.0%
		PY3	$24	$23	$22	$19	$2	$0	$4	6.9%
	Institutional Post-Acute Care PBPM	PY1-PY3	$556	$532	$536	$541	- $30 **	-$51	-$8	-5.4%
		PY1	$557	$527	$536	$559	- $53 **	-$91	-$14	-9.5%
		PY2	$557	$528	$536	$541	- $35 **	-$60	-$9	-6.2%
		PY3	$556	$521	$536	$519	-$18	-$41	$5	-3.2%
	Hospital Outpatient PBPM	PY1-PY3	$380	$420	$408	$448	$0	-$9	$9	0.10%
		PY1	$381	$380	$408	$416	-$9	-$25	$7	-2.3%
		PY2	$380	$432	$408	$456	$4	-$6	$15	1.1%
		PY3	$380	$453	$408	$481	$1	-$9	$11	0.27%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care (cont.)	Total Part B PBPM	PY1-PY3	$4,074	$4,121	$4,065	$4,122	-$11	-$33	$11	-0.27%
		PY1	$4,074	$4,000	$4,065	$4,027	-$36	-$73	$0	-0.89%
		PY2	$4,074	$4,032	$4,065	$4,036	-$13	-$38	$12	-0.31%
		PY3	$4,074	$4,336	$4,065	$4,327	$0	-$25	$25	-0.01%
	Office Visits PBPM	PY1-PY3	$53	$55	$52	$53	$1 ***	$1	$2	2.0%
		PY1	$53	$55	$52	$53	$1	$0	$2	1.5%
		PY2	$53	$56	$52	$53	$1 ***	$1	$2	2.3%
		PY3	$53	$56	$52	$53	$1 ***	$0	$2	1.9%
	Total Dialysis PBPM	PY1-PY3	$2,598	$2,680	$2,605	$2,680	$7 * ‡	$0	$14	0.27%
		PY1	$2,598	$2,609	$2,605	$2,605	$11 ** ‡	$3	$20	0.44%
		PY2	$2,598	$2,608	$2,605	$2,607	$7 ** ‡	$2	$13	0.28%
		PY3	$2,598	$2,846	$2,605	$2,848	$5 ‡	-$6	$16	0.20%
	Hospitalizations for ESRD Complications PBPM	PY1-PY3	$154	$173	$149	$178	- $11 ***	-$17	-$5	-7.0%
		PY1	$154	$147	$149	$158	- $16 ***	-$25	-$8	-10.7%
		PY2	$154	$184	$149	$188	- $10 *	-$18	-$1	-6.2%
		PY3	$155	$192	$149	$196	- $10 **	-$19	-$2	-6.7%
	Part B Drug PBPM	PY1-PY3	$25	$36	$24	$36	$0 ‡	-$3	$3	-0.15%
		PY1	$24	$33	$24	$31	$2	-$2	$6	7.6%
		PY2	$25	$36	$24	$34	$2 ‡	-$2	$5	6.1%
		PY3	$25	$41	$24	$43	- $2 ‡	-$6	$2	-8.4%
Unintended Consequences	Total Part D Drug Cost PBPM	PY1-PY3	$822	$1,022	$836	$1,016	$20 ‡	-$36	$76	2.4%
		PY1	$822	$1,083	$836	$1,089	$8	-$43	$60	1.0%
		PY2	$822	$1,167	$836	$1,163	$18 ‡	-$36	$71	2.1%
		PY3	$822	$803	$836	$792	$25 ‡	-$41	$91	3.0%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-28. Impact of the CEC Model on Medicare Payments across the Continuum of Care, Wave 1

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care	Total Part A and Part B PBPM	PY1-PY3	$6,396	$6,376	$6,370	$6,483	- $134 ***	-$216	-$52	-2.1%
		PY1	$6,396	$6,289	$6,370	$6,405	- $143 **	-$240	-$46	-2.2%
		PY2	$6,396	$6,239	$6,370	$6,405	- $193 ***	-$289	-$97	-3.0%
		PY3	$6,396	$6,621	$6,370	$6,672	- $77	-$169	$14	-1.2%
	Acute Inpatient PBPM	PY1-PY3	$1,668	$1,651	$1,670	$1,738	- $85 ***	-$125	-$46	-5.1%
		PY1	$1,668	$1,648	$1,670	$1,738	- $88 ***	-$137	-$39	-5.3%
		PY2	$1,668	$1,635	$1,670	$1,745	- $108 ***	-$156	-$59	-6.5%
		PY3	$1,668	$1,665	$1,670	$1,732	- $64 **	-$111	-$18	-3.9%
	Readmissions PBPM~	PY1-PY3	$583	$573	$579	$613	- $44 ***	-$68	-$20	-7.5%
		PY1	$583	$565	$579	$605	- $43 **	-$73	-$14	-7.5%
		PY2	$583	$563	$579	$614	- $55 ***	-$85	-$25	-9.4%
		PY3	$583	$599	$579	$628	- $33 *	-$64	-$1	-5.6%
	Home Health PBPM	PY1-PY3	$173	$173	$170	$165	$5	-$3	$13	3.1%
		PY1	$173	$181	$170	$166	$12 *	$2	$22	6.9%
		PY2	$173	$168	$170	$163	$1	-$7	$10	0.64%
		PY3	$173	$171	$170	$165	$3	-$4	$11	2.0%
	Hospice PBPM	PY1-PY3	$24	$23	$22	$20	$0	-$2	$2	0.65%
		PY1	$24	$24	$22	$21	$0	-$2	$3	0.84%
		PY2	$24	$22	$22	$21	-$1	-$4	$1	-5.2%
		PY3	$24	$23	$22	$19	$1	-$1	$4	5.2%
	Institutional Post-Acute Care PBPM	PY1-PY3	$556	$523	$536	$542	- $40 *	-$74	-$6	-7.1%
		PY1	$557	$527	$536	$559	- $53 **	-$91	-$14	-9.5%
		PY2	$557	$503	$536	$542	- $59 **	-$99	-$20	-10.6%
		PY3	$556	$527	$536	$519	-$13	-$50	$25	-2.3%
	Hospital Outpatient PBPM	PY1-PY3	$380	$418	$408	$447	-$1	-$15	$14	-0.17%
		PY1	$381	$380	$408	$416	-$9	-$25	$7	-2.3%
		PY2	$380	$429	$408	$456	$1	-$15	$18	0.33%
		PY3	$380	$457	$408	$481	$5	-$11	$22	1.4%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care (cont.)	Total Part B PBPM	PY1-PY3	$4,074	$4,098	$4,065	$4,118	-$29	-$60	$2	-0.71%
		PY1	$4,074	$4,000	$4,065	$4,027	-$36	-$73	$0	-0.89%
		PY2	$4,074	$3,998	$4,065	$4,037	- $48 **	-$82	-$13	-1.2%
		PY3	$4,074	$4,329	$4,065	$4,327	-$7	-$43	$29	-0.17%
	Office Visits PBPM	PY1-PY3	$53	$55	$52	$53	$1 *	$0	$2	1.7%
		PY1	$53	$55	$52	$53	$1	$0	$2	1.5%
		PY2	$53	$56	$52	$53	$2 ***	$1	$3	2.9%
		PY3	$53	$55	$52	$53	$0	$0	$1	0.92%
	Total Dialysis PBPM	PY1-PY3	$2,598	$2,682	$2,605	$2,677	$13 ** ‡	$4	$21	0.49%
		PY1	$2,598	$2,609	$2,605	$2,605	$11 ** ‡	$3	$20	0.44%
		PY2	$2,598	$2,609	$2,605	$2,608	$8 ‡	$0	$16	0.30%
		PY3	$2,598	$2,859	$2,605	$2,848	$18 ** ‡	$4	$32	0.68%
	Hospitalizations for ESRD Complications PBPM	PY1-PY3	$154	$168	$149	$177	- $15 ***	-$22	-$7	-9.6%
		PY1	$154	$147	$149	$158	- $16 ***	-$25	-$8	-10.7%
		PY2	$154	$180	$149	$188	- $14 **	-$24	-$4	-9.1%
		PY3	$155	$188	$149	$196	- $14 **	-$25	-$4	-9.3%
	Part B Drug PBPM	PY1-PY3	$25	$38	$24	$36	$2	-$2	$5	6.7%
		PY1	$24	$33	$24	$31	$2	-$2	$6	7.6%
		PY2	$25	$39	$24	$34	$4	$0	$9	17.1%
		PY3	$25	$43	$24	$43	-$1	-$6	$4	-3.2%
Unintended Consequences	Total Part D Drug Cost PBPM	PY1-PY3	$822	$1,025	$836	$1,023	$16	-$41	$74	2.0%
		PY1	$822	$1,083	$836	$1,089	$8	-$43	$60	1.0%
		PY2	$822	$1,175	$836	$1,164	$25	-$45	$95	3.1%
		PY3	$822	$794	$836	$792	$15	-$43	$74	1.9%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-29. Impact of the CEC Model on Medicare Payments across the Continuum of Care, Wave 2

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care	Total Part A and Part B PBPM	PY2 & PY3	$6,408	$6,522	$6,382	$6,539	-$43	-$101	$15	-0.67%
		PY2	$6,408	$6,390	$6,382	$6,404	-$41	-$114	$33	-0.64%
		PY3	$6,408	$6,654	$6,382	$6,672	-$45	-$113	$23	-0.70%
	Acute Inpatient PBPM	PY2 & PY3	$1,690	$1,710	$1,693	$1,739	-$26	-$59	$6	-1.6%
		PY2	$1,690	$1,696	$1,693	$1,746	- $47 *	-$89	-$6	-2.8%
		PY3	$1,690	$1,716	$1,693	$1,732	-$13	-$51	$26	-0.76%
	Readmissions PBPM~	PY2 & PY3	$592	$606	$588	$620	-$18	-$40	$5	-3.0%
		PY2	$592	$596	$588	$614	-$22	-$49	$5	-3.7%
		PY3	$592	$618	$588	$628	-$14	-$41	$14	-2.3%
	Home Health PBPM	PY2 & PY3	$172	$163	$169	$164	-$4	-$10	$2	-2.3%
		PY2	$172	$163	$169	$163	-$3	-$10	$4	-1.9%
		PY3	$172	$163	$169	$165	-$4	-$11	$2	-2.6%
	Hospice PBPM	PY2 & PY3	$24	$24	$21	$20	$1	-$1	$3	5.7%
		PY2	$24	$24	$21	$21	$0	-$2	$3	1.1%
		PY3	$24	$23	$21	$19	$2	$0	$4	8.3%
	Institutional Post-Acute Care PBPM	PY2 & PY3	$564	$533	$544	$530	-$17	-$39	$4	-3.0%
		PY2	$564	$553	$544	$541	-$10	-$37	$18	-1.7%
		PY3	$564	$518	$544	$519	-$22	-$46	$3	-3.8%
	Hospital Outpatient PBPM	PY2 & PY3	$383	$442	$411	$468	$2	-$9	$12	0.40%
		PY2	$383	$435	$411	$456	$7	-$6	$21	1.9%
		PY3	$382	$450	$411	$481	-$2	-$14	$10	-0.58%
	Total Part B PBPM	PY2 & PY3	$4,061	$4,203	$4,052	$4,182	$11	-$13	$36	0.27%
		PY2	$4,061	$4,066	$4,052	$4,036	$21	-$9	$51	0.53%
		PY3	$4,061	$4,341	$4,052	$4,327	$4	-$23	$32	0.11%

Measures		Performance Year	CEC		Comparison		Difference-in-Differences Estimate			
			Pre-CEC Mean	PY Mean	Pre-CEC Mean	PY Mean	DiD	90% Lower CI	90% Upper CI	Percent Change
Medicare Payments across the Continuum of Care (cont.)	Office Visits PBPM	PY2 & PY3	$54	$56	$52	$53	$1 ***	$1	$2	2.3%
		PY2	$54	$55	$52	$53	$1 **	$0	$2	1.8%
		PY3	$54	$56	$52	$53	$1 ***	$1	$2	2.6%
	Total Dialysis PBPM	PY2 & PY3	$2,597	$2,722	$2,605	$2,729	$0	-$9	$9	0.01%
		PY2	$2,597	$2,607	$2,605	$2,607	- $7 *	$0	$14	0.26%
		PY3	$2,597	$2,837	$2,605	$2,848	-$4	-$17	$9	-0.16%
	Hospitalizations for ESRD Complications PBPM	PY2 & PY3	$157	$192	$151	$192	-$6	-$15	$2	-4.0%
		PY2	$157	$189	$151	$188	-$5	-$16	$5	-3.3%
		PY3	$157	$195	$151	$196	-$7	-$17	$3	-4.6%
	Part B Drug PBPM	PY2 & PY3	$27	$37	$26	$38	- $2 ‡	-$6	$2	-8.5%
		PY2	$27	$33	$26	$34	- $1 ‡	-$5	$3	-5.1%
		PY3	$27	$40	$26	$43	- $3 ‡	-$8	$1	-11.4%
Unintended Consequences	Total Part D Drug Cost PBPM	PY2 & PY3	$904	$985	$918	$975	$24 ‡	-$35	$83	2.7%
		PY2	$904	$1,159	$918	$1,163	$10 ‡	-$34	$53	1.1%
		PY3	$904	$811	$918	$792	$32 ‡	-$42	$106	3.6%

Notes: PY1 covers October 2015 - December 2016; PY2 covers January 2017 - December 2017; and PY3 covers January 2018 - December 2018. All ESCOs estimates include both waves from October 2015 - December 2018. The estimate of All ESCOs is the combined cumulative impact of CEC, accounting for different lengths of exposure to the model. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Significance of the DiD impact estimate is indicated next to each outcome where * implies significance at the 10% level, ** at the 5% level, and *** at the 1% level assuming a two-tailed test. ~ Readmission drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact estimate.

Exhibit F-30. Impact of the CEC Model on Core Measures for Selected Beneficiary Subgroups, PY1-PY3, All ESCOs

		Total Part A and Part B PBPM	Number of Hospitalizations per 1,000 Beneficiaries per Month	Percent of Beneficiaries with at Least One Readmission within 30-days of an Index Hospitalization Stay in a Given Month~	Number of ED Visits per 1,000 Beneficiaries per Month	Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)
Race	White	-$85*	-3.4 *	-0.9**	-2.0	0.8	-0.9***
	Black	-$118***	-4.5 **	-0.5	1.7	0.3	-0.8**
	Other	-$121*	-9.6 ***	-2.6***	-6.8 *	-1.8**	0.4
Sex	Male	-$71*	-3.3 **	-0.8*	-1.2	0.5	-0.6**
	Female	-124***	-6.5 ***	-1.1**	-0.17	-0.03	-0.8**
OREC	Age	-$81	-2.6	-1.2**	-0.99	0.5	-1.0***
	Disabled	-$88	-6.0 **	-0.4	3.2	0.1	-0.9**
	ESRD	-$94**	-5.3 **	-1.4**	1.6	0.2	-0.4
	ESRD and Disabled	-$116**	-5.3 **	-0.8	-6.4 *	0.05	-0.3
Dual Medicaid Medicare Status	Partial	-$105	-5.9 *	0.4	-2.8	-0.3	-0.6
	Full	-$146***	-7.1 ***	-2.0***	0.26	-0.5	-0.6
Months on Dialysis	≤ six months	-$74	1.44	0.8	-0.23	1.2	-1.8**
	> six months	-$102***	-5.2 ***	-1.2***	-0.75	0.1	-0.6***

Notes: All ESCOs estimates include both waves from October 2015 - December 2018. About 21.7% of facilities have 13 quarters of CEC participation (October 2015 to December 2018), 44.8% of facilities have 8 quarters of CEC participation (January 2017 to December 2018), and the remaining 33.5% participated in CEC from January 2018 to December 2018 (4 quarters). Each impact estimate is based on a DiD analysis and reflects the difference in the regression-adjusted mean outcome for beneficiaries in CEC facilities for the intervention period with baseline relative to the same difference over time for beneficiaries in matched comparison facilities. Medicare payment outcomes are standardized to remove the effect of geographic and other adjustments. CI= confidence interval, ***p<0.01, **p<0.05, *p<0.1. (*) Other race includes all non-White and non-Black beneficiaries with the majority of beneficiaries being Hispanic or Asian races. For more details on OREC see https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/mc86c07.pdf. ~ Readmission expenditures are included in the overall acute inpatient payments and drops the last quarter of intervention data to account for a lag in claims to prevent an underestimation due to a lack of claims maturity. ‡ Data from the pre-CEC period showed intervention and matched comparison facilities were not on parallel trends for this outcome, which is required for an unbiased impact.

Exhibit F-31. Use of Preventative Care by Facility Location

Characteristics	Facility Location	Wave 1 PY1 Joiners (N=206)	Wave 1 PY2 Joiners (N=79)	Wave 1 PY3 Joiners (N=68)	Wave 2 PY2 Joiners (N=347)	Wave 2 PY3 Joiners (N=251)
Primary Care E/M Visits PBPM (2014)	Metropolitan	0.25	0.25	0.22	0.24	0.24
	Non-metropolitan	0.25	0.27	0.14	0.24	0.23
Specialty Care E/M Visits PBPM (2014)	Metropolitan	0.45	0.44	0.44	0.43	0.44
	Non-metropolitan	0.38	0.44	0.31	0.39	0.39

Appendix G: Power Calculation Methodology

In this section, we describe our power calculation methodology and our findings concerning the ability of our model to detect changes in Medicare payments. Power calculations provide essential information for researchers to determine the smallest detectable difference, with a given sample size, in the average of the outcome variable between treatment and control groups. An equally important consideration in study designs is to control the type 1 error, which is the probability of falsely rejecting the null hypothesis when it is in fact true, or, in other words, claiming treatment efficacy when in fact it does not exist. We set an acceptable level of type 1 error to be 0.1, and compute power under this specification.

To compute power, we use a STATA user command called "clsampsi," developed by Batistatou et al. (2014).[38] The authors use a formula based on a non-central F distribution as described by Moser et al. (1989).[39]

$$1\text{-}\beta = (\Phi\ [\frac{\delta}{\sqrt{\left[\frac{\sigma_t^2}{N_t}\left\{1+\left(\bar{m}+\frac{\sigma_{mt}^2}{\bar{m}}-1\right)\rho_t\right\}+\frac{\sigma_c^2}{N_c}\left\{1+\left(\bar{m}+\frac{\sigma_{mc}^2}{\bar{m}}-1\right)\rho_c\right\}\right]}} - z_\alpha]) \qquad (1)$$

Here, δ denotes various effect sizes for potential predicted savings, ρ_t and ρ_c are intra-cluster correlation coefficients (ICC) (which measure how related the clustered observations are) for the treatment and control group, respectively. Clustered practices are standard in DiD designs.[40] Furthermore, we also consider how the fit of an estimation would impact power by adjusting the variance and ICC factors using an assumed R^2 of 0.3.[41] The term $\frac{\sigma_{mt,c}^2}{\bar{m}}$ corresponds to the variation in the size of clusters which has been shown by Guittet et al. (2006) to heavily influence power, when there is large variation.[42] Additionally, $\bar{m}$ refers to the average number of individuals per cluster. Finally, σ_t^2, N_t, σ_c^2, and N_c, are the variance outcome and the total sample size for each trial arm (t: treatment, c: control), respectively, and z_α is the one-tail z statistic. Combining these factors, we are able to generate two terms commonly referred to as the design effect.

We calculate values of the factors discussed above for the outcome variable Medicare payments using the matched beneficiary data. A key component of Equation (1) is the ICC, which depends on how observations are clustered. For each group, we cluster observations by their aligned facility to identify individual beneficiary observations. Specifically, we cluster by aligned ESCO and comparison facilities identified in the matched sets which corresponds to 1,902 clusters units. As a result, the power calculations do not take into consideration the repeated nature of the

[38] Batistatou, E., Roberts, C., Roberts, S. (2014). Sample size and power calculations for trials and quasi-experimental studies with clustering. *Stata Journal,* 14(1):159-75.

[39] Moser, B.K., Stevens, G.R., Watts, C.L. (1989). The two-sample t test versus Satterthwaite's approximate F test. *Communications in Statistics - Theory and Methods,* 18(11):3963-3975.

[40] Bertrand, M., Duflo, E., Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics,* 119(1):249-75.

[41] The R^2 value provides an indication of how well the covariates of regression estimate the outcome of interest. Thus, the greater the value of R^2 the lower the necessary sample size needed to reach a desired level of power.

[42] Guittet, L., Ravaud, P., Giraudeau, B. (2006). Planning a cluster randomized trial with unequal cluster sizes: Practical issues involving continuous outcomes. *BMC Med Research,* 6(1):17.

data, which would only improve power if all other calculations and assumptions were maintained.

For the second year evaluation of the CEC Model, the number of dialysis facilities and patients provides reasonable confidence that the analysis will detect modest impacts on Medicare service use and costs for all beneficiaries. Specifically, the combined PY1-PY3 estimates of power using one-tailed tests at the 10% significance level and adjustments for goodness of fit from the regression models imply that the evaluation has 80% power to detect impacts on standardized Medicare payments of 1% or more.

Appendix H: ICH CAHPS® Analysis Supplement

Data: The In-Center Hemodialysis Consumer Assessment of Healthcare Providers and Systems (ICH CAHPS®) survey is administered twice annually. This analysis supplement includes results from surveys from fall 2014 through fall 2018. The ICH CAHPS® survey periods, included as pre-CEC (baseline period) or post-CEC (intervention period) in the analysis, differed based on when the facility began CEC participation.

- Among facilities that began CEC participation in PY1, the analysis included results from the fall 2014 and spring 2015 surveys for the pre-CEC period. The post-CEC period included results from surveys from fall 2015, spring 2016, fall 2016, spring 2017, fall 2017, spring 2018, and fall 2018.
- Among facilities that began CEC participation in PY2, the analysis for the pre-CEC period included results from the fall 2014, spring 2015, fall 2015, spring 2016, and fall 2016 surveys. Results from the spring 2017, fall 2017, spring 2018, and fall 2018 surveys were included for the post-CEC period.
- Among facilities that began CEC participation in PY3, the analysis included results from the fall 2014, spring 2015, fall 2015, spring 2016, fall 2016, spring 2017, and fall 2017 surveys for the pre-CEC period. Results for the post-CEC period included surveys from spring 2018 and fall 2018.

We received risk-adjusted, facility-level ICH CAHPS® data from CMS to prevent any potential beneficiary confidentiality concerns. Measures were risk adjusted using the methodology for publicly reporting ICH CAHPS® survey results on the Dialysis Facility Compare website.[43] The risk adjustment methods account for the following characteristics: mode of survey administration; overall health; overall mental health; heart disease; deafness or serious difficulty hearing; blindness or serious difficulty seeing; difficulty concentrating, remembering, or making decisions; difficulty dressing or bathing; age; sex; education; language; assistance with the survey; and number of years on dialysis. We weighted results from each ICH CAHPS® survey wave (e.g., fall or spring) by the number of respondents to pool the risk adjusted measures within a facility across survey periods (for example, we pooled the fall 2014 and spring 2015 surveys for pre-CEC period values among facilities that began CEC participation in PY1).

Study Population: The analytic dataset included survey data from samples of beneficiaries receiving in-center hemodialysis treatment from ESCO and comparison facilities during each semiannual survey period. Beneficiaries eligible for sampling by CMS (i.e., those who would receive the ICH CAHPS® survey) received in-center hemodialysis at a specific facility for at least 3 months, were at least 18 years of age, and were not institutionalized, deceased, or receiving hospice care. Among facilities with more than 200 beneficiaries meeting these criteria, 200 beneficiaries were randomly sampled. Among facilities with 200 or fewer beneficiaries, all beneficiaries were included in the sample.

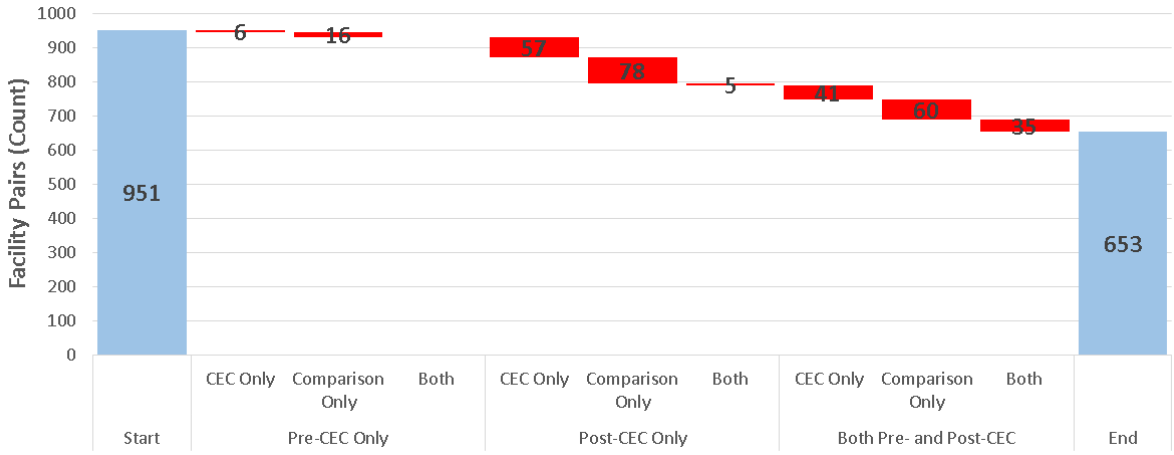
This analysis included beneficiary responses from 951 ESCO facilities and 951 matched comparison group facilities. The pool of comparison group facilities for this analysis was the same pool that was used in the other analyses for PY3 in this third annual report. (A description of the

[43] https://www.medicare.gov/dialysisfacilitycompare/#

methods for selecting comparison facilities is provided in **Appendix F**.) We received data that had already applied ICH CAHPS® suppression rules (i.e., suppressing facility results when there were 10 or fewer respondents) to ensure beneficiary confidentiality, which reduced the number of facilities available for the analysis by 298 pairs. In **Exhibit H-1** we provide a summary of the reasons these facility pairs were excluded, which include (1) whether the facility pair was excluded due to the CEC facility, the comparison group facility, or both, and (2) whether the facility pair was excluded in the pre-CEC period, the post-CEC period, or both.[44] Specifically, 22 facility pairs were excluded because either a CEC facility (6 pairs) or a matched comparison facility (16 pairs) did not have pre-CEC data. A larger group, 140 pairs, were excluded because a CEC facility (57 pairs), a matched comparison facility (78 pairs), or both the CEC facility and the matched comparison facility (5 pairs) had 10 or fewer respondents in the post-CEC period. Finally, 136 facility pairs were excluded because at least one facility in the pair (i.e., CEC or matched comparison or both) did not have data in both the pre- and post-CEC periods.

On average, the excluded CEC facilities were slightly smaller, having fewer dialysis stations compared to the included CEC facilities (17 vs. 21), with a standardized mean difference (SMD) of 0.6. Similarly, the excluded comparison facilities were slightly smaller on average, having fewer dialysis stations compared to included comparison facilities (17 vs. 21), with a SMD of 0.5. Across the 7 LDOs and non-LDOs, the proportion of excluded facilities averaged 29% and ranged between 13% and 50%; Fresenius facilities accounted for the majority of excluded facilities (n=238, or 80%).

Exhibit H-1. Summary of ICH CAHPS® Facility Pair Exclusions



Analysis: We employed ordinary least squares (OLS) regression to derive the DiD estimates. The dependent variables were the risk-adjusted, facility-level values, with no additional adjustment for other covariates. Dialysis facilities in the regression were weighted by the number of aligned

[44] A facility pair was excluded if either facility had ten or fewer respondents in all periods in either the pre-CEC or post-CEC period.

beneficiaries at each facility from the corresponding CEC periods. The beneficiary counts included in the pre- and post-CEC periods differed based on when the facility began CEC participation.

- Among facilities that began CEC participation in PY1, the pre-CEC counts included quarter four (Q4) 2014 through quarter one (Q1) 2015, and the post-CEC counts included Q4 2015 through Q4 2018.
- Among facilities that began CEC participation in PY2, the pre-CEC counts included Q4 2014 through quarter two (Q2) 2016, and the post-CEC counts included Q1 2017 through Q4 2018.
- Among facilities that began CEC participation in PY3, the pre-CEC counts included Q4 2014 through Q2 2017, and the post-CEC counts included Q1 2018 through Q4 2018.

Results for 653 of the total 951 matched pairs of facilities (note: 298 pairs were excluded) were included in all measures, except for the measure assessing if beneficiaries received an explanation of transplant ineligibility, which included 652 matched pairs of facilities (note: 299 pairs were excluded).[45]

The questions used from the ICH CAHPS® survey for the global ratings measures, composite scores, and individual survey items are shown in **Exhibits H-2** and **H-3**.

Exhibit H-2. ICH CAHPS® Global Ratings and Select Individual Questions

Category	Question	Response
Global Ratings	Rating of Nephrologist (Q8): Using any number from 0 to 10, where 0 is the worst kidney doctors possible and 10 is the best kidney doctors possible, what number would you use to rate the kidney doctors you have now?	0 -10, where Worst =0 and 10 = Best
	Rating of Dialysis Center Staff (Q32): Using any number from 0 to 10, where 0 is the worst dialysis center staff possible and 10 is the best dialysis center staff possible, what number would you use to rate your dialysis center staff?	0 -10, where Worst =0 and 10 = Best
	Rating of the Dialysis Center (Q35): Using any number from 0 to 10, where 0 is the worst dialysis center possible and 10 is the best dialysis center possible, what number would you use to rate this dialysis center?	0 -10, where Worst =0 and 10 = Best
Individual Items	Q33: In the last 3 months, when you arrived on time, how often did you get put on the dialysis machine within 15 minutes of your appointment or shift time?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q38: In the last 12 months, has a doctor or dialysis center staff explained to you why you are not eligible for a kidney transplant?	1 = Yes, 2 = No

[45] The question regarding explanation of transplant ineligibility had fewer observations because this survey question is restricted to beneficiaries who responded "yes" to the preceding question that asked if they are eligible for a kidney transplant. Therefore, some additional facilities were excluded if they had 10 or fewer responses to this question, even if they had more than 10 beneficiary responses on all other questions.

Exhibit H-3. ICH CAHPS® Questions Included in Composite Scores

Category	Question	Response
Nephrologists' Communication & Caring	Q3: In the last 3 months, how often did your kidney doctors listen carefully to you?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q4: In the last 3 months, how often did your kidney doctors explain things in a way that was easy for you to understand?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q5: In the last 3 months, how often did your kidney doctors show respect for what you had to say?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q6: In the last 3 months, how often did your kidney doctors spend enough time with you?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q7: In the last 3 months, how often did you feel your kidney doctors really cared about you as a person?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q9: Do your kidney doctors seem informed and up-to-date about the health care you receive from other doctors?	1 = Yes, 2 = No
Quality of Dialysis Center Care & Operations	Q10: In the last 3 months, how often did the dialysis center staff listen carefully to you?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q11: In the last 3 months, how often did the dialysis center staff explain things in a way that was easy for you to understand?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q12: In the last 3 months, how often did the dialysis center staff show respect for what you had to say?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q13: In the last 3 months, how often did the dialysis center staff spend enough time with you?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q14: In the last 3 months, how often did you feel the dialysis center staff really cared about you as a person?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q15: In the last 3 months, how often did dialysis center staff make you as comfortable as possible during dialysis?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q16: In the last 3 months, did dialysis center staff keep information about you and your health as private as possible from other patients?	1 = Yes, 2 = No
	Q17: In the last 3 months, did you feel comfortable asking the dialysis center staff everything you wanted about dialysis care?	1 = Yes, 2 = No

Category	Question	Response
Quality of Dialysis Center Care & Operations (cont.)	Q21: In the last 3 months, how often did dialysis center staff insert your needles with as little pain as possible?	1 = Never 2 = Sometimes 3 = Usually 4 = Always 5 = I insert my own needles
	Q22: In the last 3 months, how often did dialysis center staff check you as closely as you wanted while you were on the dialysis machine?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q24: In the last 3 months, how often was the dialysis center staff able to manage problems during your dialysis?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q25: In the last 3 months, how often did dialysis center staff behave in a professional manner?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q26: In the last 3 months, did dialysis center staff talk to you about what you should eat and drink?	1 = Yes, 2 = No
	Q27: In the last 3 months, how often did dialysis center staff explain blood test results in a way that was easy to understand?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q33: In the last 3 months, when you arrived on time, how often did you get put on the dialysis machine within 15 minutes of your appointment or shift time?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q34: In the last 3 months, how often was the dialysis center as clean as it could be?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
	Q43: In the last 12 months, how often were you satisfied with the way they handled these problems?	1 = Never 2 = Sometimes 3 = Usually 4 = Always
Providing Information to Patients	Q19: The dialysis center staff can connect you to the dialysis machine through a graft, fistula, or catheter. Do you know how to take care of your graft, fistula, or catheter?	1 = Yes, 2 = No
	Q28: As a patient you have certain rights. For example, you have the right to be treated with respect and the right to privacy. Did this dialysis center ever give you any written information about your rights as a patient?	1 = Yes, 2 = No
	Q29: Did dialysis center staff at this center ever review your rights as a patient with you?	1 = Yes, 2 = No
	Q30: Has dialysis center staff ever told you what to do if you experience a health problem at home?	1 = Yes, 2 = No
	Q31: Has any dialysis center staff ever told you how to get off the machine if there is an emergency at the center?	1 = Yes, 2 = No
	Q36: You can treat kidney disease with dialysis at a center, a kidney transplant, or with dialysis at home. In the last 12 months, did your kidney doctors or dialysis center staff talk to you as much as you wanted about which treatment is right for you?	1 = Yes, 2 = No

Category	Question	Response
Providing Information to Patients (cont.)	Q38: In the last 12 months, has a doctor or dialysis center staff explained to you why you are not eligible for a kidney transplant?	1 = Yes, 2 = No
	Q39: Peritoneal dialysis is dialysis given through the belly and is usually done at home. In the last 12 months, did either your kidney doctors or dialysis center staff talk to you about peritoneal dialysis?	1 = Yes, 2 = No
	Q40: In the last 12 months, were you as involved as much as you wanted in choosing the treatment for kidney disease that is right for you?	1 = Yes, 2 = No

Summary statistics and regression results for the eight examined ICH CAHPS® measures are displayed in **Exhibit H-4**.

Exhibit H-4. Summary of Impact of CEC on ICH CAHPS® Measures

Measure (Response)	ESCO Wave	Performance Year	Facility N (Pairs)	Average Response[a]				DiD
				CEC Facilities[b]		Comparison Facilities[b]		
				Pre-CEC	Post-CEC	Pre-CEC	Post-CEC	
Rating of Kidney Doctors (Top - 9 or 10) [c]	1	PY1	137	55.1%	57.3%	58.9%	60.2%	0.8
	1	PY2	185	55.1%	57.8%	58.9%	60.3%	1.3
	1	PY3	222	55.1%	59.3%	58.9%	60.6%	2.5**
	2	PY2	202	58.3%	58.4%	58.9%	60.3%	-1.3
	2	PY3	344	58.3%	59.4%	58.9%	60.6%	-0.6
Rating of Dialysis Center Staff (Top - 9 or 10) [c]	1	PY1	137	57.4%	59.1%	59.6%	60.2%	1.0
	1	PY2	185	57.4%	60.0%	59.6%	61.2%	1.0
	1	PY3	222	57.4%	59.8%	59.6%	62.0%	-0.1
	2	PY2	202	57.0%	58.5%	59.6%	61.2%	-0.0
	2	PY3	344	57.0%	58.6%	59.6%	62.0%	-0.9
Rating of Dialysis Center (Top - 9 or 10) [c]	1	PY1	137	62.6%	65.1%	64.5%	65.1%	1.9
	1	PY2	185	62.6%	64.9%	64.5%	66.0%	0.9
	1	PY3	222	62.6%	65.3%	64.5%	67.1%	0.1
	2	PY2	202	61.7%	63.5%	64.5%	66.0%	0.3
	2	PY3	344	61.7%	63.4%	64.5%	67.1%	-0.8
Seen within 15 Minutes (Always) [d]	1	PY1	137	37.2%	39.0%	39.3%	40.6%	0.5
	1	PY2	185	37.2%	40.5%	39.3%	41.5%	1.2
	1	PY3	222	37.2%	41.5%	39.3%	44.4%	-0.8
	2	PY2	202	37.4%	40.0%	39.3%	41.5%	0.4
	2	PY3	344	37.4%	41.3%	39.3%	44.4%	-1.2
Explained Transplant Ineligibility (Yes) [d]	1	PY1	136	67.0%	67.4%	69.1%	68.3%	1.1
	1	PY2	183	67.0%	67.8%	69.1%	69.5%	0.4
	1	PY3	220	67.0%	67.9%	69.1%	70.6%	-0.6
	2	PY2	201	69.7%	68.9%	69.1%	69.5%	-1.3
	2	PY3	343	69.7%	68.0%	69.1%	70.6%	-3.3**

Measure (Response)	ESCO Wave	Performance Year	Facility N (Pairs)	Average Response[a]				DiD
				CEC Facilities[b]		Comparison Facilities[b]		
				Pre-CEC	Post-CEC	Pre-CEC	Post-CEC	
Nephrologists' Communication & Caring (Always or Yes) [e]	1	PY1	137	64.2%	66.2%	66.2%	66.9%	1.3
	1	PY2	185	64.2%	66.3%	66.2%	66.7%	1.5
	1	PY3	222	64.2%	66.4%	66.2%	67.0%	1.4
	2	PY2	202	66.7%	66.9%	66.2%	66.7%	-0.4
	2	PY3	344	66.7%	67.1%	66.2%	67.0%	-0.5
Quality of Dialysis Center Care & Operations (Always or Yes) [e]	1	PY1	137	59.4%	60.6%	60.4%	61.0%	0.6
	1	PY2	185	59.4%	61.1%	60.4%	61.6%	0.5
	1	PY3	222	59.4%	61.1%	60.4%	62.1%	0.1
	2	PY2	202	59.1%	59.5%	60.4%	61.6%	-0.8
	2	PY3	344	59.1%	60.0%	60.4%	62.1%	-0.8
Providing Information to Patients (Yes) [e]	1	PY1	137	77.6%	78.3%	79.0%	78.9%	0.8
	1	PY2	185	77.6%	78.3%	79.0%	79.1%	0.5
	1	PY3	222	77.6%	78.1%	79.0%	79.5%	-0.1
	2	PY2	202	78.1%	77.9%	79.0%	79.1%	-0.4
	2	PY3	344	78.1%	78.1%	79.0%	79.5%	-0.6

Note: (a) Responses are weighted and are risk-adjusted facility-level averages (please see Analysis section above for additional detail); (b) all measures included results for 653 of 951 total matched facilities, except the Explained Transplant Ineligibility measure, which included 652 matched facilities; (c) denotes the three global ratings measures; (d) denotes the two individual survey items; (e) denotes the three composite score measures. Asterisks denote varying levels of statistical significance: *** for $p \leq 0.01$, ** for $p \leq 0.05$, and * for $p \leq 0.1$.

Appendix I: Standardized Measures Methodology

This appendix describes the methodology used to create and evaluate the standardized measures. Each measure is discussed individually, with results summarized at the end of the section.

A. Standardized Measures

1. Data Sources

The main data source for this third annual report was the CMS's Chronic Conditions Data Warehouse (CCW), from which we pulled Medicare claims data, beneficiary characteristics (e.g., demographics and enrollment), and CCW condition indicators.[46] This report includes CCW claims from January 1, 2015 through March 31, 2019, processed by August 02, 2019.[47] All CCW claims were final action claims and had a minimum of three months of run-out.[48]

For the calculation of standardized measures, we used claims data from the CCW to identify hospitalization admission and discharge dates, primary diagnosis code for hospital admissions, and comprehensive listings of diagnosis codes across all institutional settings.

We also extracted data (through December 2018) from the January 2019 quarterly file of the Consolidated Renal Operations in a Web-enabled Network (CROWNWeb) to complete the beneficiary history.

Beneficiary demographic and clinical information at ESRD incidence were extracted from the CMS ESRD Medical Evidence Report form (CMS-2728). These data included, but were not limited to, primary cause of renal failure, cause of renal failure groupings, height, race, dry weight, physician name, dialysis type, and comorbidities at ESRD incidence.

The ESRD Death Notification form (CMS-2746) provided data relating to primary causes of death for beneficiaries with ESRD.

The first service date was extracted from the Renal Management Information System (REMIS).

The Long-term Care Minimum Data Set (MDS) identified prior year nursing home status for adjustment to the models for mortality and hospitalization, respectively. For the annual report, the complete MDS 2018 assessments were obtained in the March 07, 2019 download from CMS.

B. Methods

1. Determination of Beneficiary Eligibility during a Given Month

The standardized measures incorporate the monthly CEC eligibility criteria. Specifically, in the calculation of the standardized hospitalization ratio (SHR) and standardized mortality ratio (SMR),

[46] The CCW condition indicators are claims-based algorithms that identify beneficiaries with select clinical conditions (e.g., diabetes, hyperlipidemia, hypertension, etc.): https://www.ccwdata.org/web/guest/condition-categories.

[47] Kidney transplants are an exception, which also included claims that ended in 2011 to assess the kidney transplant exclusion criterion in 2012 (i.e., excluded in the 12 months following the month of a transplant).

[48] The analytic CCW claims files are based on final action claims. We used final action claims only to avoid internal data inconsistencies caused by use of original claims (e.g., we observed beneficiaries aligned based on original claims for whom we found no final action claims).

if a beneficiary was not eligible during the month, the time at risk and events that occurred during the month (hospital admissions or deaths) were excluded from the calculation. For the standardized readmission ratio (SRR), hospital discharges that occurred during an ineligible month were not counted as an index discharge. An index discharge is used as the basis to identify if a subsequent hospital admission is considered to be a readmission. Any readmission associated with an ineligible index discharge was removed. However, if the readmission itself happened in an eligible month and it did not meet any of the exclusion criteria, then the readmission was kept and the associated discharge would be considered as a potential index discharge.

2. Modifications to Population for Standardized Models

Prior to this third annual report and the Q1 2018 quarterly report, the CEC evaluation team used publicly available Dialysis Facility Report (DFR) model coefficients to calculate expected values for mortality, readmissions, and hospitalizations used in CUSUM and the annual standardized measures.

As an alternative to applying the DFR risk-adjustment coefficients (derived from the national ESRD dialysis population), we estimated coefficients based on the CEC population with some modifications to model specifications. Overall, the populations in the CEC and DFR estimation models differ. Compared to the national-based DFR population, the CEC population includes only beneficiaries with type 72 Medicare dialysis claims. There are some other measure-specific specifications for the CEC population, as outlined in Q1 2018 methods for the risk model and revised population on which these are modeled. For the DFR population, inclusion criteria are measure-specific and for a larger population than the CEC population.

Coefficients estimated using a CEC population are likely to better represent the beneficiaries in the ESCOs and yield more accurate expected event rates. As discussed in detail in the Q1 2018 quarterly report methods, applying the CEC population to estimate the risk-adjustment coefficients impacts the results in the standardized measures analyses. The effects are most pronounced in the SHR and less so in both the standardized ratios for readmission and mortality. Please note all time at risk and events regardless of the eligibility criteria are included in the model to generate the coefficients.

C. Standardized Hospitalization Ratio Methodology

This section reviews the techniques used to compute the SHR, including the determination of beneficiary assignment and the development of other steps. Then we describe the risk-adjusted model for the expected number of events during a given time period and the specification of the SHR measure.

1. Beneficiary Assignment

Assignment to an ESCO begins after a patient has had ESRD for at least 90 days. As of Q1 2018, the 60-day rule previously applied for care alignment to an ESCO was removed as a criterion. Therefore, once past the 90-day mark for ESRD, time-at-risk attributed to an ESCO is from the first day that indicates receipt of dialysis care. Time-at-risk ends at the earliest occurrence of the following: three days prior to a transplant, date of death, or end of ESCO alignment. As mentioned above, after we determine beneficiary assignment, we exclude the ineligible time-at-risk and hospitalization events according to the monthly eligibility criteria.

Exclusions include the following:

- Beneficiaries with a missing ESRD Medical Evidence Form (CMS-2728) in CROWNWeb.
- Beneficiaries with a missing date of birth or sex.

2. Ratio Calculation

a. Observed/Expected (O/E)

The SHR is calculated by dividing the observed total admissions (O) by the expected total admissions (E). The SHR calculation enables comparison of the ESCO's experience to the average experience of the ESRD Medicare population in the United States. A value of less than 1.0 indicates that the ESCO's total number of admissions was less than expected, relative to the national ESRD Medicare population, whereas a value of greater than 1.0 indicates that the facility had total admissions higher than expected, relative to the national ESRD Medicare population.

b. Observed Number of Hospital Admissions

O equals the observed number of hospital admissions among the beneficiaries assigned to this ESCO in the calendar year (CY). Admissions are counted at the discharge date. When applicable, admissions are bridged according to the discharge dates and admission dates. When there is one day between a discharge and admission, these events are bridged and a single admission is counted. If there is more than one day between two hospitalization events, then both events would be counted as hospital admissions.

c. Expected Number of Hospital Admissions

E equals the expected number of hospital admissions among beneficiaries assigned to this ESCO in a CY. The expected number of hospital admissions is calculated based on rates for the ESRD Medicare population for hospital admissions in the same year. A Cox model adjusts for beneficiary age, sex, diabetes, duration of ESRD, nursing home status, comorbidities at ESRD incidence, BMI at incidence, and CY. Duration of ESRD is divided into six intervals with cut points at six months, one year, two years, three years, and five years; hospitalization rates are estimated separately within each interval. The baseline rate is assumed to be constant within each of these six intervals and are denoted as $\alpha_1,\ldots,\alpha_6$.

For each beneficiary, the time at-risk in each ESRD interval is multiplied by the (adjusted) ESRD Medicare admissions rate for that interval, and a sum over the intervals gives the expected number of admissions for each beneficiary. Let q denote the number of beneficiary characteristics being incorporated into the model, and note that these characteristics will include both main effect and interaction terms. Most covariates are fixed at entry for beneficiaries in the model, but some, such as nursing home status, can change over time. Let Z_{ijk} be the specific value of the j^{th} beneficiary in the i^{th} ESRD within period k. The risk adjustment factor is given by

$$R_{ijk} = \exp(\beta^T Z_{ijk})$$

where β is the regression coefficient. Technical details for estimating β are provided below.

Let t_{ijk} represent the days at-risk (until the current evaluation time) for beneficiary *j* in ESCO *i* and in the k[th] interval with estimated rate α_k (defined in the first paragraph of this subsection). The corresponding expected number of hospital admissions in the kth interval for this beneficiary j is calculated as

$$E_{ijk}=\alpha_k t_{ijk} R_{ijk}$$

It should be noted that t_{ijk} and hence can be 0 if beneficiary *j* is never at risk during the k^{th} interval. Summing the E_{ijk} over all of the six intervals and all *N* beneficiaries in a given ESCO gives the expected number of hospital admissions during follow-up at that ESCO. Details for variables included in the models may be found in Section F (Model Variables) of this appendix, below.

d. Risk-Adjusted Model for Computing Expected Number of Hospital Admissions

The calculation of expected hospital admissions is based on a two-stage model. In the first stage, the Cox model with piecewise-constant baseline rates stratified by facilities is used to estimate regression parameters associated with $\hat{\beta}^T Z_{ij}$; that is, the baseline hospitalization rate function for the j^{th} beneficiary in the i^{th} facility is assumed as

$$\lambda_{ij}(t) = \lambda_0(t)\exp(\hat{\beta}^T Z_{ij}),$$

where Z_{ij} is a vector of adjustment covariates, β is the corresponding parameter, and $\lambda_{0i}(t)$ is the facility-specific baseline hospitalization rate function. This approach avoids complicated issues arising from, for example, interactions between beneficiary characteristics and facility effects. In the second stage, the population baseline hospitalization rate function is computed through an unstratified Cox model using $\hat{\beta}^T Z_{ij}$ as an offset; in other words, the baseline hospitalization rate function for the j^{th} beneficiary in the i^{th} facility is assumed as

$$\lambda_{ij}(t) = \lambda_0(t)\exp(\hat{\beta}^T Z_{ij}),$$

where $\lambda_0(t)$ is the common baseline hospitalization rate function. For computation purposes, we adopt piecewise constant baseline rates; that is, the baseline rate is assumed to be a piecewise constant function with six intervals (i.e., 91 days-six months, six months-one year, one-two years, two-three years, three-five years, or five or more years duration of ESRD) and a separate level or rate in each interval.[49] We denote the estimated rates obtained at stage 2 as $\alpha_1,\ldots,\alpha_6$.

D. Standardized Readmission Ratio Methodology

In this section, we review the methods used to compute the SRR, including beneficiary assignment and the development of other steps. Then we describe the risk-adjusted model for the expected number of events during a given time period and the specification of the SRR measure.

[49] This specification was developed by Liu D., Kalbfleisch J.D., Schaubel D.E. (2014). Methods for estimating center effects on recurrent events. *Statistics in Biosciences*, 1;6(1):19-37.

1. Beneficiary Assignment

For the standardized readmission ratio, assignment to an ESCO is from the first day that indicates receipt of dialysis care. The SRR for an ESCO serves as a measure of 30-day unplanned hospital readmission for dialysis beneficiaries discharged from any acute care hospital (ACH). The SRR for an ESCO is defined to be the ratio of observed number of unplanned readmissions (which meet inclusion criteria) that occur within 30 days of an eligible indexed discharge divided by the expected readmission, given the number of discharges, characteristic of hospitalization, characteristics of beneficiaries, and median readmission rate for Medicare ESRD beneficiaries. Note that in this report, "hospital" always refers to ACH.

Monthly eligibility status guides if a discharge is considered to be an index discharge and attributed to an ESCO. For example, if an admission occurs during an ineligible month but the corresponding discharge date occurs during an eligible month, then the index discharge is eligible, assuming other criteria are met. If a readmission occurs during an ineligible month but the index discharge occurs during an eligible month, the readmission will count against that eligible index discharge and be attributed to that ESCO.

2. Beneficiary Exclusions

Beneficiary exclusions are listed below:

- Beneficiaries with a missing ESRD Medical Evidence Form (CMS-2728) in CROWNWeb
- Beneficiaries with a missing date of birth or sex

3. Determination of Index Discharge

Index discharges are restricted to Medicare-covered hospitalizations for inpatient care at short-term ACHs and critical access hospitals. Discharges from skilled nursing facilities (SNFs), long-term care hospitals, rehabilitation hospitals, and Prospective Payment System (PPS)-exempt cancer hospitals—as well as those from separate dedicated units for hospice, rehabilitation, and psychiatric care—are excluded. To be counted as an index discharge, the beneficiary must be receiving dialysis treatment for ESRD at the time of discharge.

In addition to monthly eligibility requirements, the SRR denominator (index discharge) excludes hospitalizations:

- For beneficiaries who died during the hospitalization (*Rationale: There was no opportunity for readmission*);
- That are followed within 30-days by the beneficiary's death (and no readmission);
- For beneficiaries who were discharged against medical advice (*Rationale: Providers did not have the opportunity to deliver full care and prepare the beneficiary for discharge*);
- That include a primary diagnosis of medical treatment of cancer, certain psychiatric conditions, or rehabilitation for prosthesis[50] (*Rationales: Admissions for medical treatment of cancer have a different mortality and readmission profile than the rest of*

[50] See http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp and https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp for descriptions of the AHRQ Clinical Classifications Software (CCS) used to identify these conditions.

the Medicare population, and outcomes for these admissions do not correlate well with outcomes for other admissions; patients admitted for psychiatric treatment are typically cared for in separate psychiatric or rehabilitation centers that are not comparable to short-term ACHs; rehabilitation for prosthesis admissions are not typically to a short-term ACH and are not for acute care);

- That occur after a beneficiary's 12th hospital admission in the time period *(Rationale: During the technical expert panel's review of the SRR measure, members were concerned that, especially for small facilities, allowing a beneficiary at high risk of readmission (e.g., an HIV-positive patient) to contribute without limit to the denominator and numerator could unfairly skew that facility's measure. In response to this concern, hospitalizations following an individual beneficiary's 12th discharge in the time period were excluded. Sensitivity analyses excluding this cap (representing 0.8% of 2012 hospital discharges) led to only small changes in the flagging rate for smaller facilities);*
- That took place at PPS-exempt cancer hospitals *(Rationale: These hospitals care for a unique population of patients that cannot reasonably be compared to patients admitted to other hospitals);*[51]
- That result in a transfer to another acute care facility *(Rationale: For beneficiaries who are transferred between one ACH and another, the measure considers these multiple contiguous hospitalizations as a single acute episode of care, and readmission for transferred beneficiaries is attributed to the hospital that ultimately discharges the beneficiary to a non-acute care setting).*

4. Ratio Calculation

a. Observed/Expected

The SRR measure is useful for examining whether facility-specific readmission rates are in line with the national average for Medicare patients across all dialysis facilities (adjusted for case mix). The SRR reflects the number of readmission events for beneficiaries in an ESCO, relative to the number of readmission events that would be expected, based on rates for the ESRD Medicare population, and the characteristics of the beneficiaries at that ESCO as well as the number of discharges. An ESCO that experienced readmissions at a rate higher than average for all ESRD Medicare patients will have an SRR greater than 1.0. In contrast, an ESCO experiencing readmissions at a rate lower than average for all ESRD Medicare patients will have an SRR less than 1.0.

The SRR was calculated from January 1, 2015 to December 31, 2018. For the annual SRR measures, the eligible index discharge date determines the year in which any corresponding readmission would be counted. For example, if an eligible hospitalization began in December 30, 2014, with a corresponding discharge date on January 4, 2015, the index discharge

[51] CMS 2016 All-Cause Hospital-Wide Measure Updates and Specifications Report: Hospital-Level 30-Day Risk Standardized Readmission Measure –Version 5.0, submitted by Yale New Haven Health Service Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE), March 2016. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Downloads/Hospital-Visits-after-Hospital-Outpatient-Surgery-Measure.pdf
In developing the SRR measure, CMS wanted the Dialysis Facility SRR to align with the Hospital Wide Readmission (HWR) measure to the greatest extent possible. To that end, the SRR adopted the exclusion criteria applied in the HWR measure by the Yale Center for Outcomes Research, the developer of this measure.

would be counted in 2015. If an index discharge occurred in December 2014, but the eligible readmission occurred in January 2015, this readmission would be counted in 2014.

b. Observed Number of Readmissions

The observed event (O) is the actual number of readmission events over the CY among beneficiaries attributed to an ESCO. A readmission event is defined as an admission to an ACH, with exclusions as stated above, within 30-days of the eligible indexed discharge date. Planned and unplanned readmissions are identified using Version 1.0 of the algorithm developed by the Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation for the Hospital-Wide All-Cause Unplanned Readmission Measure, which was endorsed in 2012 (National Quality Forum [NQF] #1789).[52] Hospitalizations are counted as events in the numerator if they meet the definition of an unplanned readmission that (a) occurred within 30-days of a hospital discharge and (b) was not preceded by a "planned" readmission that also occurred within 30-days of discharge. A readmission is considered "planned" under two scenarios:[53]

1. The beneficiary undergoes a procedure that is always considered planned (e.g., bone marrow transplant) or has a primary diagnosis that always indicates the hospitalization is planned (e.g., maintenance chemotherapy). These are identified using Clinical Classifications Software (CCS) groupers.[54]
2. The beneficiary undergoes a procedure that may be considered planned if it is not accompanied by an acute diagnosis. For example, a hospitalization involving a heart valve procedure accompanied by a primary diagnosis of diabetes would be considered planned, whereas a hospitalization involving a heart valve procedure accompanied by a primary diagnosis of acute myocardial infarction would be considered unplanned. These are identified using a combination of CCS groupers and individual International Classification of Diseases (ICD) codes (9th Revision [ICD-9]: before October 2015; 10th Revision [ICD-10]: after October 2015).

Note that a discharge from a planned admission may be considered an index discharge.

To monitor readmission rates, let X_{ij} denote the observed outcome for the j^{th} discharge within the i^{th} facility. To compute SRR, j is sorted based on the time of discharge. Furthermore, X_{ij}=1 if the j^{th} discharge in ESCO i results in a readmission within 30-days, and X_{ij}=0 otherwise. The observed number of events (until the t^{th} observations) for the ESCO is given by

$$O_{it} = \sum_{j=1}^{t} X_{ij}$$

.

[52] Hospital-Wide All-Cause Unplanned Readmission Measure Final Technical Report. Contract number: HHSM-500-2008-0025I/HHSM-500-T0001, Modification No. 000007. Prepared For: Centers for Medicare & Medicaid Services (CMS). July 2012. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Measure-Methodology.html

[53] Report for the Standardized Readmission Ratio. Contract number: HHSM-500-2013-13017I. Prepared for Centers for Medicare & Medicaid Services (CMS). June 2014. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP/Downloads/MeasureMethodologyReportfortheProposedSRRMeasure.pdf

[54] See http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp and https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp for descriptions of each Condition Category (CC).

c. Expected Number of Readmissions

The expected event (E) is the number of readmission events that would be expected if beneficiaries at the facility experienced readmission events at the median ESRD Medicare population rate for patients with similar characteristics.

The expected number of events in one ESCO until the i^{th} discharge is computed as $\sum_{j=1}^{t} P_{ijM}$, where P_{ijM} represents the expected probability if the ESCO under investigation has the same effects as the population average (benchmark: defined as the median facility effect across all dialysis facilities), e.g.,

$$P_{ijM} = \frac{\exp(\gamma_M + \beta^T Z_{ij})}{1 + \exp(\gamma_M + \beta^T Z_{ij})}$$

with γ_M being the median population effect. The estimates for β and γ_M are calculated by fitting a logistic regression model. Regression adjustments include age, sex, duration of ESRD, diabetes as cause of ESRD, BMI at incidence, days hospitalized during index hospitalization, past-year comorbidities, high-risk diagnosis groups, and CY. Details for variables included in the models may be found in **Section F** (Model Variables) of this appendix, below.

5. Risk-Adjusted Model for Computing Expected Number of Readmissions

The development of a new readmission model for the Q1 2018 quarterly report provided us with the opportunity to develop a two-stage model that is more reflective of readmission patterns in our CEC population.

The computation of E_{ij} (here, expected readmission for the j^{th} beneficiary in the i^{th} facility) is done in a two-stage model. In the first stage, we consider a logistic model in which facilities are represented as fixed effects. Regression adjustments include age, sex, years with ESRD, diabetes as cause of ESRD, BMI at incidence, days hospitalized during index hospitalization, past-year comorbidities, high-risk diagnosis groups, and CY. This leads to a regression model of the form:

$$logit(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \gamma_i + \beta^T Z_{ij},$$

where P_{ij} is the probability of readmission for the j^{th} discharge assigned to facility i, Z_{ij} is a vector of adjustment covariates for this discharge, and β is the corresponding coefficient. The parameter γ_i corresponds to the fixed facility effects in the sense that a large value of γ_i would indicate that the i^{th} facility has higher readmission rates.

In the second stage, the population average intercept γ_M is computed through a logistic model (with no covariates) using $\hat{\beta}^T Z_{ij}$ from the first stage as an offset.

The expected number of events in one ESCO until the t^{th} discharge is computed as $E_{it} = \sum_{j=1}^{t} P_{ijM}$, where P_{ijM} represents the expected probability if the ESCO under investigation has the same effects as the population average:

$$P_{ijM} = \frac{\exp(\gamma_M + \beta^T Z_{ij})}{1 + \exp(\gamma_M + \beta^T Z_{ij})}$$

In prior quarters, instead of fitting the second stage model to calculate population average intercept γ_M, we used the median fixed patient effect γ_i (as determined in the first stage) to calculate the expected probability P_{ijM}. The two-stage model now developed using the CEC population is a better representation of the population median for readmissions.

E. Standardized Mortality Ratio Methodology

This section presents the methods used to compute the SMR, including the determination of beneficiary assignment and the development of other steps. Then we describe the risk-adjusted model for the expected number of events during a given time period and the specification of the SMR measure.

1. Beneficiary Assignment

For SMR, beneficiary time-at-risk is defined as the duration of time over which the death of a beneficiary would be attributed to that particular ESCO, thus counting as an observed event. Beneficiary time-at-risk is attributed to an ESCO after he/she has had ESRD for at least 90 days and has been aligned to that ESCO for at least 60 days.[55] If the beneficiary had been treated in that ESCO for more than 60 days prior to January 1, 2012, that beneficiary's time-at-risk would be attributed to that ESCO as of January 1, 2012. If the beneficiary had been treated for fewer than 60 days at the ESCO and aligned on January 1, 2012, the beneficiary's time-at-risk attributed to the ESCO facility would begin on day 61. Time-at-risk ends at the earliest occurrence of the following: one day prior to a transplant, date of death, or end of ESCO alignment plus 60 days.[56] As mentioned above, after we determine beneficiary assignment, we exclude the ineligible time-at-risk and death events according to the monthly eligibility criteria.

[55] Since a patient's follow-up in the database can be incomplete during the first 90 days of ESRD therapy, we only include a patient's follow-up into the measure after that patient has received chronic renal replacement therapy for at least 90 days. This minimum 90-day period also assures that most patients are eligible for Medicare, either as their primary or secondary insurer. It also excludes from analysis patients who die or recover renal function during the first 90 days of ESRD. In order to exclude patients who only received temporary dialysis therapy, we assign patients to a facility only after they have been on dialysis there for the past 60 days. This 60-day period is used both for patients who started ESRD for the first time and for those who returned to dialysis after a transplant. For additional details, see https://dialysisdata.org/sites/default/files/content/ESRD_Measures/nqf/SMR%20MIF.pdf.

[56] This rule is used in the mortality (SMR), hospitalization (SHR), and transfusion standardized outcome measures publically reported on Dialysis Facility Compare. It applies to both discharging dialysis and admitting facilities. Patient outcomes continue to be attributed to a dialysis facility for up to 60 days after the patient leaves that facility and, therefore, are not attributed to a patient's new facility until 60 days after their admission date. The rule attempts to acknowledge the delayed clinical consequences of dialysis facility care provided in the recent past (e.g., cumulative infection risk associated with specific vascular access use, cumulative risks of inadequate dialysis, or fluid management).

Beneficiary exclusions include the following:

- Beneficiaries with a missing ESRD Medical Evidence Form (CMS-2728) in CROWNWeb
- Beneficiaries with a missing date of birth or sex.

2. Ratio Calculation

a. Observed/Expected

The SMR is useful for examining whether facility-specific mortality rates are in line with the ESRD Medicare patient population average across all dialysis facilities (adjusted for case mix) and provides additional assurance that the CEC Model is not adversely impacting beneficiary survival. The annual SMR is the actual number of deaths divided by the expected number of deaths during the CY. An ESCO that experienced deaths at a rate higher than the ESRD Medicare patient population average will have an SMR greater than 1.0. In contrast, an ESCO experiencing deaths at a rate lower than the national average will have an SMR less than 1.0.

b. Observed Number of Deaths

O equals the observed number of deaths among the beneficiaries attributed to an ESCO during the CY. This count does not include deaths from street drugs or accidents unrelated to treatment, which vary by facility (for example, urban facilities that treat large numbers of male and young patients report proportionally higher number of deaths from these causes when compared to other facilities).[57] Since these deaths are unlikely to have been due to treatment facility characteristics, we excluded them from the observed number of deaths calculations.

c. Expected Number of Deaths

E equals the expected number of death events among the beneficiaries assigned to this ESCO during the CY. The expected number of deaths is calculated based on a Cox risk model, adjusting for beneficiary age, race, ethnicity, sex, diabetes, years with ESRD, nursing home status, comorbidities at incidence, BMI at incidence, and CY. For this report, we tested and revised model specifications to better fit the ESRD Medicare population in comparison to the DFR SMR model that had been developed for the national population.

Unlike the models for SHR and SRR, the coefficients for the SMR model showed instability for some of the variable coefficients when updated for data years (2015-2018). In the prior SMR model, the interaction of race and diabetes, years with ESRD, sex, and age, respectively, were included as were interactions with race and ethnicity. For the CEC population, these interaction terms did not improve model stability or predictability. We therefore tested all interaction terms with race or ethnicity. The results of this evaluation led to the removal of the race and ethnicity interaction terms; coefficients across race main effects then became stable and statistically consistent across the four-year model as well as when the model was evaluated by year.

[57] Turenne, M.N., Loos, M.E., Port, F.K., Emmert, G., Hulbert-Shearon, T.E., Wolfe, R.A., Levine, G.N., Daugirdas, J.T., Agodoa, L.Y.C., Held, P.J. (1996). The impact of deaths due to AIDS, accidents, and street drugs on standardized mortality ratios (SMRs) by facility. U.S. Renal Data System and University of Michigan, Ann Arbor. Poster presented at the American Society of Nephrology, New Orleans, LA, November, 1996. Abstracts – *Journal of the American Society of Nephrology,* 7:1467.

The next revised set of variables related to age. Our evaluation showed how mortality differed across categorical age groups, with a change in slope at 25 years. We modified the age spline to more accurately reflect how age differentially affects mortality for those under the age of 25 years compared to those over the age of 25 years, across the ESRD Medicare population. The final set of interaction terms evaluated included years of ESRD interacted with diabetes and sex, respectively, as well as the interaction term for female and diabetes. Similar to the interactions terms across the race categories, most of these other interaction terms did not add stability or predictability to model. The final model retained two interaction terms: (1) less than one year of ESRD by incident diabetes diagnosis and (2) one to two years of ESRD by incident diabetes diagnosis.

The model also controls for age-adjusted population death rates by state and race, based on the U.S. population in 2014-2016.[58]

For mortality, the expected number of events is computed as

$$E_i(t) = \sum_{j=1}^{n_i} \int_0^t Y_{ij}(u) \exp\left(\hat{\beta}^T Z_{ij}\right) d\,\hat{\Lambda}_0\left(u;\hat{\beta}\right),$$

where β is the at-risk indicator at time *u*, Z_{ij} is the covariate vector for the *j*-th beneficiary in ESCO *i*, $Y_{ij}(u)$ is the estimated coefficients for adjustment variables and $\hat{\Lambda}_0(t;\hat{\beta})$ is the estimated national average cumulative baseline hazard; the benchmark is defined as the average facility effect across all dialysis facilities. Details for variables included in the models may be found in **Section F** (Model Variables) of this appendix, below.

3. Risk-Adjusted Model to Compute the Expected Mortality

The risk-adjusted model used to compute the expected number of deaths is discussed below.

Subscript *i* represents the facility and subscript *j* represents the individual beneficiary-level values. Let *F* be the total number of facilities. The total number of beneficiaries is denoted by $n = \sum_{i=1}^{F} n_i$, where n_i is the number of subjects in facility *i*. Let T_{ij} represent the survival time and C_{ij} represent censoring time[59] for the *j*th beneficiary in facility *i*. Observation times are denoted by $X_{ij} = T_{ij} \wedge C_{ij}$, with at risk indicator $Y_{ij}(t) = I(X_{ij} \geq t)$, where $a \wedge b = \min(a, b)$ and $I(A)$ is an indicator function taking the value 1 when condition A holds and 0 otherwise. The observed death indicators are denoted by $\Delta_{ij} = I(T_{ij} \leq C_{ij})$, and the death counting process is defined as $N_{ij}(t) = \Delta_{ij} I(X_{ij} \leq t)$. The observed data consist of *n* independent vectors, $(X_{ij}, \Delta_{ij}, Z_{ij})$, where Z_{ij} is a vector of adjustment covariates.

[58] Table 16, Health, United States, 2017 (https://www.cdc.gov/nchs/hus/contents2017.htm#Table_016).
[59] Censored at transplant; ineligibility/removal from ESCO; end of study period.

The computation of E_{ij} (here, expected mortality for the j^{th} beneficiary in the i^{th} facility) is done in a two-stage model. In the first stage, a Cox model stratified by dialysis facilities is used to estimate regression parameters associated with Z_{ij}, e.g., the hazard function for the j^{th} beneficiary in the i^{th} facility is assumed as

$$\lambda_{ij}(t) = \lambda_0(t)\exp(\hat{\beta}^T Z_{ij}),$$

where β is the coefficient for adjustment variables and $\lambda_{0i}(t)$ is the facility-specific baseline hazard function. This approach avoids any problems that might arise with confounding between beneficiary characteristics and facility effects.

In the second stage, the population average cumulative baseline hazard is computed through a stratified Cox model (with no covariates) using $\hat{\beta}^T Z_{ij}$ as an offset, i.e., the hazard function for the *j*-th beneficiary in the *i*-th facility is assumed as

$$\lambda_{ij}(t) = \lambda_0(t)\exp(\hat{\beta}^T Z_{ij}),$$

where β is the estimated coefficient for adjustment variables and $\lambda_0(t)$ is the common baseline hazard function. The corresponding estimated cumulative baseline hazard is

$$\hat{\Lambda}_0(t;\hat{\beta}) = \sum_{j=1}^{n_i} \int_0^t \frac{dN_{ij}(u)}{\sum_{j=1}^{n_i} Y_{ij}(u)\exp(\hat{\beta}^T Z_{ij})},$$

where β is estimated from stage 1 (i.e., the stratified Cox model).

F. Model Variables: Adjustors and Data Sources for the Mortality, Readmission, and Hospitalization Risk-Adjustment Models

The following are details on the risk adjustors and data sources for the mortality, readmission, and hospitalization risk-adjustment models used to calculate the respective expected values. All three models use each covariate unless otherwise indicated.

- *Age*: Beneficiary age is derived from the date of birth in the Master Beneficiary Summary File (MBSF).
- *Race and ethnicity*: Race and ethnicity are determined from CMS's Medical Evidence Report form (CMS-2728) at the time of ESRD incidence. Race and ethnicity (i.e., Hispanic versus non-Hispanic) are included as separate covariates, which are included only in the SMR model.
- *Sex*: Beneficiary sex is obtained from the MBSF.
- *Diabetes as cause of ESRD*: Beneficiary primary cause of ESRD is obtained from his/her CMS-2728 form. When the cause of ESRD is missing, it is assumed that diabetes is not the cause.
- *Years with ESRD*: Each beneficiary's length of time with ESRD is determined using the first dialysis service date from the REMIS database.

- *Nursing home status*: In the mortality and hospitalization models, the MDS is used to determine if a beneficiary was in a nursing home in the previous year.
- *Comorbidities at ESRD incidence*: Comorbidities are determined using a selection of comorbid conditions reported on the CMS-2728 form, namely alcohol dependence, atherosclerotic heart disease, cerebrovascular disease, CHF, diabetes, drug dependence, inability to ambulate, inability to transfer, cancer, other cardiac disease, peripheral vascular disease, and tobacco use (current smoker). Each comorbidity is included as a separate covariate in the mortality and hospitalization models.
- *BMI at ESRD incidence*: Beneficiary BMI is based on the height and weight provided on his/her CMS-2728 form. When height and/or weight are missing, a BMI is imputed for the beneficiary based on the average BMI of all beneficiaries—specific to sex, race, diabetic status, and age at ESRD incidence.
- *CY*: Calendar year
- *Population death rates*: In the mortality model, age-adjusted population death rates (per 100,000) by state and race in 2014 to 2016 are obtained from the U.S. Centers for Disease Control and Prevention's National Center for Health Statistics.[60]
- *Days hospitalized during index hospitalization*: In the readmissions model, the length of each hospitalization is determined by taking the difference between the date of admission and the date of discharge available on the inpatient claim. For beneficiaries who are transferred between one ACH and another, the measure considers these multiple contiguous hospitalizations as a single acute episode of care, and the length is calculated by taking the difference between the date of admission for the first hospitalization and the date of discharge from the last hospitalization included.
- *Past-year comorbidities (risk variables):* In the readmissions model, all unique ICD diagnosis codes are identified for each patient reported on Medicare claims in the 365 days preceding (and inclusive of) the index discharge date. Note that SRR was developed to align with the risk adjustment approach of the CMS Hospital Wide All-Cause Readmission Measure. A part of this SRR includes risk adjustment for prevalent comorbidities (in the prior year) that are specifically associated with readmissions.[61] Five available claim types for codes are examined: inpatient, outpatient, SNF, hospice, and home health claims. These diagnosis codes are grouped by diagnosis area using CMS's HCCs.[62] The Condition Categories (CCs) used in the calculation of the readmissions model are:
    - CCs 177 and 178: Amputation status
    - CC 79: Cardiorespiratory failure/shock
    - CC 46: Coagulation defects and other specified hematologic disorders
    - CCs 51 and 52: Drug and alcohol disorders

[60] Table 16, Health, United States, 2017 (http://www.cdc.gov/nchs/data/hus/2017/016.pdf).

[61] When SMR and SHR were originally developed, they only included adjustment for a set of comorbidities at ESRD incidence. The current SMR and SHR were updated in 2016 to include prevalent comorbidity adjustment and are the production versions reported on DFC. They received final NQF endorsement in early 2017.

[62] Evaluation of the CMS-HCC Risk Adjustment Model Final Report, prepared by RTI International, March 2011 (https://www.cms.gov/Medicare/HealthPlans/MedicareAdvtgSpecRateStats/downloads/evaluation_risk_adj_model_2011.pdf)

- CCs 25 and 26: End-stage liver disease
- CC 109: Fibrosis of lung or other chronic lung disorders
- CCs 67-69, 100, and 101: Hemiplegia, paraplegia, paralysis
- CC 158: Hip fracture/dislocation
- CC 174: Major organ transplant (excluding kidney)
- CC 7: Metastatic cancer/acute leukemia
- CC 44: Other hematological disorders
- CCs 6 and 111-113: Other infectious disease and pneumonias
- CCs 10-12: Other major cancers
- CC 32: Pancreatic disease
- CCs 54-56, 58, and 60: Psychiatric comorbidity
- CC 77: Respirator dependence/tracheostomy status
- CC 38: Rheumatoid arthritis and inflammatory connective tissue disease
- CC 74: Seizure disorders and convulsions
- CC 2: Septicemia/shock
- CCs 8 and 9: Severe cancer
- CCs 1 and 3-5: Severe infection
- CCs 148 and 149: Ulcers

- *Discharged with High-Risk Condition*: In the readmissions model, a high-risk diagnosis is defined as any diagnosis area (grouped by the Agency for Healthcare Research and Quality [AHRQ] CCS) that was rare in the population but had a 30-day readmission rate of at least 40%. Note that high-risk diagnosis groups related to cancer or mental health are not index discharges, and thus such diagnoses are not included. The CCS areas identified as high-risk are:
  - CCS 5: HIV infection
  - CCS 6: Hepatitis
  - CCS 56: Cystic fibrosis
  - CCS 57: Immunity disorders
  - CCS 61: Sickle cell anemia
  - CCS 190: Fetal distress and abnormal forces of labor
  - CCS 151: Other liver diseases
  - CCS 182: Hemorrhage during pregnancy; abruptio placenta; placenta previa
  - CCS 186: Diabetes or abnormal glucose tolerance complicating pregnancy; childbirth; or the puerperium

- CCS 210: Systemic lupus erythematosus and connective tissue disorders
- CCS 243: Poisoning by nonmedicinal substances

1. Standardized Measures Limitations

These measures utilize indirect standardization. While statistically appropriate for the data structure of these outcomes, the resulting ambiguity in determining whether observed changes over time are due to changes in risk-adjusted expected events, observed events, or both, can be challenging. In addition, how these complex models, based on multiple years of data, adjust for the declining mortality and hospitalization relative to other risk adjusters is uncertain. Comparisons of standardized measures performance between the ESCOs and the comparison group within a given year helps give a clearer picture, particularly when matching is used to select comparison groups.

In addition, the SRR has complex risk-adjustment and exclusion components based on diagnoses derived from Medicare claims data. The predictive models that calculate the expected readmission values were developed using ICD-9 diagnosis coding system several years prior to implementation in the CEC evaluation. On October 1, 2015, CMS mandated conversion to ICD-10 diagnosis coding. Initial crosswalks were developed, based on CMS-recommended General Equivalence Mappings (GEM) reference databases for ICD-9 to ICD-10 conversion. These crosswalks have been implemented in the SRR reported publicly on Dialysis Facility Compare in 2016. Additional changes to the crosswalk are planned, based on the initial experience with the crosswalk, including an interim step of adding additional ICD-10 codes from the GEM ICD-10 to ICD-9 reference, as well as additional clinical review of the resulting crosswalk and coding results. Given the uncertainty inherent in conversion to a new coding tool, results for any measure dependent on complex claims-based risk adjustment should be interpreted with caution in the initial time period after implementation of the new tool. Such is the case for SRR, particularly for changes in SRR from 2014 through 2016, given that ICD-9 was used exclusively in 2014, both ICD-9 and ICD-10 systems were used for parts of 2015, and ICD-10 is being used as the sole coding instrument for 2016 data.

A summary of each standardized measure by year for all ESCOs and the comparison group are displayed in **Exhibits I-1** through **I-3**.

Exhibit I-1. Standardized Hospitalization Ratio for All ESCOs and Comparison Group

Group	Statistic	Standardized Hospitalization Ratio (Admissions) Summary			
		2015	2016	2017	2018
ALL ESCOs	Beneficiary-years at risk	29,176	28,844	32,255	45,603
	Observed number of hospital admissions	45,721	44,863	50,044	72,257
	Expected number of hospital admissions	43,642	43,512	49,061	69,980
	SHR	1.05	1.03	1.02	1.03
Comparison Group	Beneficiary-years at risk	24,100	22,994	24,658	33,022
	Observed number of hospital admissions	38,991	36,724	40,043	54,266
	Expected number of hospital admissions	36,382	35,078	38,125	51,533
	SHR	1.07	1.05	1.05	1.05

Exhibit I-2. Standardized Readmission Ratio for All ESCOs and Comparison Group

Group	Statistic	Standardized Readmission Ratio Summary			
		2015	2016	2017	2018
ALL ESCOs	Index discharges	44,109	43,626	48,087	68,155
	Observed number of readmissions	13,569	13,226	14,686	21,087
	Expected number of readmissions	13,809	13,700	15,047	21,266
	SRR	0.98	0.97	0.98	0.99
Comparison Group	Index discharges	38,309	36,434	39,369	51,660
	Observed number of readmissions	11,803	11,244	12,327	16,476
	Expected number of readmissions	12,041	11,452	12,409	16,287
	SRR	0.98	0.98	0.99	1.01

Exhibit I-3. Standardized Mortality Ratio for All ESCOs and Comparison Group

Group	Statistic	Standardized Mortality Ratio Summary			
		2014	2015	2016	2017
ALL ESCOs	Beneficiary years at risk	28,645	28,321	31,624	44,689
	Observed number of deaths	4,877	4,611	5,183	7,489
	Expected number of deaths	5,274	5,300	6,264	9,524
	SMR	0.92	0.87	0.83	0.79
Comparison Group	Beneficiary years at risk	23,965	22,898	24,446	32,702
	Observed number of deaths	4,280	3,962	4,413	5,916
	Expected number of deaths	4,531	4,415	5,024	7,232
	SMR	0.94	0.90	0.88	0.82

Appendix J: Mortality Analysis

This appendix defines the methodology used to conduct the mortality analysis. Results are summarized at the end of the section.

A. Data and Outcome Measures

The CMS's CCW was the main data source for this mortality analysis. We used Medicare claims data, beneficiary characteristics (e.g., demographics and enrollment), and CCW condition indicators.[63] This analysis includes CCW claims from January 1, 2014 through December 31, 2018 that were processed by March 31, 2019.[64] All CCW claims were final action claims and had a minimum of three months of run out.[65]

We also extracted patient data from Consolidated Renal Operations in a Web-enabled Network (CROWNWeb) to complete the patient history. Data were pulled from the January 2019 quarterly file (for data through December 2018) extracted from CROWNWeb.

Patient demographic and clinical information were extracted from the CMS ESRD Medical Evidence Report form (Form-2728). These data included, but were not limited to, primary cause of renal failure, cause of renal failure groupings, height, race, dry weight, physician name, dialysis type, and incident comorbidities.

Date of death was extracted from the Master Beneficiary Summary Files which include validated dates of death for each beneficiary if death occurred.

The first dialysis service date was extracted from the Renal Management Information System (REMIS).

The analysis sample starts with the same set of beneficiaries and analysis time period (monthly data from January 2014 – December 2018) as the overall DiD analysis

B. CEC and Comparison Group Populations

For this mortality analysis, beneficiary time-at-risk is defined as the duration of time over which the death of a beneficiary would be attributed to an ESCO or comparison group facility, thus counting as an observed event. Beneficiary time-at-risk is attributed to an ESCO or comparison group facility after he/she has had ESRD for at least 90 days.[66] Time-at-risk ends at the earliest

[63] The CCW condition indicators are claims-based algorithms that identify beneficiaries with select clinical conditions (e.g., diabetes, hyperlipidemia, hypertension, etc.) https://www.ccwdata.org/web/guest/condition-categories.

[64] Kidney transplants are an exception, which also included claims that ended in 2011 to assess the kidney transplant exclusion criterion in 2012 (i.e., excluded in the 12 months following the month of a transplant).

[65] The analytic CCW claims files are based on final action claims. We used final action claims only to avoid internal data inconsistencies caused by use of original claims (e.g., we observed beneficiaries aligned based on original claims for whom we found no final action claims).

[66] Since a patient's follow-up in the database can be incomplete during the first 90 days of ESRD therapy, we only include a patient's follow-up into the measure after that patient has received chronic renal replacement therapy for at least 90 days. This minimum 90-day period also assures that most patients are eligible for Medicare, either as their primary or secondary insurer. It also excludes from analysis patients who die or recover renal function during the first 90 days of ESRD. For additional details, see https://dialysisdata.org/sites/default/files/content/ESRD_Measures/nqf/SMR%20MIF.pdf.

occurrence of the following: one day prior to a transplant, date of death, end of alignment, or the end of the follow-up period on December 31st 2018.

Beneficiaries with missing model covariates were excluded from the survival models.

This survival analysis does not incorporate the monthly CEC eligibility criteria. If a beneficiary became ineligible during the follow-up period, that beneficiary was retained for this analysis so as to not bias the results of the survival models.

In addition to survival models examining all beneficiaries, separate survival analyses were conducted for incident beneficiaries. Incident beneficiaries were defined as those who were aligned to an ESCO or comparison group facility during their first year of dialysis.

In addition to analyses examining the full period of follow-up, survival models were run after restricting follow-up time to two years for both prevalent and incident beneficiaries.

C. Survival Models and Estimated CEC Impact

A frequently used statistical model for survival analysis is the Cox proportional hazards models (Cox, 1972), which evaluates the treatment (CEC participation) effect while accounting for patients' characteristics. We set time 0 to be the later of alignment date and 90 days after ESRD, which approximates the treatment (or control) start date. This has been commonly used in clinical trials when comparing survival across different groups (e.g. treatment vs control). We fitted several Cox models which included different populations which will be detailed below. In each model, all the included patients were followed until death (event), transplant date minus 1 (censoring), becoming unaligned (censoring), loss to follow-up (censoring), or end of study (December 31, 2018) (censoring), whichever came first. As described below, we performed tests of the proportional hazards assumption underlying the Cox model to confirm its appropriateness for this application.

The most general model compares survival in the entire CEC-aligned population (all waves and cohorts) to the entire matched comparison population. Because Wave 1.1 contributed all of the observed patient experience beyond two years, a more restricted version of this model was fitted by limiting patient's follow up to the first two years after alignment. In this case, death beyond 2 years will be coded as censoring at 2 years. This restriction is intended to allow Wave 1.1 and subsequent waves and cohorts to contribute to the estimates in a more symmetrical fashion. We further considered models that only used data from patients who became aligned to the CEC or comparison group during their first year on dialysis (we call these "incident" models and call the previously described models without this restriction "prevalent" models).

A second set of models was estimated to test whether the impact of the CEC on survival differed by wave. To implement this test, when fitting the models we included an interaction term between alignment and wave. In our analysis, we specifically considered the patients aligned to facilities joining in Wave 1 PY1 (starting 10/1/2015) and Wave 2 PY2 (starting 1/1/2017) and their matched comparisons. The model included an indicator for alignment (1 if aligned to CEC, 0 if aligned to the comparison), wave (1 if aligned to either a Wave 2 PY2 joiner or its comparison, 0 if aligned to either a Wave 1 PY1 joiner or its comparison), and an interaction between alignment and wave. The alignment indicator estimates the effect of CEC for Wave 1 PY1 joiners, while the interaction estimates how the effect of CEC differs between Wave 2 PY2

joiners and Wave 1 PY1 joiners. That is, an interaction term close to 0 may suggest that the CEC effect is similar across both waves. In our analysis, we considered the following four permutations of populations: prevalent and incident samples, each with and without limiting patient-level follow-up to two years post alignment.

In summary, the different survival models we estimate are specified as follows:

- Model 1: Adjusts for ESCO alignment, year, age, vintage (prevalent model only), race, sex, diabetes as cause of ESRD, ethnicity, log of BMI at incidence, log of BMI at incidence spline at 35, pre-ESRD nephrology care, and incident comorbidities, including atherosclerotic heart disease, other cardiac disease, congestive heart failure, inability to ambulate, inability to transfer, cancer, diabetes (all types including cause of ESRD), peripheral vascular disease, cerebrovascular disease, tobacco use, alcohol dependence, drug dependence, and having at least one comorbidity.
- Model 2: Adjusts for the same covariates listed for Model 1 (apart from year) but also includes a Wave Indicator (Wave 1 PY1 joiner = 0; Wave 2 PY2 joiner = 1) and a Wave Indicator*Alignment interaction term.
- Models 1c, 1d, 2c, and 2d are restricted to incident beneficiaries only. Models 1b, 1d, 2b, and 2d are restricted to only two years of follow-up time.

1. Estimation Results

The most general model (**Exhibit J-1**), which includes all waves as a single treatment group (CEC) relative to their single matched comparison (control), shows a modest but statistically significant survival benefit for CEC patients. When restricting follow-up to 2 years post-alignment, the survival benefit remains significant and similar in magnitude (**Exhibit J-2**). The hazard ratio slightly decreased from 0.964 to 0.962, which implies that the CEC benefits on survival for patients beyond 2 years of follow-up were only slightly larger than for patients during the first 2 years.

We hypothesized that the CEC impact would be larger among patients who were exposed to the program earlier in their course of treatment. These models (**Exhibit J-3** and **Exhibit J-4**) for incident patients (aligned during their first year on dialysis) supported this hypothesis as the CEC treatment effects were about twice the magnitude of those in the prevalent models. For the incident model that included all waves (**Exhibit J-3**), the CEC indicator coefficient equaled -0.067 (p=.004) with HR= 0.936; for the prevalent model that included all waves, the CEC indicator coefficient equaled -0.036 (p=.002) with HR= 0.964.

The next set of models tested whether the effects on mortality differed by wave. CEC effect was associated with slightly better survival than the comparison group. **Exhibit J-5** shows CEC indicator coefficient equaled -0.027, but the difference was not significant (p=.150). Similarly, alignment to Wave 2 PY1 joiners was associated with slightly better survival than for Wave 1 PY1 (Hazard Ratio=0.967), but again that association was not significant (p=.225). However, when comparing CEC vs comparison in Wave 2 PY2 joiners, CEC was associated with significantly better survival than the comparison group (Hazard Ratio=0.973*0.967=0.941) with a significant p-value (p=0.002) for the test of the null hypothesis that effect for Wave 2 PY2 joiners is not different than zero (**Exhibit J-6**). When restricting to 2 years of follow-up, the results remained similar to those from the unrestricted model.

Restricting the models to patients aligned during their first year on dialysis (**Exhibit J-9** and **Exhibit J-11**), the effects are again somewhat larger than in the prevalent model. In Wave 1 PY1 joiners, CEC was associated with better survival than the comparison group (HR= 0.945) but the difference was not significant (p=.100) (**Exhibit J-9**). However, when comparing CEC vs comparison in Wave 2 PY2 joiners, we find that CEC was associated with significantly better survival than the comparison group (HR=0.907) with a significant p-value (p=0.01) (**Exhibit J-10**).

Exhibit J-1. Model 1a—Analysis of Maximum Likelihood Estimates: All Prevalent Beneficiaries

Measures (N=125,216)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.036	0.012	0.002	0.964
Year (2017)	0.051	0.015	0.001	1.052
Year (2018)	0.101	0.018	<.0001	1.106
Age	0.032	0.001	<.0001	1.033
Dialysis Start<1yr	0.005	0.021	0.808	1.005
Dialysis Start between 2yr and 3yr	0.034	0.025	0.179	1.035
Dialysis Start greater than 3yr	0.243	0.020	<.0001	1.275
White	0.391	0.021	<.0001	1.478
Black	0.012	0.023	0.587	1.012
Female	-0.005	0.012	0.692	0.995
Diabetes as cause of ESRD	0.045	0.018	0.012	1.046
Hispanic	-0.256	0.021	<.0001	0.774
Unknown ethnicity	-0.142	0.354	0.688	0.867
Log of BMI at incidence	-0.501	0.036	<.0001	0.606
BMI at incidence: Missing	-0.300	0.290	0.300	0.741
Log of BMI at incidence spline at 35	0.535	0.083	<.0001	1.707
Incident Comorbidity: Atherosclerotic heart disease	0.088	0.017	<.0001	1.092
Incident Comorbidity: Other cardiac disease	0.125	0.016	<.0001	1.133
Incident Comorbidity: Congestive heart failure	0.184	0.014	<.0001	1.202
Incident Comorbidity: Inability to ambulate	0.265	0.031	<.0001	1.303
Incident Comorbidity: Inability to transfer	0.217	0.043	<.0001	1.242
Incident Comorbidity: Malignant neoplasm, cancer	0.084	0.024	0.001	1.087
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.155	0.021	<.0001	1.167
Incident Comorbidity: Peripheral vascular disease	0.135	0.020	<.0001	1.144
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.072	0.021	0.001	1.075
Incident Comorbidity: Tobacco use (current smoker)	0.117	0.026	<.0001	1.124
Incident Comorbidity: Alcohol dependence	0.177	0.053	0.001	1.193
Incident Comorbidity: Drug dependence	0.183	0.057	0.001	1.200
Incident Comorbidity: At least one comorbidity	0.190	0.023	<.0001	1.209
Pre-ESRD Nephrology Care: No	0.063	0.016	<.0001	1.065
Pre-ESRD Nephrology Care: Unknown	0.179	0.018	<.0001	1.196
Pre-ESRD Nephrology Care: Missing	0.295	0.026	<.0001	1.343

Notes: C Statistic = 0.676.

Exhibit J-2. Model 1b—Analysis of Maximum Likelihood Estimates: All Prevalent Beneficiaries with 2-Year Follow-up

Measures (N=125,216)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.038	0.012	0.002	0.962
Year (2017)	0.051	0.015	0.001	1.052
Year (2018)	0.101	0.018	<.0001	1.106
Age	0.032	0.001	<.0001	1.033
Dialysis Start<1yr	0.021	0.022	0.348	1.021
Dialysis Start between 2yr and 3yr	0.040	0.027	0.135	1.041
Dialysis Start greater than 3yr	0.250	0.021	<.0001	1.284
White	0.391	0.022	<.0001	1.479
Black	0.006	0.024	0.806	1.006
Female	-0.006	0.013	0.663	0.994
Diabetes as cause of ESRD	0.040	0.019	0.032	1.041
Hispanic	-0.254	0.022	<.0001	0.775
Unknown ethnicity	-0.170	0.379	0.654	0.844
Log of BMI at incidence	-0.502	0.038	<.0001	0.606
BMI at incidence: Missing	-0.262	0.290	0.365	0.769
Log of BMI at incidence spline at 35	0.540	0.087	<.0001	1.716
Incident Comorbidity: Atherosclerotic heart disease	0.093	0.018	<.0001	1.097
Incident Comorbidity: Other cardiac disease	0.129	0.016	<.0001	1.138
Incident Comorbidity: Congestive heart failure	0.189	0.014	<.0001	1.207
Incident Comorbidity: Inability to ambulate	0.259	0.032	<.0001	1.296
Incident Comorbidity: Inability to transfer	0.237	0.044	<.0001	1.268
Incident Comorbidity: Malignant neoplasm, cancer	0.087	0.025	0.001	1.091
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.157	0.022	<.0001	1.169
Incident Comorbidity: Peripheral vascular disease	0.138	0.020	<.0001	1.148
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.073	0.022	0.001	1.075
Incident Comorbidity: Tobacco use (current smoker)	0.102	0.027	0.000	1.107
Incident Comorbidity: Alcohol dependence	0.217	0.054	<.0001	1.243
Incident Comorbidity: Drug dependence	0.179	0.060	0.003	1.196
Incident Comorbidity: At least one comorbidity	0.190	0.024	<.0001	1.209
Pre-ESRD Nephrology Care: No	0.077	0.016	<.0001	1.080
Pre-ESRD Nephrology Care: Unknown	0.193	0.019	<.0001	1.213
Pre-ESRD Nephrology Care: Missing	0.308	0.027	<.0001	1.361

Notes: C Statistic = 0.6767.

Exhibit J-3. Model 1c—Analysis of Maximum Likelihood Estimates: All Incident Beneficiaries

Measures (N=37,574)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.067	0.023	0.004	0.936
Year (2017)	0.028	0.029	0.334	1.028
Year (2018)	0.047	0.034	0.172	1.048
Age	0.031	0.001	<.0001	1.032

Measures (N=37,574)	Coeff	SE	p-value	HR
White	0.441	0.043	<.0001	1.554
Black	0.039	0.047	0.410	1.040
Female	-0.004	0.023	0.878	0.996
Diabetes as cause of ESRD	-0.036	0.033	0.278	0.965
Hispanic	-0.382	0.049	<.0001	0.683
Unknown ethnicity	-4.152	71.225	0.954	0.016
Log of BMI at incidence	-0.785	0.069	<.0001	0.456
BMI at incidence: Missing	0.530	1.001	0.596	1.699
Log of BMI at incidence spline at 35	0.982	0.167	<.0001	2.671
Incident Comorbidity: Atherosclerotic heart disease	0.074	0.031	0.018	1.077
Incident Comorbidity: Other cardiac disease	0.135	0.027	<.0001	1.145
Incident Comorbidity: Congestive heart failure	0.269	0.025	<.0001	1.308
Incident Comorbidity: Inability to ambulate	0.344	0.048	<.0001	1.411
Incident Comorbidity: Inability to transfer	0.438	0.062	<.0001	1.549
Incident Comorbidity: Malignant neoplasm, cancer	0.221	0.038	<.0001	1.247
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.114	0.037	0.002	1.121
Incident Comorbidity: Peripheral vascular disease	0.173	0.035	<.0001	1.188
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.071	0.037	0.058	1.073
Incident Comorbidity: Tobacco use (current smoker)	-0.067	0.052	0.201	0.935
Incident Comorbidity: Alcohol dependence	0.259	0.098	0.008	1.295
Incident Comorbidity: Drug dependence	0.319	0.113	0.005	1.376
Incident Comorbidity: At least one comorbidity	0.144	0.047	0.002	1.154
Pre-ESRD Nephrology Care: No	0.245	0.030	<.0001	1.278
Pre-ESRD Nephrology Care: Unknown	0.372	0.030	<.0001	1.451
Pre-ESRD Nephrology Care: Missing	-5.993	71.225	0.933	0.002

Notes: C Statistic = 0.703.

Exhibit J-4. Model 1d—Analysis of Maximum Likelihood Estimates: All Incident Beneficiaries with 2-Year Follow-up

Measures (N=37,574)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.072	0.024	0.003	0.931
Year (2017)	0.028	0.029	0.332	1.028
Year (2018)	0.047	0.034	0.165	1.049
Age	0.032	0.001	<.0001	1.032
White	0.434	0.045	<.0001	1.543
Black	0.034	0.049	0.493	1.034
Female	-0.004	0.024	0.856	0.996
Diabetes as cause of ESRD	-0.044	0.034	0.190	0.957
Hispanic	-0.359	0.050	<.0001	0.698
Unknown ethnicity	-4.143	71.828	0.954	0.016
Log of BMI at incidence	-0.779	0.071	<.0001	0.459
BMI at incidence: Missing	0.524	1.001	0.601	1.688
Log of BMI at incidence spline at 35	0.990	0.173	<.0001	2.691
Incident Comorbidity: Atherosclerotic heart disease	0.084	0.032	0.009	1.087
Incident Comorbidity: Other cardiac disease	0.138	0.028	<.0001	1.148

Measures (N=37,574)	Coeff	SE	p-value	HR
Incident Comorbidity: Congestive heart failure	0.275	0.026	<.0001	1.316
Incident Comorbidity: Inability to ambulate	0.339	0.049	<.0001	1.403
Incident Comorbidity: Inability to transfer	0.460	0.063	<.0001	1.584
Incident Comorbidity: Malignant neoplasm, cancer	0.232	0.039	<.0001	1.261
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.114	0.038	0.003	1.121
Incident Comorbidity: Peripheral vascular disease	0.177	0.036	<.0001	1.193
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.070	0.038	0.068	1.072
Incident Comorbidity: Tobacco use (current smoker)	-0.113	0.055	0.039	0.893
Incident Comorbidity: Alcohol dependence	0.300	0.100	0.003	1.350
Incident Comorbidity: Drug dependence	0.318	0.118	0.007	1.375
Incident Comorbidity: At least one comorbidity	0.132	0.048	0.006	1.141
Pre-ESRD Nephrology Care: No	0.275	0.031	<.0001	1.316
Pre-ESRD Nephrology Care: Unknown	0.382	0.031	<.0001	1.465
Pre-ESRD Nephrology Care: Missing	-6.018	71.828	0.933	0.002

Notes: C Statistic = 0.704.

Exhibit J-5. Model 2a—Analysis of Maximum Likelihood Estimates: All Prevalent Beneficiaries, Interaction Model for Wave 1 PY1 and Wave 2 PY2 Joiners

Measures (N=85,732)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.027	0.019	0.150	0.973
Wave Indicator (wave 1.1=0; wave 2.1=1)	0.053	0.021	0.011	1.055
Wave Indicator*Align	-0.033	0.027	0.225	0.967
Age	0.033	0.001	<.0001	1.033
Dialysis Start<1yr	-0.022	0.024	0.365	0.978
Dialysis Start between 2yr and 3yr	0.013	0.029	0.662	1.013
Dialysis Start greater than 3yr	0.231	0.023	<.0001	1.260
White	0.414	0.025	<.0001	1.513
Black	0.034	0.026	0.197	1.035
Female	-0.015	0.014	0.275	0.985
Diabetes as cause of ESRD	0.045	0.020	0.028	1.046
Hispanic	-0.247	0.025	<.0001	0.781
Unknown ethnicity	-0.038	0.355	0.914	0.962
Log of BMI at incidence	-0.500	0.042	<.0001	0.607
BMI at incidence: Missing	-0.282	0.303	0.352	0.755
Log of BMI at incidence spline at 35	0.575	0.095	<.0001	1.777
Incident Comorbidity: Atherosclerotic heart disease	0.086	0.020	<.0001	1.090
Incident Comorbidity: Other cardiac disease	0.110	0.018	<.0001	1.116
Incident Comorbidity: Congestive heart failure	0.189	0.016	<.0001	1.208
Incident Comorbidity: Inability to ambulate	0.273	0.036	<.0001	1.313
Incident Comorbidity: Inability to transfer	0.216	0.050	<.0001	1.242
Incident Comorbidity: Malignant neoplasm, cancer	0.069	0.028	0.012	1.072
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.162	0.024	<.0001	1.176
Incident Comorbidity: Peripheral vascular disease	0.135	0.023	<.0001	1.145
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.048	0.024	0.044	1.049
Incident Comorbidity: Tobacco use (current smoker)	0.148	0.030	<.0001	1.159

Measures (N=85,732)	Coeff	SE	p-value	HR
Incident Comorbidity: Alcohol dependence	0.176	0.061	0.004	1.192
Incident Comorbidity: Drug dependence	0.150	0.066	0.023	1.162
Incident Comorbidity: At least one comorbidity	0.185	0.026	<.0001	1.203
Pre-ESRD Nephrology Care: No	0.060	0.018	0.001	1.062
Pre-ESRD Nephrology Care: Unknown	0.191	0.021	<.0001	1.211
Pre-ESRD Nephrology Care: Missing	0.306	0.029	<.0001	1.358

Notes: C Statistic = 0.678. Wave 1.1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2.1 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-6. Model 2a—Complete-Year Cox Model: Prevalent Beneficiaries

Align vs Non-Align	Effect	95% Lower CI	95% Upper CI	p-value
Wave 1	-0.027	-0.065	0.010	0.150
Wave 2	-0.061	-0.100	-0.022	0.002

Align vs Non-Align	Hazard Ratio	95% Lower CI	95% Upper CI	p-value
Wave 1	0.973	0.937	1.010	0.150
Wave 2	0.941	0.905	0.978	0.002

Notes: Wave 1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-7. Model 2b—Analysis of Maximum Likelihood Estimates: Prevalent Beneficiaries, Interaction Model with 2-Year Follow-up

Measures (N=85,732)	Coeff	SE	p-value	HR
Align (Control=0; ESCO=1)	-0.031	0.021	0.149	0.97
Wave Indicator (wave 1.1=0; wave 2.1=1)	0.052	0.022	0.015	1.054
Wave Indicator*Align	-0.029	0.029	0.316	0.971
Age	0.033	0.001	<.0001	1.034
Dialysis Start<1yr	-0.004	0.026	0.882	0.996
Dialysis Start between 2yr and 3yr	0.018	0.031	0.567	1.018
Dialysis Start greater than 3yr	0.239	0.025	<.0001	1.27
White	0.418	0.026	<.0001	1.519
Black	0.028	0.028	0.317	1.029
Female	-0.018	0.015	0.237	0.983
Diabetes as cause of ESRD	0.038	0.022	0.080	1.039
Hispanic	-0.244	0.027	<.0001	0.783
Unknown ethnicity	-0.055	0.379	0.885	0.947
Log of BMI at incidence	-0.500	0.044	<.0001	0.607
BMI at incidence: Missing	-0.243	0.303	0.423	0.784
Log of BMI at incidence spline at 35	0.588	0.101	<.0001	1.801
Incident Comorbidity: Atherosclerotic heart disease	0.092	0.021	<.0001	1.097
Incident Comorbidity: Other cardiac disease	0.114	0.019	<.0001	1.121
Incident Comorbidity: Congestive heart failure	0.196	0.017	<.0001	1.216

Measures (N=85,732)	Coeff	SE	p-value	HR
Incident Comorbidity: Inability to ambulate	0.265	0.038	<.0001	1.304
Incident Comorbidity: Inability to transfer	0.246	0.052	<.0001	1.278
Incident Comorbidity: Malignant neoplasm, cancer	0.072	0.029	0.014	1.075
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.166	0.025	<.0001	1.18
Incident Comorbidity: Peripheral vascular disease	0.140	0.024	<.0001	1.151
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.046	0.025	0.068	1.047
Incident Comorbidity: Tobacco use (current smoker)	0.131	0.032	<.0001	1.14
Incident Comorbidity: Alcohol dependence	0.231	0.063	0.000	1.26
Incident Comorbidity: Drug dependence	0.141	0.070	0.045	1.151
Incident Comorbidity: At least one comorbidity	0.183	0.028	<.0001	1.201
Pre-ESRD Nephrology Care: No	0.078	0.019	<.0001	1.082
Pre-ESRD Nephrology Care: Unknown	0.213	0.022	<.0001	1.237
Pre-ESRD Nephrology Care: Missing	0.326	0.031	<.0001	1.385

Notes: C Statistic = 0.679. Wave 1.1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2.1 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-8. Model 2b—2-Year Cox Model: Prevalent Beneficiaries

Align vs Non-Align	Effect	95% Lower CI	95% Upper CI	p-value
Wave 1	-0.031	-0.073	0.011	0.149
Wave 2	-0.060	-0.099	-0.021	0.002

Align vs Non-Align	Hazard Ratio	95% Lower CI	95% Upper CI	p-value
Wave 1	0.970	0.930	1.011	0.149
Wave 2	0.942	0.906	0.979	0.002

Notes: Wave 1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-9. Model 2c—Analysis of Maximum Likelihood Estimates: Incident Beneficiaries, Interaction Model for Wave 1 PY1 and Wave 2 PY2 Joiners

Measures (N=27,118)	Coeff	SE	p-value	HR
Align (control=0; ESCO=1)	-0.057	0.035	0.100	0.945
Wave Indicator (wave 1.1=0; wave 2.1=1)	0.032	0.038	0.411	1.032
Wave Indicator*Align	-0.041	0.053	0.437	0.960
Age	0.031	0.001	<.0001	1.031
White	0.449	0.050	<.0001	1.567
Black	0.037	0.054	0.491	1.038
Female	0.003	0.027	0.925	1.003
Diabetes as cause of ESRD	-0.053	0.037	0.159	0.949
Hispanic	-0.407	0.056	<.0001	0.665
Unknown ethnicity	-5.198	118.360	0.965	0.006
Log of BMI at incidence	-0.823	0.078	<.0001	0.439

Measures (N=27,118)	Coeff	SE	p-value	HR
BMI at incidence: Missing	-7.327	63.278	0.908	0.001
Log of BMI at incidence spline at 35	1.048	0.190	<.0001	2.851
Incident Comorbidity: Atherosclerotic heart disease	0.095	0.036	0.008	1.099
Incident Comorbidity: Other cardiac disease	0.118	0.031	0.000	1.125
Incident Comorbidity: Congestive heart failure	0.266	0.029	<.0001	1.305
Incident Comorbidity: Inability to ambulate	0.378	0.056	<.0001	1.459
Incident Comorbidity: Inability to transfer	0.396	0.072	<.0001	1.486
Incident Comorbidity: Malignant neoplasm, cancer	0.188	0.044	<.0001	1.207
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.115	0.042	0.006	1.122
Incident Comorbidity: Peripheral vascular disease	0.141	0.041	0.001	1.151
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.051	0.043	0.230	1.053
Incident Comorbidity: Tobacco use (current smoker)	-0.015	0.059	0.798	0.985
Incident Comorbidity: Alcohol dependence	0.149	0.118	0.206	1.160
Incident Comorbidity: Drug dependence	0.379	0.128	0.003	1.460
Incident Comorbidity: At least one comorbidity	0.185	0.053	0.001	1.203
Pre-ESRD Nephrology Care: No	0.224	0.034	<.0001	1.251
Pre-ESRD Nephrology Care: Unknown	0.397	0.035	<.0001	1.487
Pre-ESRD Nephrology Care: Missing	-6.871	118.360	0.954	0.001

Notes: C Statistic = 0.702. Wave 1.1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2.1 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-10. Model 2c—Complete-Year Cox Model: Incident Beneficiaries

Align vs Non-Align	Effect	95% Lower CI	95% Upper CI	p-value
Wave 1	-0.057	-0.124	0.011	0.100
Wave 2	-0.098	-0.176	-0.020	0.014

Align vs Non-Align	Hazard Ratio	95% Lower CI	95% Upper CI	p-value
Wave 1	0.970	0.883	1.011	0.100
Wave 2	0.907	0.839	0.981	0.014

Notes: Wave 1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-11. Model 2d—Analysis of Maximum Likelihood Estimates: Incident Beneficiaries, Interaction Model for Waves 1.1 and 2.1 with 2-Year Follow-up

Measures (N=27,118)	Coeff	SE	p-value	HR
Align (control=0; ESCO=1)	-0.068	0.037	0.068	0.934
Wave Indicator (wave 1.1=0; wave 2.1=1)	0.027	0.039	0.496	1.027
Wave Indicator*Align	-0.028	0.055	0.602	0.972
Age	0.031	0.001	<.0001	1.032
White	0.440	0.052	<.0001	1.552
Black	0.029	0.057	0.609	1.029

Measures (N=27,118)	Coeff	SE	p-value	HR
Female	0.002	0.028	0.942	1.002
Diabetes as cause of ESRD	-0.066	0.039	0.089	0.936
Hispanic	-0.379	0.058	<.0001	0.684
Unknown ethnicity	-5.185	119.690	0.965	0.006
Log of BMI at incidence	-0.818	0.081	<.0001	0.441
BMI at incidence: Missing	-7.361	63.948	0.908	0.001
Log of BMI at incidence spline at 35	1.066	0.199	<.0001	2.903
Incident Comorbidity: Atherosclerotic heart disease	0.109	0.037	0.003	1.115
Incident Comorbidity: Other cardiac disease	0.121	0.032	0.000	1.129
Incident Comorbidity: Congestive heart failure	0.274	0.030	<.0001	1.315
Incident Comorbidity: Inability to ambulate	0.372	0.058	<.0001	1.451
Incident Comorbidity: Inability to transfer	0.425	0.074	<.0001	1.529
Incident Comorbidity: Malignant neoplasm, cancer	0.200	0.045	<.0001	1.221
Incident Comorbidity: Diabetes (all types including cause of ESRD)	0.116	0.043	0.008	1.123
Incident Comorbidity: Peripheral vascular disease	0.143	0.043	0.001	1.154
Incident Comorbidity: Cerebrovascular disease, CVA, TIA	0.049	0.045	0.272	1.050
Incident Comorbidity: Tobacco use (current smoker)	-0.072	0.063	0.255	0.931
Incident Comorbidity: Alcohol dependence	0.197	0.120	0.101	1.217
Incident Comorbidity: Drug dependence	0.384	0.134	0.004	1.469
Incident Comorbidity: At least one comorbidity	0.173	0.055	0.002	1.189
Pre-ESRD Nephrology Care: No	0.261	0.035	<.0001	1.298
Pre-ESRD Nephrology Care: Unknown	0.412	0.036	<.0001	1.510
Pre-ESRD Nephrology Care: Missing	-6.903	119.690	0.954	0.001

Notes: C Statistic = 0.704. Wave 1.1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2.1 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-12. Model 2d—Complete-Year Cox Model: Incident Beneficiaries

Align vs Non-Align	Effect	95% Lower CI	95% Upper CI	p-value
Wave 1	-0.068	-0.141	0.005	0.068
Wave 2	-0.096	-0.175	-0.018	0.016

Align vs Non-Align	Hazard Ratio	95% Lower CI	95% Upper CI	p-value
Wave 1	0.934	0.869	1.005	0.068
Wave 2	0.908	0.840	0.982	0.016

Notes: Wave 1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

Exhibit J-13. Estimated Survival for Patients in CEC and Comparison Group (Wave 1 PY1 and Wave 2 PY2 Joiners)

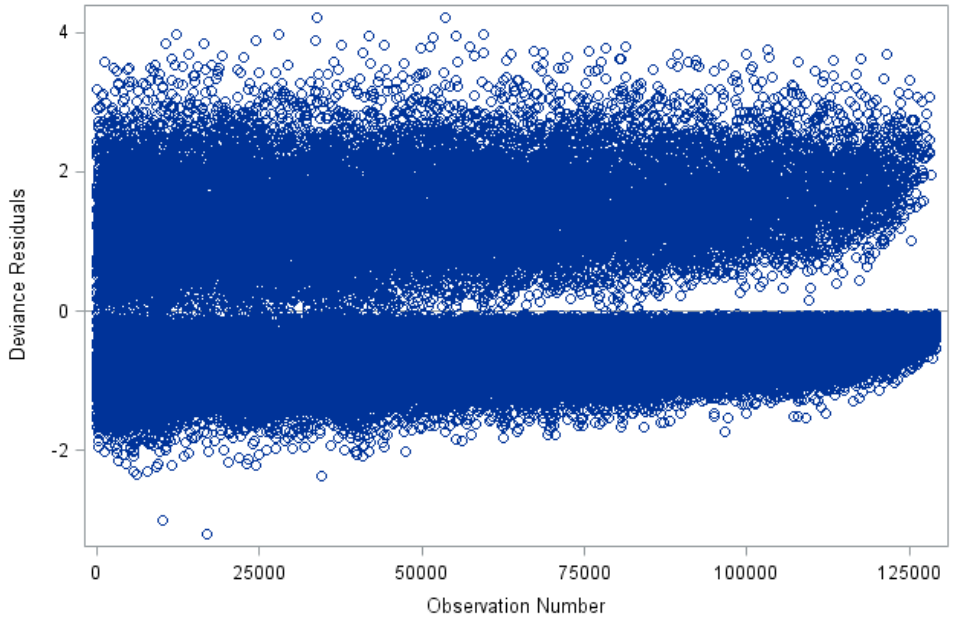
Model	Group	1-Year	3-Year
Model 2a: Prevalent Beneficiaries	CEC Wave 1.1	89.7%	71.2%
	Comparison Wave 1.1	89.4%	70.5%
	CEC Wave 2.1	89.5%	70.7%
	Comparison Wave 2.1	88.8%	69.2%
Model 2b: Prevalent Beneficiaries with 2-year Follow-up	CEC Wave 1.1	90.0%	
	Comparison Wave 1.1	89.7%	
	CEC Wave 2.1	89.7%	
	Comparison Wave 2.1	89.1%	
Model 2c: Incident Beneficiaries	CEC Wave 1.1	90.1%	
	Comparison Wave 1.1	89.5%	
	CEC Wave 2.1	90.2%	
	Comparison Wave 2.1	89.2%	
Model 2d: Incident Beneficiaries with 2-year Follow-up	CEC Wave 1.1	90.4%	
	Comparison Wave 1.1	89.7%	
	CEC Wave 2.1	90.4%	
	Comparison Wave 2.1	89.5%	

Notes: Wave 1.1 indicates beneficiary is aligned to a Wave 1 PY1 joiner facility and Wave 2.1 indicates beneficiary is aligned to a Wave 2 PY2 joiner facility.

D. Model Diagnostics

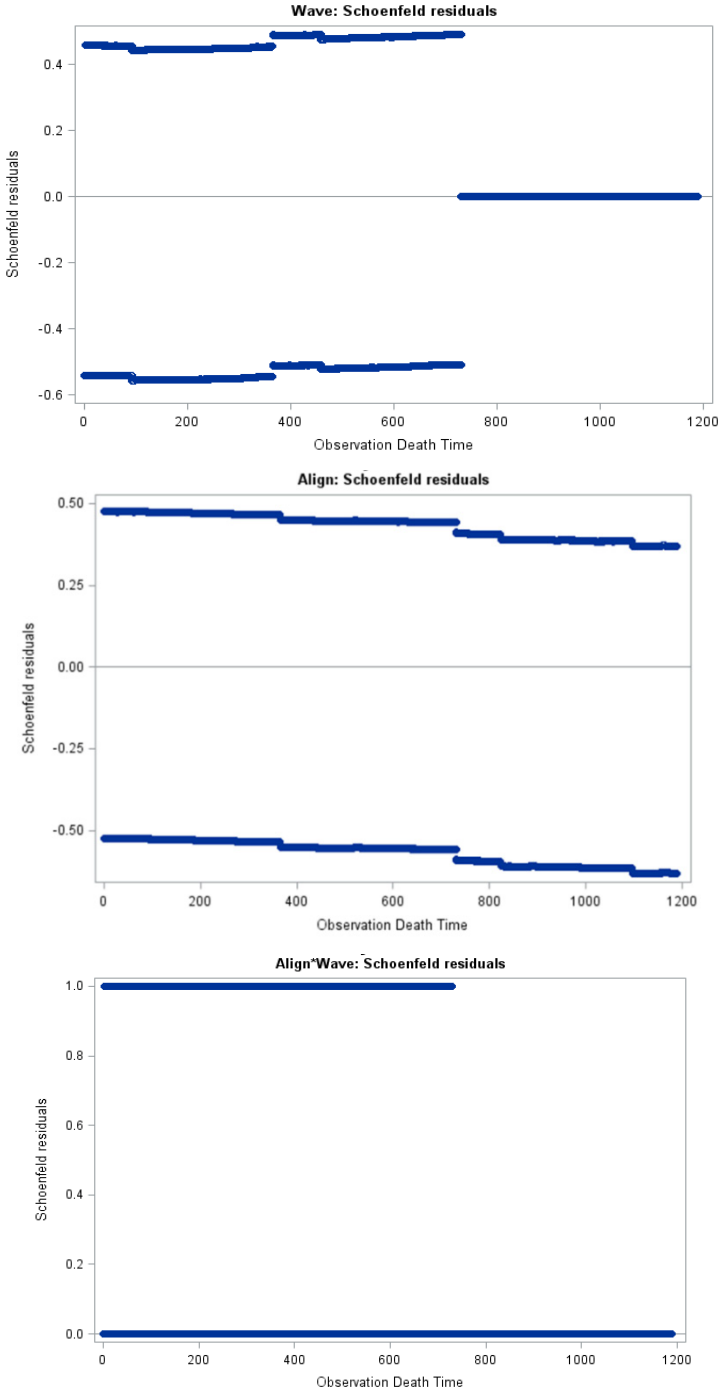
We visually perform model diagnostics for the Cox model with complete follow-up as well as with maximal 2-year follow-up. We first draw the scatter plot of deviance residuals to check whether the functional forms of covariates used in the model were proper and whether there were outliers in the observations. We then plot the Schoenfeld residuals against each covariate in the model to check the proportional hazards (PH) assumption on that covariate. For all the plots, any patterns that deviates from random scattering around 0 may indicate lack of fit or violation of the PH assumption.

Exhibit J-14. Complete-Year Cox Model: Deviance Residuals



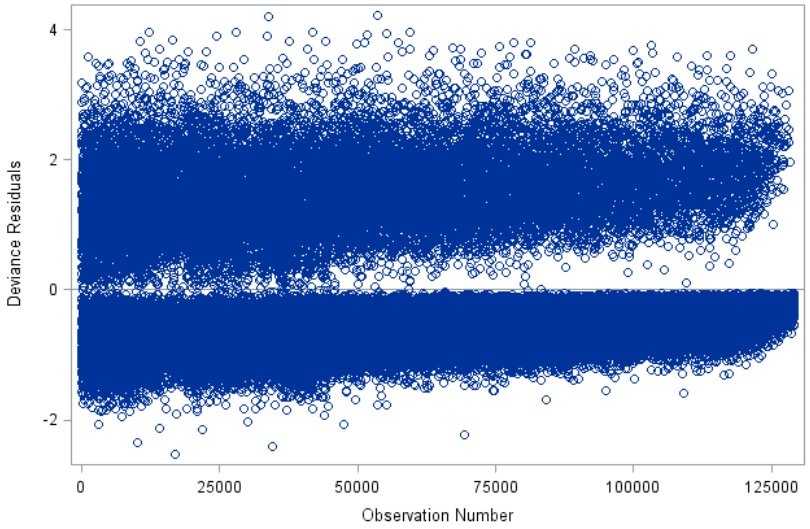
As the residuals were roughly scattered around 0, the functional forms for the covariates seemed to be proper. There were no indications for outliers as well.

Exhibit J-15. Complete-Year Cox Model: Schoenfeld Residuals (Proportional Hazards)



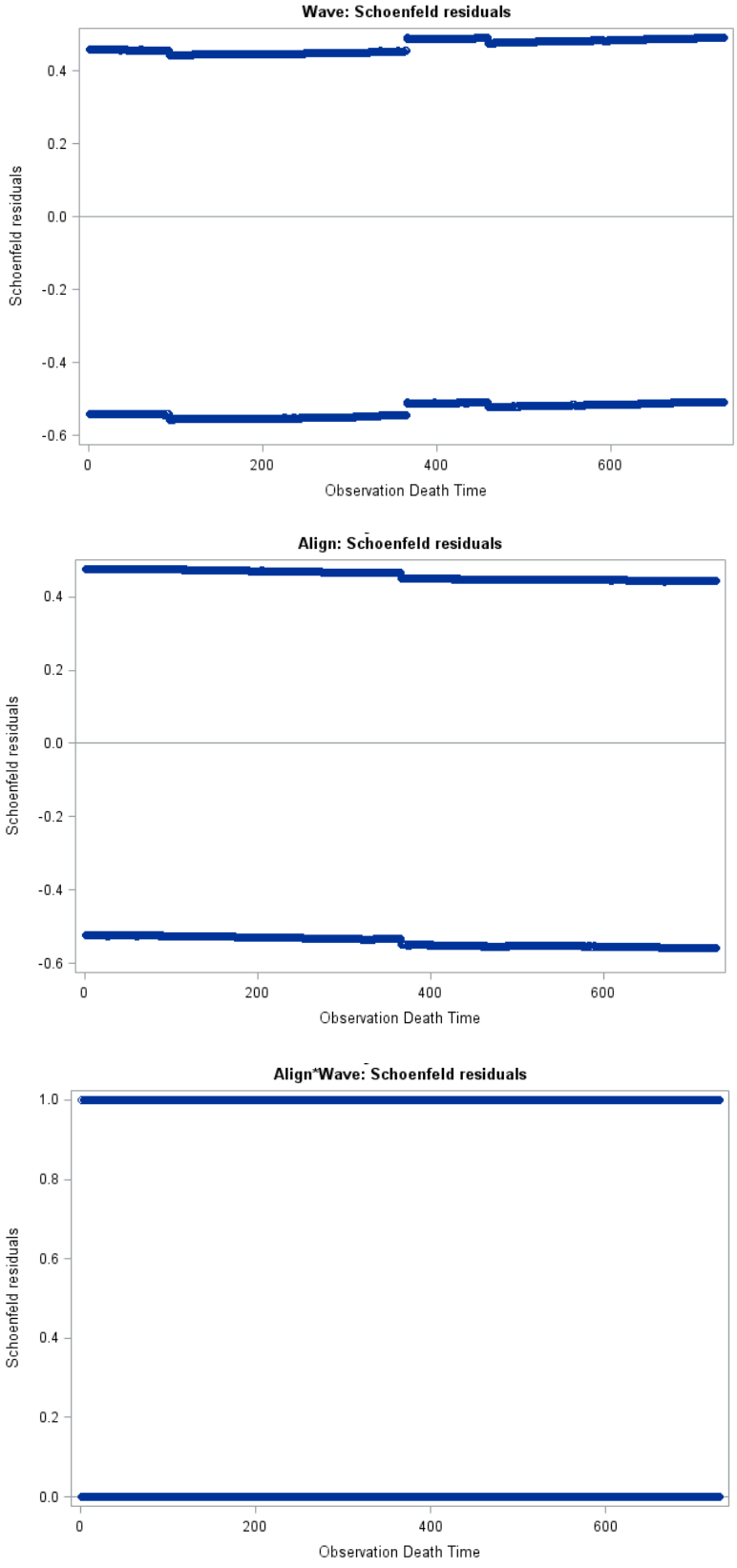
As the residuals were roughly scattered around 0 for each covariate, there were no obvious patterns to indicate violations of the PH assumption as indicated by these plots.

Exhibit J-16. 2-Year Cox Model: Deviance Residuals



As the residuals were roughly scattered around 0, the functional forms for the covariates seemed to be proper. There were no indications for outliers as well.

Exhibit J-17. 2-Year Cox Model: Schoenfeld Residuals (Proportional Hazards)



As the residuals were roughly scattered around 0 for each covariate, there were no obvious patterns to indicate violations of the PH assumption as indicated by these plots.

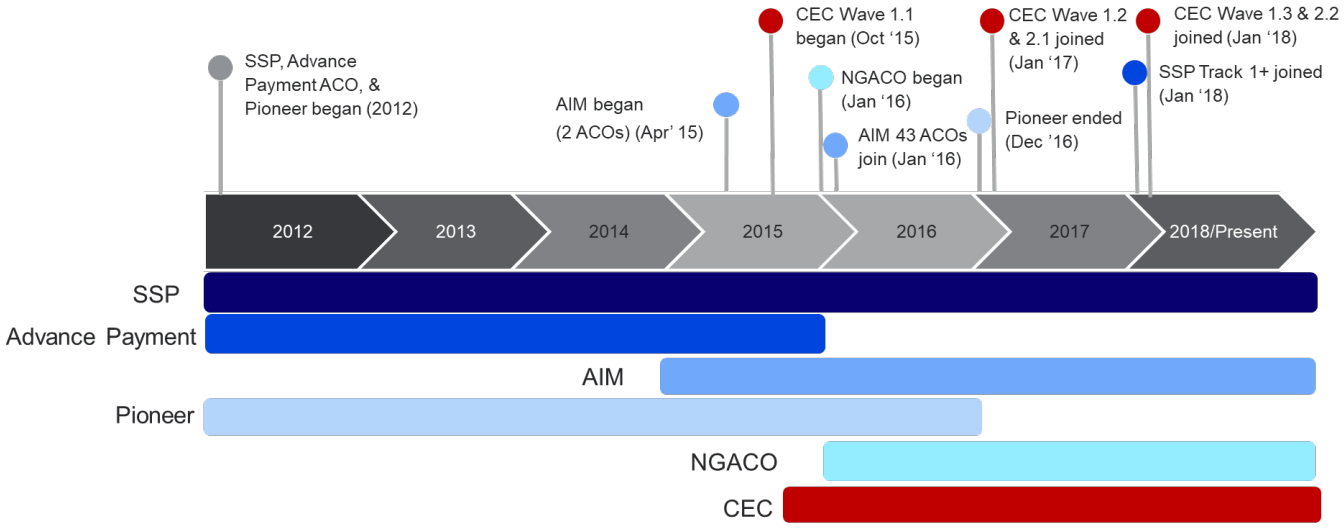
Appendix K: Methodology for Comparing CEC Model to Primary Care-Based ACOs

We used the DiD approach to assess whether CEC provided better results for beneficiaries with ESRD than primary care-based accountable care organizations (ACOs). The DiD approach compared the experiences of beneficiaries with ESRD over time, before and after they transitioned into either CEC or a primary care-based ACO, relative to beneficiaries with ESRD who remained in Medicare FFS. We estimated the DiD impact of CEC relative to FFS and the DiD impact of primary care-based ACOs relative to FFS, and compared the results of the two types of care models.

A. ACO and ESCO (CEC) Risk-Sharing Programs and Alignment Rules

In addition to CEC, a specialty-oriented ACO, Medicare beneficiaries with ESRD could become aligned to one of the following primary care-based ACOs: Medicare Shared Savings Program (SSP) or one of its four different risk-sharing tracks (Advanced Payment, ACO Investment Model [AIM],[67] Pioneer, and Next Generation [NGACO]). In terms of size, SSP is by far the largest program, with 518 current ACOs that are responsible for an estimated 10.9 million assigned beneficiaries.[68] NGACO began with 51 and currently has 41 participating ACOs. Pioneer began with 32 ACOs and ended with 9. There are currently 37 ESCOs in the CEC Model.[69] The ACO models overlap with CEC, as shown in **Exhibit K-1**.

Exhibit K-1. ACO and CEC Timeline



[67] Although included in **Exhibit K-1**, we did not consider Advanced Payment or AIM ACOs in this analysis because they have a unique structure compared to the primary care-based ACOs previously listed and the ESCOs. Specifically, ACOs in both these models receive an upfront fixed payment, upfront variable payment, and an ongoing monthly payment to encourage participation by rural providers and smaller practices with less access to upfront capital.

[68] https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/about.html

[69] https://innovation.cms.gov/initiatives/next-generation-aco-model/

Risk Arrangements: The ACOs and ESCOs we considered in this analysis receive financial incentives for care coordination based on two-sided risk.

In a two-sided risk arrangement, ACOs receive a percentage of savings and are also at risk for a portion of spending over the target. The two-sided risk structure encourages a higher level of accountability by financially penalizing ACOs that incur costs above the set benchmark. To help compensate for the downside risk, two-sided risk participants who reduce costs below the benchmark receive a larger financial gain relative to one-sided risk. The amount of risk sharing varies within and between primary care-based ACO programs (30-100%) and the CEC Model (50-100%).

In addition to earning potential shared savings and losses adjusted for quality performance, SSP (Track 1+, Track 2, and Track 3), NGACO, and CEC that have two-sided risk are all considered Advanced Alternative Payment Models (A-APMs) and are given additional financial rewards (5%) for taking on more risk and going further in improving patient care.[70] ACOs with two-sided risk are similar to ESCOs made up of LDO facilities, while ACOs that do not accept downside risk are relatively similar to the three out of four non-LDO ESCOs that opted for one-sided risk tracks. The notable difference is that the ACOs are able to decide whether to accept downside risk, while the ESCO's acceptance of risk is determined first by organizational membership, then choice. To ensure comparable incentive structures and to better disentangle the driving factors that generate differences in patient outcomes between the ACOs and ESCOs, we implemented our recommendation from AR2 and restricted the sample to beneficiaries who were aligned to two-sided risk ACOs or ESCOs. This restriction results in the exclusion of SSP Track 1 ACOs and the three non-LDO ESCOs that opted for one-sided risk tracks. A total of 669 CEC and 4,619 SSP Track 1 beneficiaries were dropped after limiting to one-side risk. More than one-third (38%) of the total ACO transitioning sample are ACO beneficiaries aligned to a two-sided risk structure in 2018, 28% of which are aligned to SSP Track 1+, a program in its first year of participation.

Alignment Rules. Though Pioneer ACOs, SSP ACOs, NGACO, and the CEC Model all utilize claims-based prospective alignment when assigning beneficiaries, there are differences in beneficiary alignment between the programs. Under SSP, alignment is based on plurality of services. This means that a beneficiary is assigned to an ACO if he or she receives a greater proportion of primary care services (measured in allowed charges) within the ACO than the proportion of services received at any other organization outside the ACO or if the beneficiary receives a plurality of services from PCPs or certain professionals within the ACO. This may be less than a majority of total services. For Track 2 of SSP, CMS uses prospective beneficiary alignment along with retrospective reconciliation (retrospective alignment for each performance year which removes anyone who is not alignment-eligible in that year). For Track 1+ and Track 3, on the other hand, CMS uses only prospective beneficiary alignment.

Two ACO models have started to use voluntary alignment. The Pioneer ACO Model began testing voluntary alignment in PY4 (2015). While the NGACO Model used claims-based alignment in PY1 (2016), an option for voluntary alignment was added in PY2 (2017). Under voluntary

[70] The incentive payment is 5% of the estimated aggregate payment amounts for Medicare Part B covered professional services furnished by the quality performance in the year preceding the payment year. The 5% incentive is earned if the participant receives 25% of their Medicare Part B payments through an A-APM or sees 20% of their Medicare patients through an A-APM. (The percentages of payments and patients rise to 50% or 35% in 2019 and to 75% or 50% in 2021)

alignment, beneficiaries can choose to be aligned to an ACO. In the Pioneer Model they may be aligned even if they are not aligned through claims. Voluntary alignment provides beneficiaries the opportunity to confirm or deny their care relationships with certain NGACO/Pioneer participants.

In the CEC Model, eligible beneficiaries are assigned to an ESCO after their first visit to a dialysis facility participating in an ESCO. If a beneficiary receives more than 50% of their care from another dialysis facility outside of the CBSA market in a performance year or receives a transplant, is aligned to another SSP, and/or is no longer receiving treatment at an ESCO, then the beneficiary is removed from the ESCO's alignment list in subsequent performance years.

B. Methods

We used a DiD approach to evaluate whether CEC performed better than primary care-based ACOs. With this approach, we compared the experiences of beneficiaries with ESRD over time, before and after they transitioned into either an ESCO or a primary care-based ACO, relative to beneficiaries with ESRD who remained in Medicare FFS. The additional year of data in AR3 updates the results from AR2 as well as implements our recommendation from the previous report to limit the analysis to beneficiaries that transition into two-sided risk arrangements. Specifically, the intervention groups included beneficiaries with ESRD aligned with CEC ESCOs or primary care-based ACOs with two-sided risk arrangements. Primary care-based ACOs included Pioneer, Shared Savings Program (SSP) Tracks 1+, 2, and 3, and Next Generation ACO (NGACO). The comparison group consisted of CEC-eligible matched beneficiaries who continued to receive services FFS.

The analysis compares the first year experience of beneficiaries who became aligned to 2-sided risks ESCOs or primary care-based ACOs, compared to ESRD beneficiaries who continue to receive services under traditional FFS. The analysis imposed several restrictions. First, we restricted the sample to beneficiaries who had at least 12 consecutive months of FFS enrollment before alignment to one of the intervention groups. Requiring the same number of baseline months helps ensure that differences in outcomes following alignment to an ESCO or ACO are due to treatment effects and not compositional changes in the data. A given beneficiary may have less than 12 months of data following an alignment start date due to de-alignment, eligibility rules, or death. Second, the sample includes only beneficiaries who receive the majority of services from the same dialysis facility during the study period (prior to and after alignment dates). Third, ACO and FFS beneficiaries who become aligned to an ESCO at any point during the study period are excluded from the analysis.[71]

The comparison group for this analysis was constructed differently than the core evaluation, where we match dialysis facilities, because the CEC Model and the primary care-based ACOs do not share a common provider type. Therefore, we created a patient-level comparison group. Specifically, we matched CEC and ACO beneficiaries to traditional FFS beneficiaries with ESRD that would have been ACO and CEC eligible. We generated a propensity score by including characteristics that may influence outcomes, such as time since start of dialysis, reasons for ESRD, comorbidities, and demographic factors like age and sex. Rather than following providers pre- and

[71] The study design in AR3 is similar to AR2 with only two differences. The analysis is limited to only two-sided risk intervention groups and all beneficiaries have 12 consecutive months of FFS enrollment (in AR2 only one month prior to alignment was required).

post-intervention, the DiD strategy for the patient-level match followed beneficiaries with ESRD as they transitioned from traditional FFS Medicare to different payment models (i.e., ACO, CEC) and compared changes in outcomes before and after alignment. The identifying assumption of the DiD model in this patient-level match was that beneficiaries who remained in traditional FFS are a good approximation of what would have happened to transitioning beneficiaries if they would have stayed in FFS.

We identified five potential alignment dates where a beneficiary could transition to either ACO or CEC: (1) January 2015 [ACO newly aligned], (2) October 2015 [CEC newly aligned start date of Wave 1 ESCOs], (3) January 2016 [ACO newly aligned], (4) January 2017 [ACO and CEC newly aligned; start date of Wave 2 ESCOs and late-starting Wave 1 ESCO facilities], and (5) January 2018 [ACO and CEC newly aligned; start date of Wave 2 ESCOs and Wave 1 ESCO facilities joining in PY3]. These alignment dates were used to identify intervention and comparison beneficiaries. ACO participation status was determined using the Master Data Management file, while CEC participation status is determined using CEC alignment criteria.

Due to the high mortality rate in the ESRD population, the share of beneficiaries with better odds of survival in the analysis sample increases as we extend the number of baseline months required for inclusion. This is because beneficiaries would have to be enrolled in FFS for at least the duration of the baseline period to be included in the study. Since surviving beneficiaries may be inherently different than a typical beneficiary with ESRD, extending the number of required months for inclusion would affect our ability to generalize results to the average beneficiary with ESRD. Given the consideration discussed above, we only required 12 consecutive baseline enrollment months. For each of the beneficiaries meeting this criterion, all 12 months of baseline data and up to 12 months of intervention data were included in the analysis. If a beneficiary had less than 12 months of intervention data, the available months were included.

Comparison Group Construction. We used PSM to select comparison beneficiaries that best resembled newly aligned ACO and CEC beneficiaries in with characteristics listed in **Exhibit K-2**. We used average values for all of the baseline characteristics, with some exceptions: Medicare Part A and Part B payments were aggregated to total baseline payments in the 12 consecutive months prior to alignment; age and time on dialysis were measured in the month prior to becoming newly aligned to an ACO or to CEC; BMI is measured at the time of a beneficiary's first ESRD diagnosis; and chronic conditions are based on beneficiary status in the year prior to alignment date.[72] Any beneficiaries who had missing values for the matching characteristics were excluded from the matching process and from all subsequent analysis.

[72] Chronic condition indicators were taken from the Chronic Conditions Data Warehouse (CCW) which are defined using claims-based criteria for a given condition by the end of the reference year. For the purposes of matching, the values are based on the calendar year prior to the alignment date. Detailed specifications for conditions can be found at https://www.ccwdata.org/web/guest/condition-categories.

Exhibit K-2. Matching Covariates

Group	Covariates
Beneficiary	CCW Indicators for the following conditions: Acquired Hypothyroidism, Acute Myocardial Infarction, Alzheimer's and Related Disorders Alzheimer's Disease, Anemia, Asthma, Atrial Fibrillation, Benign Prostatic, Breast Cancer, Cancer, Cataracts, Cause of ESRD: (Diabetes, Hypertension, and Unknown), Chronic Congestive Heart Failure, Congestive Heart Failure, Chronic Obstructive Pulmonary Disease, Colorectal Cancer, Diabetes, Depression, Endometrial Cancer, Female, Glaucoma, Hip Fracture, Hyperlipidemia, Hyperplasia Hypertension, Ischemic Heart Disease, Original Reason for Entitlement to Care: (Disability, ESRD, and ESRD & Disability), Osteoporosis, Prostate Cancer, Race: (Black and White), Rheumatoid/Osteo-Arthritis, and Stroke. Age and Months on Dialysis in Month Prior to Alignment Date, BMI at first ESRD Diagnosis, Percent Baseline Months: Hemodialysis, Partial Medicaid Dual Enrollment, and Full Medicaid Dual Enrollment. Total Standardized Part A and Part B Payments in baseline period
Facility	Percent Baseline Months: For-Profit, Home Dialysis, Late-Shift, LDO, and Peritoneal Dialysis. Average Baseline Months: Standardized Hospitalization, Mortality and Readmission Ratio
Market	Average Baseline Months: ACO Percent, Dual Beneficiaries per 10,000, ESRD Beneficiary Count, Median Household Income, and Medicare Advantage Penetration. Indicators of: Region (Midwest, Northwest, and South)

Separate logit models were estimated for each treatment group (ACO or CEC) and for each group's relevant alignment dates. Traditional FFS beneficiaries were separated into comparison pools for each alignment date if they met the previously described restrictions. A given comparison beneficiary could contribute to more than one comparison pool if they had eligible observations that extended through multiple alignment windows. After assigning the traditional FFS beneficiaries who are never aligned to an ACO or ESCO in a given observation period to comparison pools, a total of seven matching models were estimated.[73]

Within each group defined by either the alignment or potential alignment date, ACO and CEC beneficiaries were matched to the closest comparison non-aligned beneficiary based on the predicted probabilities. The predicted probability of becoming a newly aligned ACO beneficiary was used to match ACO beneficiaries to non-aligned beneficiaries. Similarly, the predicted probability of becoming a newly aligned CEC beneficiary was used to match CEC beneficiaries to non-aligned beneficiaries. A caliper was applied to ensure that only beneficiaries with a close match were included in the model. Each ACO and CEC beneficiary was matched to a single comparison beneficiary that was the closest in terms of propensity score and not yet matched to another ACO or CEC beneficiary within a given alignment date.

Comparison of Pre and Post Matching Result. A comparison of ACO to usual care FFS beneficiaries and CEC to usual care FFS beneficiaries, before and after matching, using SMDs for each alignment date is provided in **Exhibits K-3** through **K-10**. The before-matching populations typically vary most on market characteristics relative to the comparison pool. After matching, the differences between both groups decreased substantially. The results show that none of the matching covariates had a SMD greater than 0.15 for any matched population.

[73] Comparison pools used for matching CEC beneficiaries was restricted to FFS beneficiaries who receive their dialysis care from an LDO because the CEC sample consisted of only 0.3% beneficiaries treated at an SDO. The restricted limited issues with model convergence.

Exhibit K-3. Descriptive Statistics and Standardized Mean Differences (FFS to ACO, January 2015)

Characteristics	ACO Benes with a match (01/2015 switch) N=1,235		FFS Comparison Pool N=71,880		Std Diff Before Matching	FFS Comparison Group N=1,235		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.16	0.36	0.18	0.38	-0.06	0.15	0.35	0.03
Acute Myocardial Infarction	0.03	0.17	0.03	0.17	-0.01	0.03	0.17	-0.01
Age in Month Prior to Alignment Date	62.2	14.6	62.8	14.5	-0.04	62.1	15.1	0.005
Alzheimer's and Related Disorders	0.11	0.32	0.13	0.33	-0.05	0.11	0.31	0.01
Alzheimer's Disease	0.02	0.13	0.03	0.17	-0.08	0.01	0.11	0.05
Anemia	1.0	0.03	1.0	0.04	0.03	1.0	0.00	-0.04
Asthma	0.09	0.28	0.08	0.28	0.01	0.10	0.30	-0.04
Atrial Fibrillation	0.11	0.32	0.12	0.33	-0.02	0.12	0.32	-0.02
Benign Prostatic Hyperplasia	0.06	0.23	0.05	0.22	0.03	0.05	0.22	0.03
BMI at time of first ESRD diagnosis	29.1	8.1	29.8	8.3	-0.08	29.4	8.1	-0.04
Breast Cancer	0.02	0.13	0.02	0.13	0.002	0.02	0.12	0.02
Cancer	0.06	0.24	0.06	0.24	0.01	0.05	0.22	0.05
Cataracts	0.15	0.36	0.13	0.34	0.06	0.14	0.35	0.02
Cause of ESRD: Diabetes	0.45	0.50	0.45	0.50	0.0001	0.44	0.50	0.02
Cause of ESRD: Hypertension	0.28	0.45	0.30	0.46	-0.04	0.28	0.45	0.002
Cause of ESRD: Unknown	0.03	0.16	0.02	0.14	0.04	0.03	0.18	-0.03
Chronic Congestive Heart Failure	0.55	0.50	0.56	0.50	-0.01	0.55	0.50	-0.005
Chronic Obstructive Pulmonary Disease	0.16	0.37	0.19	0.40	-0.09	0.18	0.38	-0.04
Colorectal Cancer	0.01	0.11	0.01	0.12	-0.02	0.01	0.09	0.03
Congestive Heart Failure	0.55	0.50	0.56	0.50	-0.01	0.55	0.50	-0.002
Depression	0.23	0.42	0.22	0.42	0.01	0.23	0.42	-0.02
Diabetes	0.72	0.45	0.69	0.46	0.05	0.73	0.44	-0.03
Endometrial Cancer	0.00	0.04	0.003	0.06	-0.03	0.003	0.06	-0.03
Female	0.42	0.49	0.46	0.50	-0.07	0.43	0.49	-0.01
Glaucoma	0.11	0.31	0.09	0.28	0.08	0.13	0.33	-0.05
Hip Fracture	0.01	0.12	0.01	0.12	-0.01	0.01	0.10	0.04
Hyperlipidemia	0.61	0.49	0.57	0.49	0.07	0.63	0.48	-0.04
Hypertension	0.87	0.34	0.85	0.35	0.04	0.88	0.32	-0.04
Ischemic Heart Disease	0.60	0.49	0.59	0.49	0.03	0.59	0.49	0.03
Months of Dialysis in Month Prior to Alignment Date	66.4	62.6	73.4	62.0	-0.11	64.7	56.5	0.03

Characteristics	ACO Benes with a match (01/2015 switch) N=1,235		FFS Comparison Pool N=71,880		Std Diff Before Matching	FFS Comparison Group N=1,235		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.18	0.39	0.19	0.39	-0.01	0.18	0.39	0.004
OREC: ESRD	0.24	0.43	0.20	0.40	0.09	0.26	0.44	-0.05
OREC: ESRD and Disability	0.26	0.44	0.32	0.47	-0.13	0.25	0.43	0.03
Osteoporosis	0.04	0.20	0.04	0.19	0.02	0.05	0.22	-0.04
Percent Months Hemodialysis	0.90	0.29	0.92	0.26	-0.05	0.90	0.30	0.02
Percent Months with Full Medicaid Dual Enrollment	0.59	0.48	0.42	0.48	0.36*	0.58	0.48	0.03
Percent Months with Partial Medicaid Dual Enrollment	0.04	0.17	0.13	0.32	-0.37*	0.04	0.18	-0.03
Prostate Cancer	0.03	0.17	0.02	0.15	0.03	0.02	0.15	0.04
Race: Black	0.29	0.45	0.38	0.49	-0.20	0.29	0.45	0.01
Race: White	0.40	0.49	0.44	0.50	-0.07	0.41	0.49	-0.01
Rheumatoid/Osteo-Arthritis	0.24	0.43	0.28	0.45	-0.08	0.23	0.42	0.03
Stroke	0.07	0.25	0.07	0.26	-0.02	0.07	0.26	-0.02
Total Baseline Standardized Part A and Part B Payments	$64,383	$39,427	$64,840	$39,308	-0.01	$64,762	$38,622	-0.01
Facility: For-Profit	0.89	0.31	0.88	0.33	0.04	0.89	0.32	0.02
Facility: Home Dialysis	0.81	0.39	0.86	0.35	-0.12	0.81	0.39	-0.002
Facility: Late Shift	0.33	0.47	0.23	0.42	0.21*	0.30	0.46	0.05
Facility: LDO	0.64	0.48	0.72	0.45	-0.17	0.64	0.48	0.002
Facility: Peritoneal Dialysis	0.70	0.46	0.66	0.47	0.07	0.68	0.47	0.03
Facility: Standardized Hospitalization Ratio	1.0	0.23	0.95	0.24	0.19	0.99	0.26	0.03
Facility: Standardized Mortality Ratio	0.93	0.26	1.0	0.24	-0.27*	0.93	0.23	0.02
Facility: Standardized Readmission Ratio	1.0	0.26	0.97	0.27	0.16	1.0	0.26	-0.02
ACO Percentage	0.25	0.10	0.12	0.11	1.3*	0.26	0.14	-0.06
CBSA: Dual Beneficiaries per 10,000	397	102	335	105	0.59*	392	100	0.04
CBSA: ESRD Beneficiary Count	6,149	5,422	2,885	3,340	0.72*	5,714	5,332	0.08
CBSA: Median Household Income	$61,005	$11,528	$54,573	$11,965	0.55*	$61,005	$12,014	-0.0001
CBSA: Medicare Advantage Penetration	35.9	12.8	30.0	12.9	0.46*	35.0	12.6	0.07
Region: Midwest	0.12	0.33	0.15	0.35	-0.08	0.13	0.34	-0.04
Region: Northeast	0.40	0.49	0.11	0.31	0.70*	0.40	0.49	-0.005
Region: South	0.06	0.24	0.50	0.50	-1.1*	0.07	0.25	-0.03

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-4. Descriptive Statistics and Standardized Mean Differences (FFS to CEC, October 2015)

Characteristics	CEC Benes with a match (10/2015 switch) N=6,131		FFS Comparison Pool N=48,249		Std Diff Before Matching	FFS Comparison Group N=6,131		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.16	0.36	0.16	0.37	-0.01	0.16	0.36	-0.002
Acute Myocardial Infarction	0.02	0.14	0.03	0.16	-0.04	0.02	0.14	-0.003
Age in Month Prior to Alignment Date	62.3	14.2	62.9	14.3	-0.04	62.2	14.6	0.01
Alzheimer's and Related Disorders	0.16	0.37	0.10	0.30	0.17	0.14	0.35	0.06
Alzheimer's Disease	0.02	0.16	0.02	0.15	0.02	0.02	0.15	0.02
Anemia	1.0	0.04	1.0	0.04	-0.006	1.0	0.04	-0.02
Asthma	0.08	0.27	0.08	0.27	0.00	0.08	0.26	0.01
Atrial Fibrillation	0.10	0.30	0.11	0.31	-0.02	0.11	0.31	-0.01
Benign Prostatic Hyperplasia	0.06	0.23	0.05	0.22	0.02	0.06	0.23	0.003
BMI at time of first ESRD diagnosis	30.0	8.3	30.0	8.4	0.00	29.8	8.5	0.02
Breast Cancer	0.02	0.13	0.02	0.13	0.01	0.02	0.12	0.01
Cancer	0.06	0.23	0.06	0.22	0.03	0.06	0.23	0.01
Cataracts	0.12	0.33	0.13	0.33	-0.02	0.12	0.32	0.01
Cause of ESRD: Diabetes	0.40	0.49	0.44	0.50	-0.09	0.40	0.49	0.01
Cause of ESRD: Hypertension	0.36	0.48	0.31	0.46	0.11	0.34	0.48	0.03
Cause of ESRD: Unknown	0.02	0.14	0.02	0.14	0.00	0.02	0.15	-0.01
Chronic Congestive Heart Failure	0.51	0.50	0.52	0.50	-0.03	0.51	0.50	-0.01
Chronic Obstructive Pulmonary Disease	0.15	0.36	0.18	0.38	-0.08	0.15	0.35	0.01
Colorectal Cancer	0.01	0.12	0.01	0.11	0.01	0.02	0.12	-0.01
Congestive Heart Failure	0.51	0.50	0.53	0.50	-0.03	0.52	0.50	-0.01
Depression	0.20	0.40	0.21	0.41	-0.02	0.20	0.40	-0.01
Diabetes	0.65	0.48	0.67	0.47	-0.04	0.65	0.48	0.01
Endometrial Cancer	0.00	0.05	0.003	0.05	-0.001	0.004	0.06	-0.02
Female	0.44	0.50	0.45	0.50	-0.02	0.45	0.50	-0.02
Glaucoma	0.09	0.29	0.08	0.27	0.04	0.09	0.29	0.01
Hip Fracture	0.01	0.10	0.01	0.11	-0.03	0.01	0.09	0.01
Hyperlipidemia	0.59	0.49	0.53	0.50	0.10	0.57	0.50	0.04
Hypertension	0.84	0.36	0.84	0.37	0.01	0.85	0.36	-0.01
Ischemic Heart Disease	0.53	0.50	0.55	0.50	-0.04	0.53	0.50	0.003
Months of Dialysis in Month Prior to alignment date	77.9	64.7	74.4	62.7	0.05	78.4	64.6	-0.01

Characteristics	CEC Benes with a match (10/2015 switch) N=6,131		FFS Comparison Pool N=48,249		Std Diff Before Matching	FFS Comparison Group N=6,131		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.19	0.39	0.19	0.40	-0.002	0.19	0.39	0.01
OREC: ESRD	0.22	0.41	0.22	0.41	-0.001	0.22	0.42	-0.01
OREC: ESRD and Disability	0.32	0.47	0.31	0.46	0.02	0.32	0.47	-0.003
Osteoporosis	0.03	0.17	0.03	0.18	-0.01	0.03	0.17	0.01
Percent Months Hemodialysis	0.95	0.22	0.91	0.27	0.13	0.94	0.22	0.01
Percent Months with Full Medicaid Dual Enrollment	0.39	0.48	0.41	0.48	-0.04	0.39	0.48	-0.01
Percent Months with Partial Medicaid Dual Enrollment	0.12	0.31	0.14	0.33	-0.08	0.11	0.30	0.01
Prostate Cancer	0.03	0.16	0.02	0.14	0.04	0.03	0.16	0.01
Race: Black	0.54	0.50	0.40	0.49	0.28*	0.54	0.50	0.01
Race: White	0.32	0.47	0.43	0.49	-0.22*	0.32	0.47	0.001
Rheumatoid/Osteo-Arthritis	0.27	0.44	0.26	0.44	0.03	0.26	0.44	0.03
Stroke	0.07	0.25	0.07	0.25	0.02	0.07	0.25	-0.001
Total Baseline Standardized Part A and Part B Payments	$64,488	$38,356	$64,078	$38,666	0.01	$65,001	$39,390	-0.01
Facility: For-Profit	0.88	0.32	0.94	0.23	-0.22*	0.87	0.33	0.03
Facility: Home Dialysis	0.97	0.16	0.86	0.34	0.40*	0.98	0.15	-0.03
Facility: Late Shift	0.24	0.43	0.22	0.41	0.04	0.23	0.41	0.03
Facility: LDO	1	0	1	0		1	0	
Facility: Peritoneal Dialysis	0.46	0.50	0.65	0.48	-0.38*	0.47	0.50	-0.02
Facility: Standardized Hospitalization Ratio	1.0	0.21	0.95	0.25	0.10	0.97	0.24	0.02
Facility: Standardized Mortality Ratio	0.97	0.20	1.0	0.23	-0.17	0.96	0.22	0.02
Facility: Standardized Readmission Ratio	1.0	0.23	0.97	0.28	0.07	1.0	0.28	-0.01
ACO Percentage	0.20	0.12	0.14	0.12	0.55*	0.20	0.11	0.03
CBSA: Dual Beneficiaries per 10,000	279	62	333	104	-0.64*	276	87	0.04
CBSA: ESRD Beneficiary Count	4,546	3,154	2,658	3,084	0.61*	4,605	4,001	-0.02
CBSA: Median Household Income	$60,339	$6,716	$55,241	$11,736	0.53*	$60,289	$10,065	0.01
CBSA: Medicare Advantage Penetration	31.3	9.5	30.5	13.1	0.07	32.1	12.1	-0.08
Region: Midwest	0.10	0.30	0.15	0.36	-0.15	0.11	0.31	-0.02
Region: Northeast	0.27	0.44	0.09	0.28	0.49*	0.25	0.43	0.04
Region: South	0.52	0.50	0.52	0.50	0.00	0.53	0.50	-0.003

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-5. Descriptive Statistics and Standardized Mean Differences (FFS to ACO, January 2016)

Characteristics	ACO Benes with a match (01/2016 switch) N=1,818		FFS Comparison Pool N=66,549		Std Diff Before Matching	FFS Comparison Group N=1,818		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.16	0.37	0.18	0.38	-0.04	0.17	0.38	-0.04
Acute Myocardial Infarction	0.04	0.19	0.03	0.17	0.04	0.03	0.18	0.02
Age in Month Prior to Alignment Date	62.7	14.3	62.8	14.3	-0.01	62.6	14.7	0.01
Alzheimer's and Related Disorders	0.12	0.32	0.13	0.33	-0.03	0.12	0.33	-0.03
Alzheimer's Disease	0.02	0.15	0.03	0.16	-0.02	0.03	0.16	-0.02
Anemia	1.0	0.03	1.0	0.04	0.01	1.0	0.02	-0.02
Asthma	0.10	0.30	0.09	0.28	0.05	0.10	0.30	-0.002
Atrial Fibrillation	0.13	0.33	0.12	0.33	0.02	0.13	0.33	0.005
Benign Prostatic Hyperplasia	0.06	0.24	0.05	0.23	0.03	0.07	0.25	-0.02
BMI at time of first ESRD diagnosis	29.3	8.2	29.9	8.3	-0.07	29.3	8.0	0.01
Breast Cancer	0.02	0.12	0.02	0.13	-0.01	0.02	0.14	-0.03
Cancer	0.06	0.25	0.06	0.23	0.03	0.08	0.27	-0.05
Cataracts	0.14	0.35	0.13	0.34	0.02	0.14	0.35	0
Cause of ESRD: Diabetes	0.40	0.49	0.45	0.50	-0.10	0.40	0.49	-0.01
Cause of ESRD: Hypertension	0.31	0.46	0.30	0.46	0.02	0.31	0.46	-0.004
Cause of ESRD: Unknown	0.02	0.15	0.02	0.14	0.02	0.02	0.15	-0.01
Chronic Congestive Heart Failure	0.56	0.50	0.55	0.50	0.01	0.55	0.50	0.01
Chronic Obstructive Pulmonary Disease	0.18	0.39	0.20	0.40	-0.04	0.19	0.39	-0.01
Colorectal Cancer	0.02	0.12	0.01	0.12	0.01	0.02	0.13	-0.02
Congestive Heart Failure	0.56	0.50	0.55	0.50	0.01	0.55	0.50	0.01
Depression	0.22	0.41	0.23	0.42	-0.02	0.22	0.41	0.01
Diabetes	0.68	0.47	0.69	0.46	-0.03	0.67	0.47	0.004
Endometrial Cancer	0.005	0.07	0.003	0.06	0.03	0.005	0.07	0
Female	0.45	0.50	0.45	0.50	0.005	0.45	0.50	0.003
Glaucoma	0.10	0.30	0.08	0.27	0.07	0.10	0.30	0.01
Hip Fracture	0.02	0.13	0.01	0.11	0.02	0.01	0.12	0.01
Hyperlipidemia	0.59	0.49	0.56	0.50	0.08	0.60	0.49	-0.01
Hypertension	0.87	0.33	0.86	0.35	0.04	0.88	0.33	-0.01
Ischemic Heart Disease	0.62	0.49	0.58	0.49	0.07	0.64	0.48	-0.05
Months of Dialysis in Month Prior to Alignment Date	77.1	67.2	74.3	62.9	0.04	77.1	67.3	-0.001

Characteristics	ACO Benes with a match (01/2016 switch) N=1,818		FFS Comparison Pool N=66,549		Std Diff Before Matching	FFS Comparison Group N=1,818		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.20	0.40	0.20	0.40	0.004	0.19	0.40	0.01
OREC: ESRD	0.24	0.43	0.23	0.42	0.03	0.24	0.43	0
OREC: ESRD and Disability	0.27	0.45	0.29	0.46	-0.05	0.28	0.45	-0.02
Osteoporosis	0.04	0.19	0.04	0.19	0.00003	0.04	0.19	-0.02
Percent Months Hemodialysis	0.93	0.24	0.92	0.26	0.05	0.93	0.24	0.01
Percent Months with Full Medicaid Dual Enrollment	0.46	0.49	0.42	0.48	0.08	0.48	0.49	-0.04
Percent Months with Partial Medicaid Dual Enrollment	0.08	0.25	0.14	0.33	-0.21*	0.07	0.23	0.04
Prostate Cancer	0.03	0.17	0.02	0.15	0.05	0.04	0.19	-0.04
Race: Black	0.40	0.49	0.38	0.49	0.03	0.39	0.49	0.03
Race: White	0.39	0.49	0.43	0.49	-0.07	0.39	0.49	0
Rheumatoid/Osteo-Arthritis	0.27	0.44	0.29	0.45	-0.04	0.28	0.45	-0.04
Stroke	0.07	0.26	0.07	0.26	0.004	0.08	0.26	-0.01
Total Baseline Standardized Part A and Part B Payments	$63,757	$38,024	$63,981	$38,976	-0.01	$63,614	$37,233	0.004
Facility: For-Profit	0.83	0.38	0.88	0.33	-0.14	0.84	0.37	-0.03
Facility: Home Dialysis	0.85	0.36	0.85	0.36	0.02	0.86	0.35	-0.01
Facility: Late Shift	0.25	0.43	0.23	0.42	0.04	0.25	0.43	-0.01
Facility: LDO	0.62	0.49	0.73	0.44	-0.25*	0.62	0.48	-0.01
Facility: Peritoneal Dialysis	0.71	0.46	0.66	0.47	0.10	0.72	0.45	-0.03
Facility: Standardized Hospitalization Ratio	1.0	0.24	0.95	0.25	0.40*	1.0	0.27	0.01
Facility: Standardized Mortality Ratio	0.95	0.25	1.0	0.25	-0.20	0.95	0.23	0.01
Facility: Standardized Readmission Ratio	1.0	0.26	0.97	0.28	0.25*	1.0	0.25	0.002
ACO Percentage	0.27	0.13	0.15	0.13	0.95*	0.27	0.14	-0.01
CBSA: Dual Beneficiaries per 10,000	356	121	333	105	0.20*	353	115	0.03
CBSA: ESRD Beneficiary Count	4,472	4,271	2,868	3,359	0.42*	4,475	4,478	-0.001
CBSA: Median Household Income	$60,487	$14,205	$56,637	$12,591	0.29*	$60,849	$13,605	-0.03
CBSA: Medicare Advantage Penetration	36.2	14.0	31.3	13.2	0.36*	36.0	12.8	0.01
Region: Midwest	0.31	0.46	0.14	0.35	0.40*	0.31	0.46	-0.01
Region: Northeast	0.19	0.39	0.11	0.31	0.23*	0.20	0.40	-0.01
Region: South	0.27	0.44	0.50	0.50	-0.49*	0.25	0.43	0.03

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-6. Descriptive Statistics and Standardized Mean Differences (FFS to ACO, January 2017)

Characteristics	ACO Benes with a match (01/2017 switch) N=3,167		FFS Comparison Pool N=63,869		Std Diff Before Matching	FFS Comparison Group N=3,167		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.19	0.39	0.17	0.38	0.04	0.18	0.39	0.01
Acute Myocardial Infarction	0.04	0.19	0.03	0.17	0.04	0.03	0.17	0.04
Age in Month Prior to Alignment Date	63.7	14.3	62.8	14.2	0.07	63.6	14.4	0.01
Alzheimer's and Related Disorders	0.14	0.35	0.14	0.34	0.01	0.13	0.34	0.02
Alzheimer's Disease	0.03	0.17	0.03	0.16	0.01	0.03	0.17	-0.004
Anemia	1.0	0.04	1.0	0.04	0.001	1.0	0.03	-0.03
Asthma	0.09	0.29	0.08	0.28	0.03	0.08	0.28	0.03
Atrial Fibrillation	0.13	0.34	0.12	0.32	0.03	0.12	0.33	0.03
Benign Prostatic Hyperplasia	0.06	0.24	0.06	0.23	0.03	0.06	0.24	0.003
BMI at time of first ESRD diagnosis	29.6	8.3	30.0	8.4	-0.05	29.9	8.2	-0.03
Breast Cancer	0.02	0.14	0.02	0.13	0.04	0.02	0.14	0.01
Cancer	0.07	0.26	0.06	0.23	0.06	0.07	0.25	0.01
Cataracts	0.15	0.35	0.13	0.34	0.04	0.15	0.36	-0.01
Cause of ESRD: Diabetes	0.45	0.50	0.45	0.50	-0.003	0.45	0.50	-0.01
Cause of ESRD: Hypertension	0.28	0.45	0.30	0.46	-0.06	0.27	0.44	0.01
Cause of ESRD: Unknown	0.02	0.14	0.02	0.14	0.01	0.02	0.15	-0.02
Chronic Congestive Heart Failure	0.58	0.49	0.55	0.50	0.07	0.59	0.49	-0.02
Chronic Obstructive Pulmonary Disease	0.21	0.40	0.20	0.40	0.02	0.20	0.40	0.01
Colorectal Cancer	0.02	0.13	0.01	0.12	0.03	0.02	0.12	0.02
Congestive Heart Failure	0.58	0.49	0.55	0.50	0.07	0.59	0.49	-0.02
Depression	0.26	0.44	0.23	0.42	0.08	0.25	0.44	0.01
Diabetes	0.70	0.46	0.69	0.46	0.02	0.71	0.45	-0.01
Endometrial Cancer	0.003	0.05	0.004	0.06	-0.01	0.004	0.06	-0.02
Female	0.46	0.50	0.45	0.50	0.03	0.47	0.50	-0.01
Glaucoma	0.07	0.25	0.06	0.23	0.04	0.07	0.25	-0.01
Hip Fracture	0.02	0.12	0.01	0.11	0.03	0.01	0.11	0.02
Hyperlipidemia	0.63	0.48	0.57	0.50	0.13	0.63	0.48	-0.005
Hypertension	0.90	0.30	0.87	0.33	0.10	0.90	0.30	-0.01
Ischemic Heart Disease	0.62	0.49	0.57	0.49	0.09	0.62	0.48	-0.01
Months of Dialysis in Month Prior to Alignment Date	75.9	67.4	75.3	64.3	0.01	76.0	66.6	-0.001

Characteristics	ACO Benes with a match (01/2017 switch) N=3,167		FFS Comparison Pool N=63,869		Std Diff Before Matching	FFS Comparison Group N=3,167		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.22	0.41	0.20	0.40	0.03	0.22	0.41	-0.01
OREC: ESRD	0.23	0.42	0.25	0.44	-0.04	0.23	0.42	0.01
OREC: ESRD and Disability	0.24	0.42	0.26	0.44	-0.07	0.24	0.43	-0.01
Osteoporosis	0.04	0.20	0.04	0.19	0.03	0.04	0.19	0.01
Percent Months Hemodialysis	0.91	0.28	0.92	0.27	-0.03	0.92	0.26	-0.03
Percent Months with Full Medicaid Dual Enrollment	0.43	0.48	0.43	0.48	0.01	0.42	0.48	0.02
Percent Months with Partial Medicaid Dual	0.11	0.30	0.14	0.33	-0.09	0.11	0.30	-0.005
Prostate Cancer	0.03	0.16	0.02	0.15	0.01	0.03	0.17	-0.02
Race: Black	0.35	0.48	0.38	0.49	-0.06	0.36	0.48	-0.01
Race: White	0.46	0.50	0.42	0.49	0.08	0.46	0.50	-0.001
Rheumatoid/Osteo-Arthritis	0.33	0.47	0.30	0.46	0.06	0.33	0.47	0.001
Stroke	0.07	0.26	0.07	0.26	0.01	0.07	0.26	0.01
Total Baseline Standardized Part A and Part B Payments	$66,937	$39,963	$63,857	$39,073	0.08	$66,452	$41,136	0.01
Facility: For-Profit	0.88	0.33	0.88	0.32	-0.02	0.87	0.33	0.02
Facility: Home Dialysis	0.86	0.34	0.84	0.37	0.07	0.86	0.34	-0.001
Facility: Late Shift	0.26	0.44	0.23	0.42	0.07	0.26	0.44	0.004
Facility: LDO	0.70	0.46	0.74	0.44	-0.08	0.71	0.45	-0.02
Facility: Peritoneal Dialysis	0.70	0.46	0.66	0.47	0.09	0.69	0.46	0.02
Facility: Standardized Hospitalization Ratio	1.0	0.23	0.95	0.25	0.11	1.0	0.25	0.04
Facility: Standardized Mortality Ratio	0.97	0.26	1.0	0.26	-0.12	0.97	0.25	0.02
Facility: Standardized Readmission Ratio	1.0	0.26	0.97	0.28	0.004	1.0	0.28	0.01
ACO Percentage	0.24	0.15	0.16	0.13	0.54*	0.24	0.15	-0.01
CBSA: Dual Beneficiaries per 10,000	337	111	333	106	0.04	337	109	-0.002
CBSA: ESRD Beneficiary Count	3,151	3,671	2,885	3,379	0.08	3,062	3,589	0.02
CBSA: Median Household Income	$60,774	$14,012	$58,734	$13,849	0.15	$60,431	$13,710	0.02
CBSA: Medicare Advantage Penetration	35.0	11.9	32.1	13.0	0.23*	34.8	12.8	0.01
Region: Midwest	0.24	0.43	0.14	0.35	0.24*	0.24	0.43	-0.004
Region: Northeast	0.20	0.40	0.11	0.31	0.24*	0.20	0.40	-0.01
Region: South	0.34	0.47	0.48	0.50	-0.30*	0.35	0.48	-0.03

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-7. Descriptive Statistics and Standardized Mean Differences (FFS to CEC January 2017)

Characteristics	CEC Benes with a match (01/2017 switch) N=7,843		FFS Comparison Pool N=47,091		Std Diff Before Matching	FFS Comparison Group N=7,843		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.16	0.37	0.16	0.37	-0.01	0.15	0.36	0.02
Acute Myocardial Infarction	0.03	0.17	0.03	0.17	0.00	0.03	0.17	0.01
Age in Month Prior to Alignment Date	62.6	14.2	62.6	14.2	0.00	62.4	14.3	0.02
Alzheimer's and Related Disorders	0.14	0.35	0.13	0.34	0.02	0.13	0.34	0.01
Alzheimer's Disease	0.03	0.16	0.03	0.16	-0.01	0.03	0.16	-0.01
Anemia	1.0	0.05	1.0	0.04	-0.01	1.0	0.05	-0.01
Asthma	0.08	0.27	0.08	0.28	0.00	0.08	0.27	-0.001
Atrial Fibrillation	0.12	0.33	0.12	0.32	0.006	0.11	0.32	0.02
Benign Prostatic Hyperplasia	0.05	0.23	0.05	0.23	0.00	0.06	0.23	-0.01
BMI at time of first ESRD diagnosis	30.2	8.5	30.1	8.4	0.01	30.2	8.4	0.003
Breast Cancer	0.02	0.13	0.02	0.13	-0.005	0.01	0.12	0.02
Cancer	0.05	0.23	0.06	0.23	-0.01	0.05	0.22	0.01
Cataracts	0.12	0.33	0.13	0.34	-0.03	0.12	0.33	0.002
Cause of ESRD: Diabetes	0.42	0.49	0.45	0.50	-0.05	0.42	0.49	0.002
Cause of ESRD: Hypertension	0.32	0.47	0.31	0.46	0.02	0.32	0.46	0.004
Cause of ESRD: Unknown	0.02	0.14	0.02	0.14	0.01	0.02	0.14	0.004
Chronic Congestive Heart Failure	0.53	0.50	0.55	0.50	-0.02	0.53	0.50	0.01
Chronic Obstructive Pulmonary Disease	0.18	0.38	0.20	0.40	-0.06	0.18	0.38	0.003
Colorectal Cancer	0.01	0.11	0.01	0.12	-0.03	0.01	0.10	0.004
Congestive Heart Failure	0.54	0.50	0.55	0.50	-0.02	0.53	0.50	0.01
Depression	0.21	0.41	0.22	0.42	-0.03	0.21	0.41	-0.002
Diabetes	0.65	0.48	0.68	0.47	-0.06	0.66	0.47	-0.01
Endometrial Cancer	0.002	0.05	0.003	0.06	-0.02	0.003	0.05	-0.003
Female	0.44	0.50	0.45	0.50	-0.01	0.45	0.50	-0.01
Glaucoma	0.06	0.24	0.06	0.23	0.02	0.06	0.24	-0.003
Hip Fracture	0.01	0.12	0.01	0.11	0.01	0.02	0.12	-0.01
Hyperlipidemia	0.55	0.50	0.53	0.50	0.03	0.54	0.50	0.02
Hypertension	0.88	0.32	0.87	0.34	0.04	0.88	0.33	0.01
Ischemic Heart Disease	0.57	0.50	0.57	0.50	0.009	0.57	0.50	0.01
Months of Dialysis in Month Prior to Alignment Date	78.1	65.4	76.0	64.5	0.03	77.9	65.2	0.003

Characteristics	CEC Benes with a match (01/2017 switch) N=7,843		FFS Comparison Pool N=47,091		Std Diff Before Matching	FFS Comparison Group N=7,843		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.20	0.40	0.21	0.40	-0.011	0.20	0.40	-0.003
OREC: ESRD	0.26	0.44	0.25	0.43	0.03	0.27	0.44	-0.02
OREC: ESRD and Disability	0.26	0.44	0.27	0.44	-0.03	0.25	0.44	0.005
Osteoporosis	0.03	0.18	0.03	0.18	-0.01	0.03	0.18	-0.01
Percent Months Hemodialysis	0.94	0.23	0.92	0.26	0.08	0.93	0.24	0.02
Percent Months with Full Medicaid Dual Enrollment	0.36	0.47	0.42	0.48	-0.12	0.38	0.47	-0.03
Percent Months with Partial Medicaid Dual Enrollment	0.14	0.33	0.14	0.34	-0.019	0.13	0.33	0.01
Prostate Cancer	0.02	0.15	0.02	0.15	0.00	0.02	0.15	-0.004
Race: Black	0.44	0.50	0.39	0.49	0.10	0.44	0.50	0.004
Race: White	0.40	0.49	0.42	0.49	-0.03	0.40	0.49	0.01
Rheumatoid/Osteo-Arthritis	0.31	0.46	0.30	0.46	0.01	0.31	0.46	-0.01
Stroke	0.07	0.26	0.07	0.25	0.01	0.07	0.26	0.002
Total Baseline Standardized Part A and Part B Payments	$63,326	$38,686	$63,586	$38,776	-0.01	$62,820	$37,244	0.01
Facility: For-Profit	0.90	0.30	0.94	0.23	-0.16	0.90	0.30	0.004
Facility: Home Dialysis	0.94	0.23	0.85	0.36	0.31*	0.94	0.24	0.002
Facility: Late Shift	0.29	0.46	0.22	0.42	0.16	0.28	0.45	0.03
Facility: LDO	0.99	0.09	1	0	-0.13	1	0	-0.13
Facility: Peritoneal Dialysis	0.53	0.50	0.65	0.48	-0.24*	0.53	0.50	-0.01
Facility: Standardized Hospitalization Ratio	0.93	0.23	0.95	0.25	-0.07	0.93	0.24	-0.004
Facility: Standardized Mortality Ratio	0.94	0.20	1.0	0.24	-0.30*	0.93	0.23	0.01
Facility: Standardized Readmission Ratio	0.92	0.30	0.97	0.28	-0.15	0.93	0.29	-0.01
ACO Percentage	0.22	0.14	0.16	0.13	0.46*	0.22	0.14	-0.03
CBSA: Dual Beneficiaries per 10,000	309	128	333	104	-0.20	314	102	-0.04
CBSA: ESRD Beneficiary Count	3,547	3,338	2,632	3,075	0.29*	3,619	3,727	-0.02
CBSA: Median Household Income	$61,036	$11,681	$57,630	$13,009	0.28*	$61,037	$12,954	-0.0001
CBSA: Medicare Advantage Penetration	33.3	14.0	31.7	13.0	0.12	33.5	12.6	-0.01
Region: Midwest	0.22	0.41	0.15	0.36	0.16	0.21	0.41	0.002
Region: Northeast	0.12	0.33	0.09	0.28	0.11	0.13	0.34	-0.03
Region: South	0.47	0.50	0.50	0.50	-0.06	0.46	0.50	0.04

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-8. Descriptive Statistics and Standardized Mean Differences (FFS to ACO, January 2018)

Characteristics	ACO Benes with a match (01/2018 switch) N=3,781		FFS Comparison Pool N=61,589		Std Diff Before Matching	FFS Comparison Group N=3,781		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.18	0.39	0.17	0.38	0.02	0.19	0.39	-0.01
Acute Myocardial Infarction	0.03	0.18	0.03	0.18	0.001	0.03	0.18	0.004
Age in Month Prior to Alignment Date	63.0	14.4	62.7	14.1	0.02	62.9	13.9	0.002
Alzheimer's and Related Disorders	0.14	0.35	0.14	0.35	-0.002	0.14	0.34	0.01
Alzheimer's Disease	0.03	0.16	0.03	0.16	0.01	0.03	0.18	-0.02
Anemia	1.0	0.06	1.0	0.05	-0.02	1.0	0.06	0.01
Asthma	0.08	0.28	0.08	0.27	0.02	0.09	0.28	-0.003
Atrial Fibrillation	0.14	0.35	0.12	0.32	0.07	0.14	0.35	-0.004
Benign Prostatic Hyperplasia	0.07	0.25	0.06	0.24	0.04	0.07	0.25	0.01
BMI at time of first ESRD diagnosis	29.7	8.5	30.1	8.4	-0.04	29.8	8.1	-0.001
Breast Cancer	0.02	0.13	0.02	0.13	0.01	0.02	0.13	0
Cancer	0.06	0.24	0.05	0.23	0.02	0.06	0.24	0.004
Cataracts	0.13	0.34	0.13	0.34	0.01	0.13	0.34	-0.001
Cause of ESRD: Diabetes	0.44	0.50	0.45	0.50	-0.01	0.45	0.50	-0.01
Cause of ESRD: Hypertension	0.29	0.45	0.31	0.46	-0.03	0.30	0.46	-0.01
Cause of ESRD: Unknown	0.02	0.14	0.02	0.13	0.01	0.02	0.13	0.01
Chronic Congestive Heart Failure	0.56	0.50	0.55	0.50	0.03	0.57	0.50	-0.02
Chronic Obstructive Pulmonary Disease	0.19	0.39	0.19	0.40	-0.02	0.19	0.39	-0.01
Colorectal Cancer	0.02	0.13	0.01	0.11	0.03	0.02	0.12	0.01
Congestive Heart Failure	0.56	0.50	0.55	0.50	0.03	0.57	0.49	-0.02
Depression	0.26	0.44	0.23	0.42	0.07	0.25	0.43	0.02
Diabetes	0.70	0.46	0.69	0.46	0.02	0.71	0.46	-0.01
Endometrial Cancer	0.004	0.07	0.004	0.06	0.01	0.003	0.06	0.02
Female	0.45	0.50	0.45	0.50	0.002	0.44	0.50	0.01
Glaucoma	0.09	0.29	0.08	0.28	0.03	0.08	0.27	0.04
Hip Fracture	0.01	0.11	0.01	0.11	0.001	0.01	0.10	0.02
Hyperlipidemia	0.63	0.48	0.58	0.49	0.10	0.62	0.49	0.03
Hypertension	0.90	0.29	0.87	0.33	0.09	0.91	0.28	-0.02
Ischemic Heart Disease	0.60	0.49	0.57	0.50	0.07	0.61	0.49	-0.003
Months of Dialysis in Month Prior to Alignment Date	72.9	66.9	75.4	65.5	-0.04	74.2	65.2	-0.02

Characteristics	ACO Benes with a match (01/2018 switch) N=3,781		FFS Comparison Pool N=61,589		Std Diff Before Matching	FFS Comparison Group N=3,781		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.21	0.41	0.21	0.41	-0.002	0.21	0.41	-0.01
OREC: ESRD	0.29	0.45	0.28	0.45	0.02	0.29	0.46	-0.01
OREC: ESRD and Disability	0.20	0.40	0.23	0.42	-0.07	0.20	0.40	-0.005
Osteoporosis	0.04	0.21	0.03	0.18	0.05	0.04	0.20	0.01
Percent Months Hemodialysis	0.91	0.28	0.92	0.27	-0.03	0.91	0.28	-0.01
Percent Months with Full Medicaid Dual Enrollment	0.42	0.48	0.44	0.48	-0.03	0.43	0.48	-0.01
Percent Months with Partial Medicaid Dual Enrollment	0.11	0.30	0.14	0.33	-0.07	0.11	0.30	-0.01
Prostate Cancer	0.02	0.14	0.02	0.15	-0.01	0.02	0.14	-0.01
Race: Black	0.34	0.48	0.38	0.48	-0.07	0.34	0.47	0.02
Race: White	0.45	0.50	0.41	0.49	0.08	0.46	0.50	-0.01
Rheumatoid/Osteo-Arthritis	0.31	0.46	0.31	0.46	0.01	0.30	0.46	0.02
Stroke	0.07	0.26	0.07	0.26	0.01	0.07	0.25	0.02
Total Baseline Standardized Part A and Part B Payments	$65,498	$39,240	$63,461	$38,762	0.05	$64,654	$38,684	0.02
Facility: For-Profit	0.88	0.33	0.89	0.32	-0.04	0.87	0.33	0.01
Facility: Home Dialysis	0.86	0.34	0.83	0.37	0.09	0.86	0.35	0.01
Facility: Late Shift	0.27	0.44	0.23	0.42	0.09	0.26	0.44	0.01
Facility: LDO	0.72	0.45	0.75	0.43	-0.07	0.72	0.45	0.01
Facility: Peritoneal Dialysis	0.72	0.45	0.66	0.47	0.14	0.72	0.45	0.01
Facility: Standardized Hospitalization Ratio	1.0	0.23	0.95	0.25	0.12	1.0	0.26	-0.001
Facility: Standardized Mortality Ratio	0.98	0.23	1.0	0.26	-0.07	0.98	0.25	0.03
Facility: Standardized Readmission Ratio	1.0	0.27	0.97	0.28	0.03	1.0	0.27	-0.003
ACO Percentage	0.27	0.15	0.19	0.14	0.54*	0.27	0.15	-0.005
CBSA: Dual Beneficiaries per 10,000	331	111	331	106	-0.005	332	107	-0.01
CBSA: ESRD Beneficiary Count	3,303	3,858	2,923	3,429	0.10	3,271	3,688	0.01
CBSA: Median Household Income	$59,624	$12,678	$58,927	$13,993	0.05	$59,678	$13,632	-0.004
CBSA: Medicare Advantage Penetration	36.1	11.4	33.5	12.8	0.22*	36.1	12.1	0.0001
Region: Midwest	0.20	0.40	0.14	0.35	0.16	0.19	0.39	0.02
Region: Northeast	0.13	0.33	0.11	0.32	0.05	0.12	0.33	0.01
Region: South	0.38	0.49	0.48	0.50	-0.19	0.39	0.49	-0.02

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Exhibit K-9. Descriptive Statistics and Standardized Mean Differences (FFS to CEC January 2018)

Characteristics	CEC Benes with a match (01/2018 switch) N=5,937		FFS Comparison Pool N=46,397		Std Diff Before Matching	FFS Comparison Group N=5,937		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
Acquired Hypothyroidism	0.16	0.36	0.17	0.37	-0.02	0.16	0.36	0.005
Acute Myocardial Infarction	0.04	0.19	0.04	0.18	0.00	0.04	0.19	-0.004
Age in Month Prior to Alignment Date	62.0	13.9	62.6	14.1	-0.04	61.9	14.0	0.01
Alzheimer's and Related Disorders	0.14	0.34	0.14	0.34	-0.01	0.13	0.34	0.01
Alzheimer's Disease	0.02	0.16	0.03	0.16	0.00	0.03	0.16	-0.01
Anemia	1.0	0.06	1.0	0.05	-0.03	1.0	0.06	0
Asthma	0.08	0.27	0.08	0.27	0.008	0.07	0.26	0.02
Atrial Fibrillation	0.12	0.32	0.12	0.32	-0.001	0.11	0.31	0.03
Benign Prostatic Hyperplasia	0.06	0.23	0.06	0.23	-0.01	0.06	0.23	-0.01
BMI at time of first ESRD diagnosis	30.6	8.5	30.2	8.4	0.05	30.7	8.6	-0.005
Breast Cancer	0.02	0.13	0.02	0.13	0.00	0.02	0.13	0.01
Cancer	0.06	0.23	0.05	0.23	0.01	0.06	0.23	0.01
Cataracts	0.12	0.32	0.13	0.33	-0.03	0.12	0.32	0.004
Cause of ESRD: Diabetes	0.43	0.50	0.44	0.50	-0.02	0.43	0.49	0.02
Cause of ESRD: Hypertension	0.34	0.47	0.31	0.46	0.06	0.34	0.48	-0.01
Cause of ESRD: Unknown	0.02	0.13	0.02	0.13	-0.01	0.02	0.13	0.001
Chronic Congestive Heart Failure	0.56	0.50	0.55	0.50	0.03	0.55	0.50	0.01
Chronic Obstructive Pulmonary Disease	0.20	0.40	0.20	0.40	0.00	0.20	0.40	-0.002
Colorectal Cancer	0.01	0.12	0.01	0.11	0.01	0.01	0.11	0.01
Congestive Heart Failure	0.56	0.50	0.55	0.50	0.03	0.56	0.50	0.02
Depression	0.20	0.40	0.23	0.42	-0.06	0.20	0.40	0.02
Diabetes	0.67	0.47	0.68	0.47	-0.01	0.67	0.47	0.01
Endometrial Cancer	0.002	0.04	0.004	0.06	-0.03	0.002	0.04	0.01
Female	0.45	0.50	0.45	0.50	0.01	0.45	0.50	0.004
Glaucoma	0.09	0.28	0.08	0.27	0.02	0.08	0.28	0.01
Hip Fracture	0.01	0.10	0.01	0.11	-0.02	0.01	0.10	-0.02
Hyperlipidemia	0.63	0.48	0.55	0.50	0.17	0.62	0.48	0.02
Hypertension	0.88	0.32	0.87	0.33	0.03	0.88	0.32	-0.01
Ischemic Heart Disease	0.56	0.50	0.57	0.50	-0.01	0.56	0.50	0.004
Months of Dialysis in Month Prior to Alignment Date	77.8	64.2	76.1	65.6	0.03	78.0	65.4	-0.003

Characteristics	CEC Benes with a match (01/2018 switch) N=5,937		FFS Comparison Pool N=46,397		Std Diff Before Matching	FFS Comparison Group N=5,937		Std Diff After Matching
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	
OREC: Disability	0.22	0.42	0.21	0.41	0.02	0.22	0.41	0.004
OREC: ESRD	0.29	0.45	0.28	0.45	0.01	0.29	0.45	-0.01
OREC: ESRD and Disability	0.25	0.43	0.23	0.42	0.03	0.25	0.43	0.001
Osteoporosis	0.03	0.17	0.03	0.18	-0.03	0.03	0.17	-0.01
Percent Months Hemodialysis	0.95	0.21	0.92	0.26	0.12	0.94	0.22	0.01
Percent Months with Full Medicaid Dual Enrollment	0.40	0.48	0.43	0.48	-0.06	0.39	0.48	0.02
Percent Months with Partial Medicaid Dual Enrollment	0.16	0.35	0.14	0.33	0.06	0.16	0.35	0.005
Prostate Cancer	0.02	0.15	0.02	0.15	0.01	0.03	0.16	-0.01
Race: Black	0.52	0.50	0.39	0.49	0.26*	0.52	0.50	0.01
Race: White	0.35	0.48	0.41	0.49	-0.14	0.35	0.48	-0.01
Rheumatoid/Osteo-Arthritis	0.31	0.46	0.31	0.46	-0.006	0.30	0.46	0.02
Stroke	0.08	0.27	0.07	0.25	0.03	0.08	0.27	-0.01
Total Baseline Standardized Part A and Part B Payments	$65,461	$40,944	$63,234	$38,496	0.06	$65,133	$40,184	0.01
Facility: For-Profit	0.96	0.20	0.94	0.23	0.06	0.95	0.21	0.02
Facility: Home Dialysis	0.87	0.34	0.84	0.36	0.07	0.87	0.33	-0.02
Facility: Late Shift	0.19	0.40	0.22	0.41	-0.06	0.20	0.40	-0.02
Facility: LDO	1.00	0.01	1	0	-0.02	1	0	-0.02
Facility: Peritoneal Dialysis	0.52	0.50	0.65	0.48	-0.27*	0.53	0.50	-0.03
Facility: Standardized Hospitalization Ratio	1.0	0.25	0.95	0.25	0.05	1.0	0.25	-0.01
Facility: Standardized Mortality Ratio	1.0	0.23	1.0	0.24	0.09	1.0	0.25	-0.0002
Facility: Standardized Readmission Ratio	1.0	0.26	0.97	0.29	0.03	1.0	0.28	-0.01
ACO Percentage	0.19	0.15	0.19	0.14	0.01	0.19	0.13	-0.00001
CBSA: Dual Beneficiaries per 10,000	316	119	331	106	-0.13	316	104	-0.001
CBSA: ESRD Beneficiary Count	2,969	3,130	2,646	3,084	0.10	2,985	3,203	-0.01
CBSA: Median Household Income	$56,777	$12,586	$57,826	$13,183	-0.08	$56,623	$11,261	0.01
CBSA: Medicare Advantage Penetration	31.7	12.3	33.1	12.8	-0.11	31.9	12.1	-0.01
Region: Midwest	0.03	0.18	0.15	0.35	-0.40*	0.03	0.16	0.03
Region: Northeast	0.12	0.32	0.09	0.29	0.07	0.11	0.31	0.02
Region: South	0.69	0.46	0.50	0.50	0.39*	0.70	0.46	-0.02

Notes: The standardized difference was calculated by the following equation: $\text{Std. Diff} = (\mu 1 - \mu 2)/\sqrt{(\sigma_1^2 + \sigma_2^2)/2}$. Any value below 0.1 is considered to be a negligible difference.
* Indicates a standardized mean difference greater than 0.2 in absolute value.

Model Specification. To perform the DiD analysis, all of the pre- and post-alignment period data of the newly aligned beneficiaries and their matched comparison beneficiary, of each alignment date for each treatment group (ACO or CEC), were stacked together. Effectively, this stacking normalized the observations around the date a beneficiary could or did transition into an ACO or CEC. We estimated separate regression models for each treatment group and compared treated and comparison outcomes for each of the alignment groups (cohort) in a pooled regression framework.

The basic analysis again takes the form of two separate stacked DiD fixed-effects models, one for each treatment group:

$$Y_{ict} = \alpha + \beta_{ct}T_{tc} + \eta_{1c}ACO_{ic} + \delta_1 Post\_ACO_{ict} + \lambda' X_{ict} + e_{ict} \quad (1)$$

$$Y_{ict} = \alpha + \beta_{ct}T_{tc} + \eta_{1c}CEC_{ic} + \delta_1 Post\_CEC_{ict} + \lambda' X_{ict} + e_{ict} \quad (2)$$

where subscripts *i*, *c*, and *t* denote individual, cohort of alignment date, and month. T represents alignment date by month specific fixed effects four each of the four alignment dates. ACO and CEC are separate indicator variables that identify the group of individuals who are considered treated regardless of time for each of the treatment cohorts (i.e., each alignment date). They take the form of 0 for comparison beneficiaries and 1 for treatment beneficiary who belong to a specific alignment date cohort. Post ACO and Post CEC are the DiD post-treatment indicators for each of our treatment groups. The variables were coded 0 for all comparison and treatment baseline months and 1 for individuals who were aligned to an ACO or CEC Model after the alignment date. Thus, δ_1 from each regression are the primary coefficients of interest.

Finally, X was a vector of additional variable characteristics that controls for time-varying differences in beneficiary, facility, and market characteristics and are the same controls used in previous analysis. Market and facility controls were based on where the beneficiary received the majority of their care. The regression frameworks also include an indicator for a three-month treatment transition period. This indicator controls the transition period effect on outcomes and effectively exclude this time period from the DiD estimate. All estimated standard errors of the DiD estimate were calculated using two-way clusters at beneficiary and service facility levels.[74]

To assess whether the treatment and comparison group follow similar pre-intervention trends, we estimate linear trends models following the same design described in **Appendix F**, **Section E**. Formally, the parallel trend tests involved assessing the significance of the coefficient corresponding to the time and treatment dummy interaction term at $p<0.05$, using data prior to the start of the preceding alignment dates. If the outcome trends between treatment and comparison groups are the same prior to a beneficiary potential transition to an ACO or CEC care model, then the interaction coefficient should be near zero and insignificant.

The DiD estimates of all outcomes considered in the ACO analysis for both intervention groups, along with the p-value that corresponds to the linear parallel trends test, are shown in **Exhibits K-10** and **K-11**.

[74] Cameron, A., Gelbach, J.B., Miller, D.L. (2012). Robust inference with multiway clustering. *Journal of Business & Economic Statistics*, 29(2):238-49

Exhibit K-10. Impact Estimates for Newly Aligned ACO Beneficiaries

Measures	Number of Observations	Impact Estimate	90% Lower CI	90% Upper CI	Percent Change	Trend Test P-Value
Total Part A and Part B Standardized Medicare Payments	447,203	-$54	-$146	$38	-0.98%	0.65
Number of ED Visits per 1,000 Beneficiaries per Month	447,203	-0.62	-6.6	5.4	-0.45%	0.54
Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	402,637	0.03	-0.64	0.70	0.04%	0.58
Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	402,637	0.46	-0.04	0.96	5.0%	0.78
Number of Hospitalizations per 1,000 Beneficiaries per Month	446,149	-2.5	-7.1	2.2	-2.0%	0.92
Percent of Beneficiaries with at Least One Readmission in a Given Month	39,350	-0.69	-2.4	0.99	-2.8%	0.19

Notes: Each impact estimate was based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months after following alignment into an ESCO or ACO care model relative to matched comparison groups of beneficiaries who did not transition from usual FFS care. CI= confidence interval, ***p≤0.01, **p≤0.05, *p≤0.1.

Exhibit K-11. Impact Estimates for Newly Aligned CEC Beneficiaries

Measures	Number of Observations	Impact Estimates	90% Lower CI	90% Upper CI	Percent Change	Trend Test P-Value
Total Part A and Part B Standardized Medicare Payments	894,515	- $133 ***	-$197	-$68	-2.5%	0.51
Number of ED Visits per 1,000 Beneficiaries per Month	894,515	0.86	-3.4	5.1	0.59%	0.53
Fistula Use (percent of beneficiaries in a given month who had a fistula and had at least 90 days of dialysis)	831,453	0.50 *	0.06	0.93	0.75%	0.10
Catheter Use (percent of beneficiaries in a given month who had a catheter for 90 days or longer)	831,453	0.02	-0.31	0.34	0.29%	0.99
Number of Hospitalizations per 1,000 Beneficiaries per Month	892,901	-5.5 ***	-8.8	-2.2	-4.8%	0.19
Percent of Beneficiaries with at Least One Readmission in a Given Month	73,196	- 1.5 *	-2.7	-0.24	-6.4%	0.25

Notes: Each impact estimate was based on retrospective cohort study that evaluated changes in outcomes for 12 months before and up to 12 months after following alignment into an ESCO or ACO care model relative to matched comparison groups of beneficiaries who did not transition from usual FFS care. CI= confidence interval, ***p≤0.01, **p≤0.05, *p≤0.1.

Power Calculations. Finally, power calculations of the primary care-based ACO and CEC intervention groups, relative to the pooled comparison group, were calculated using the same methodology as the CEC Model evaluation presented in the earlier sections of the report. See **Appendix G** for details and equations of power methods.

For the second year of the ACO analysis, the number of ACO and CEC newly aligned beneficiaries gives reasonable confidence that the analysis will detect modest impacts on Medicare service use and costs for all beneficiaries. Specifically, estimates of power using one-tailed tests at the 10% significance level and adjustments for goodness of fit from the regression models imply that the evaluation has 80% power to detect impacts on standardized Medicare payment of 2.5% or more for CEC and 3% or more for ACO newly aligned beneficiaries.

Appendix L: Unintended Consequences

A. Patient Selection

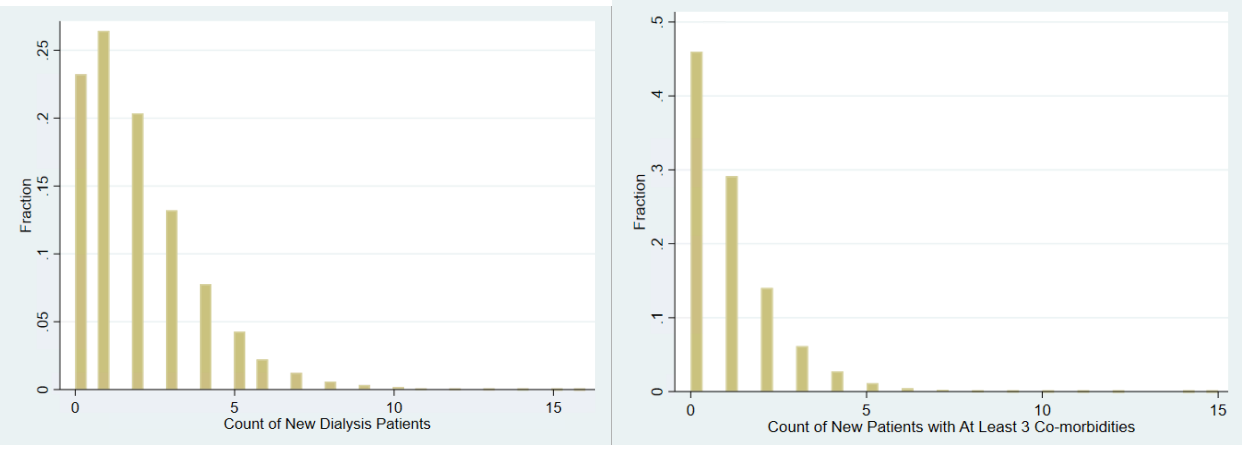
Descriptive Counts of New Dialysis Patients and Comorbidities. Patients new to dialysis are identified as any beneficiaries whose first observation, from December 2013 to June 2018, indicates they had less than one, one, two, or three months of dialysis. [75] We included new dialysis patients up to their third month of dialysis to (1) limit beneficiaries who had previous dialysis, a gap, and then began dialysis again during our sample period; (2) include beneficiaries that became eligible for Medicare as a result of having ESRD. About half the patients in our sample were Medicare eligible as a result of ESRD, and most already had three months of dialysis when they were observed in the claims data.

To measure patients' health status, we required an assessment of patient health that was reasonably observed by the nephrologist at the initiation of chronic dialysis. Since a claims history with comorbidity information is not available for about half of the beneficiaries with ESRD who qualify for Medicare as a result of ESRD, we used data from CMS Form 2728 to identify beneficiaries with reported comorbidity conditions. This form is completed by the physician within 45 days of dialysis initiation to certify that a patient has reached ESRD and requires chronic dialysis or a kidney transplant. We used data from CMS-2728 to identify beneficiaries who had any of 19 comorbid conditions listed on the form that were observed at ESRD incidence, including: CHF; atherosclerotic heart disease; other cardiac disease; cerebrovascular disease; peripheral vascular disease; history of hypertension; amputation; diabetes; current smoker/tobacco use; malignant neoplasm, cancer; toxic nephropathy; alcohol dependence; drug dependence; inability to ambulate; inability to transfer; needs assistance with daily activities; institutionalized (assisted living, nursing home, or other institution); and non-renal congenital abnormality.

We aggregated the beneficiary-month level data to the aligned facility-quarter level. The analytic sample consisted of 17,111 facility-quarter observations from CEC facilities and 17,116 facility-quarterly observations from non-CEC comparison facilities over the period of January 2014 through June 2018. Therefore, for each CEC and matched comparison facility, we observed the number of beneficiaries with ESRD who were new to dialysis and the number who were new to dialysis and had at least two, three, four, and five comorbid conditions in each quarter. In our main analysis, we focused on new dialysis patients and those with three comorbid conditions. In **Exhibit L-1**, we present the distribution of these outcomes across facilities and quarters. The median facility and quarter had two beneficiaries with ESRD that were new to dialysis and one with at least three comorbidities. We can see that the counts of outcomes of interest can be characterized by a very small number of beneficiaries on a facility-quarter basis.

[75] This analysis period ends in June 2018 instead of December 2018 to account for the lag in the CMS Form 2728 data, which is used to identify chronic conditions.

Exhibit L-1. Distribution of Number of Beneficiaries with ESRD New to Dialysis and with a Given Number of Comorbidities, across Facilities and Quarter



Model Specification. As described in the previous section, a challenge in determining whether or not CEC facilities had fewer patients with comorbidities at ESRD incidence is the small number of new dialysis beneficiaries for a given facility and quarter. The natural starting point to model the number of new dialysis patients with multiple comorbidities would be to estimate a Poisson regression specification.[76] The number of new dialysis patients with comorbidities are interpreted as "counts" that follow a Poisson distribution, and this specification assumes that the logarithm of these counts can be modeled by a linear combination of parameters. The estimating equation

$$Log(Y_{jmq}) = \beta CEC_j * Post_{jq} + \gamma CEC_j + \alpha X_{mq} + \lambda Z_{jq} + \delta_q$$

where Y_{jmq} is the count of patients new to dialysis with comorbidity(ies) at facility *j* in market *m*in quarter q, CEC_j is the CEC status of facility *j* and $Post_{jq}$indicates the post CEC period for facility *j* in quarter *q*. X_{mq} includes market characteristics and Z_{jq} includes facility characteristics and dummies for each cohort of ESCOs and their comparison group matches, and δ_q are quarterly dummies.

There are several well-known limitations to the Poisson model. The most restrictive assumption of the model is that the mean and the variance of the dependent variable are assumed to be equal (or 'equidispersion'). In addition, because of this restrictive assumption, there is the 'excess zeros problem' in which the model predicts the probability of a zero count to be considerably less than is actually observed in the sample. The negative binomial model circumvents the limitations of the Poisson model since it has the same mean as the Poisson, but the conditional variance is quadratic in the mean, and consequently it does not impose that the mean and variance are equal.

For each outcome, we estimated Poisson and negative binomial models. In deciding the most appropriate model between the Poisson and negative binomial models, we performed a statistical

[76] Modeling these outcomes with a normally distributed error by estimating OLS models is not appropriate in our particular case.

test for whether equidispersion was a problem in our data. For all our outcomes, the likelihood ratio test suggested that the negative binomial model was a more appropriate model.[77] We included in the model the following facility characteristics: beneficiary count, whether the facility offers a late shift, profit status, LDO status, rural/urban status, and dummies for region. Market characteristics included: median household income, dual eligible population, PCPs per 10,000 population, Medicare Advantage (MA) penetration, ACO penetration, and percent of Medicare beneficiaries in the CBSA that had ESRD at the pre-CEC period. The estimation results from the Poisson model are shown in **Exhibit L-2**. The Poisson specification shows that the magnitude and sign of the DiD estimates are similar to the negative binomial specification results presented in the report. They do not suggest a significant association between the CEC and the number of new patients with multiple comorbidities, relative to the comparison population.

Exhibit L-2. Number of Additional Patients with Comorbidities at CEC Facilities vs Comparison Facilities, Poisson Model

Model: Poisson	CEC		Comparison		DiD Estimate			
Outcome	Pre-CEC	Post-CEC	Pre-CEC	Post-CEC	DiD	90% Lower CI	90% Upper CI	Percent Change
New Dialysis Patients	2.0	1.8	2.1	1.9	0.04	-0.03	0.11	2.1%
New Patients with at Least Three Comorbidities	1.0	0.93	1.1	0.97	0.01	-0.04	0.06	0.70%

Notes: ***p≤0.01, **p≤0.05, *p≤0.1.

B. Transplant Waitlist Participation

This appendix details the new approach for analyzing transplant waitlist participation in PY3. As noted in **Section IX** of this annual report, although the CEC Model could have unintentionally impacted ESCO facility transplant referral behavior and subsequently the percentage of their beneficiaries waitlisted for a transplant, we did not find any evidence that the CEC had an effect on waitlist rates.

Yearly DiD Strategy for Waitlist Participation. Because waitlisting is a relatively infrequent event, the unit of observation in this analysis was beneficiary-year instead of a beneficiary-month. The new data structure required a modification of the approach presented in **Appendix F** as highlighted below.

A waitlist entry refers to registration with a transplant center. A beneficiary may have multiple entries in a year at multiple centers, meaning they are on multiple waitlists. The yearly count of entries on the transplant waitlist for the larger ESRD population of beneficiaries that were active on the list is summarized in **Exhibit L-3**. The exhibit shows that the raw yearly number of entries that were added or removed varied over time. Specifically, we observed an increase in the overall number of entries added to the transplant waitlist (with the exception of a small decrease in 2015) and an increase in the overall number of entries removed from the waitlist in recent years. Beneficiaries are removed from a center's waitlist for the following reasons: they receive a

[77] For all outcomes, the overdisperson parameter had a p-value ≤0.000.

transplant (at any center); experience a change in health status that makes them no longer an eligible candidate for transplant; no longer wish to pursue transplant; or death.

Exhibit L-3. Number of Raw Annual Transplant Waitlist Entries Added and Removed

Year	Number of Entries Added	Number of Entries Removed
2014	38,811	35,866
2015	37,621	38,801
2016	37,947	40,173
2017	38,197	40,935
2018	41,563	41,791

Notes: The entries include multiple waitlist records for beneficiaries active in multiple transplant centers.

Data Source: Scientific Registry of Transplant Recipients kidney/pancreas waiting list.

Redefinition of Time Periods. Because the unit of analysis for waitlist participation was beneficiary-year, we redefined the pre-CEC, transition, and post-CEC periods to include full calendar years (CYs). For Wave 1 PY1 joiners, this change resulted in a shorter pre-CEC period (it no longer includes the first quarter of 2015) and shorter post-CEC period (it now excludes the first intervention quarter).[78] For facilities in Wave 1 PY2 and Wave 2 PY1 joiners, the first two quarters of 2016 are reallocated from the pre-CEC to the transition period, with no change in the post-CEC period. For facilities in Wave 1 PY3 and Wave 2 PY2 joiners, the first two quarters of 2017 are reallocated from the pre-CEC to the transition period, with no change in the post-CEC period. CYs assigned to these periods for the comparison and CEC groups are shown in **Exhibit L-4.**

Exhibit L-4. Waves, Pre-CEC, Transition, and Post-CEC by Calendar Year

	Baseline		Performance Year 1	Performance Year 2	Performance Year 3
Facility Wave	2014	2015	2016	2017	2018
Wave 1 PY1 Joiners	Pre-CEC	Transition	Post-CEC		
Wave 1 PY2 Joiners	Pre-CEC		Transition	Post-CEC	
Wave 2 PY1 Joiners	Pre-CEC		Transition	Post-CEC	
Wave 1 PY3 Joiners	Pre-CEC			Transition	Post-CEC
Wave 2 PY2 Joiners	Pre-CEC			Transition	Post-CEC
Matched Comparison Group	Pre-CEC		Post-CEC		

Model Specification. Below is the regression model used to estimate the impact of treatment for all ESCOs:

$$Y_{ikt} = \alpha + Year_t + \delta_1 ESCO_{ik} + \delta_2 TransitionW1_{tk} + \delta_3 (Post_t * ESCOW1_{ik}) +$$

$$+ \delta_4 TransitionW2_{tk} + \delta_5 (Post_t * ESCOW2_{ik}) + \lambda' X_{ikt} + \varepsilon_{ikt} \quad (2)$$

where subscripts *i*, *k*, and *t* denote beneficiaries, facilities, and years, respectively. The outcome of interest, $Y_{ikt,}$ is whether a beneficiary was active on the waitlist. This variable takes on the value of 1 if individual *i*, who is aligned to facility *k*, is active on the waitlist anytime in year *t,* and it takes on a value of 0 otherwise. $ESCO_{i,k}$ is an indicator variable that identifies the group of CEC eligible beneficiaries who are aligned to an ESCO in a given year. $Year_t$ represents yearly fixed effects. (These fixed effects control for any possible trend that is common among the study population.) $TransitionW1_{tk}$ and $TransitionW2_{tk}$ are indicator variables that control for the transition years Wave 1 and Wave 2 ESCOs, respectively. Additionally, $Post_t$ * $ESCOW1_{ik}$ takes the value of 0 for all beneficiaries during the pre-CEC period and the value of 1 for beneficiaries aligned to Wave 1 ESCOs when facility *k* is participating in the CEC Model. Similarly, $Post_t$ * $ESCOW2_{ik}$ takes the value of 0 for all beneficiaries during the pre-CEC period and the value of 1 for beneficiaries aligned to Wave 2 ESCOs when facility *k* is participating in the CEC Model. Beneficiaries in the comparison group who do not receive treatment at an ESCO facility will receive a 0 for this indicator variable in both years. The coefficients of interest, δ_3 and δ_5, reveal the wave-specific effect of the CEC on waitlist participation.

Finally, X_{ikt} is a vector of beneficiary and facility level characteristics that have been shown to be associated with waitlist participation.[79] This term controls for characteristics of the beneficiary population, markets, and facilities that could potentially influence waitlist participation, and which are outside the control of both ESCOs and comparison facilities. The variables included in the model are summarized in **Exhibit L-5**.

[79] See: Abecassis, M., Bartlett, S.T., Collins, A.J., Davis, C.L., Delmonico, F.L., Friedewald, J.J., Hays, R., Howard, A., Jones, E., Leichtman, A.B., Merion, R.M., Metzger, R.A., Pradel, F., Schweitzer, E.J., Velez, R.L., Gaston, R.S. (2008). Kidney transplantation as primary therapy for end-stage renal disease: A National Kidney Foundation/Kidney Disease Outcomes Quality Initiative (NKF/KDOQITM) conference. *Clinical Journal of the American Society of Nephrology,* 3(2):471-80.
Balhara, K.S., Kucirka, L.M., Jaar, B.G., Segev, D.L. (2012). Disparities in provision of transplant education by profit status of the dialysis center. *American Journal of Transplantation,* 12(11):3104-10.
Grams, M.E., Chen, B.P., Coresh, J., Segev, D.L. (2013). Preemptive deceased donor kidney transplantation: considerations of equity and utility. *Clinical Journal of the American Society of Nephrology*, 8(4):575-82.
Segev, D.L., Kucirka, L.M., Oberai, P., Parekh, R.S., Boulware, L.E., Powe, N.R., Montgomery, R.A. (2009). Age and comorbidities are effect modifiers of gender disparities in renal transplantation. *Clinical Journal of the American Society of Nephrology*, 20(3):621-8.
Segev, D.L., Simpkins, C.W., Thompson, R.E., Locke, J.E., Warren, D.S., Montgomery, R.A. (2008). Obesity impacts access to kidney transplantation. *Clinical Journal of the American Society of Nephrology*, 19(2):349-55.

Exhibit L-5. Control Variables Included in the DiD Model

Variable Type	Variable
Beneficiary Level	Female; Age; BMI at ESRD Incidence; Months on Dialysis; Cancer Indicator; Type of Dialysis (Hemodialysis, Peritoneal Dialysis, Other); Race (Black, White, Other); Medicaid Status (None, Full, or Partial)
Facility Level	Facility indicators for Wave 1.1, Wave 1.2, Wave 1.3, Wave 2.1, and Wave 2.2; Profit Indicator (For Profit, Not for Profit)
Market Level	Region Indicators; Urban/ Rural Indicator (Metro Area, Urban Area, Rural Area); Number of Kidney Transplant Hospitals per 10,000 population, measured in 2011

The results of the DiD regression analysis are summarized in **Exhibit L-6**. While the percentage of CEC beneficiaries on the waitlist was lower in the post-CEC period across all waves and PYs, similar declines were observed for the comparison group and the estimated impact of CEC on transplant waitlist rates was not statistically significant in either the analysis for the overall impact (all ESCOs) or the analysis separating Wave 1 and Wave 2 ESCOs by PY. This suggests there is no evidence indicating that the CEC Model was associated with adverse changes in waitlist participation.

Parallel Trends. A pivotal assumption of the DiD model is that the ESCO and comparison groups have the same trend in outcomes prior to the intervention. Since our analysis is restricted to only one year of data before the intervention, we constructed an expanded baseline by adding information on years 2012 and 2013 to test this assumption.[80] Using the expanded baseline of 2012-2014, parallel trends were assessed graphically and using a formal statistical test. Both of these methods suggested the trends between the two groups were virtually identical before the CEC start date.

Exhibit L-6. Impact of the CEC Model on Waitlist Participation

Group	Performance Year	CEC		Comparison		DiD Estimate			
		Pre-CEC	Post-CEC	Pre-CEC	Post-CEC	DiD	90% Lower CI	90% Upper CI	Percent Change
All ESCOs	PY1-PY3	26.9%	23.9%	24.7%	21.1%	0.6%	-0.1%	1.3%	2.4%
Wave 1	PY1-PY3	26.9%	24.0%	24.7%	21.3%	0.6%	-0.5%	1.6%	2.1%
Wave 2	PY1-PY3	26.4%	23.5%	24.3%	20.6%	0.7%	-0.1%	1.6%	2.8%
All ESCOs	PY1	26.9%	25.4%	24.7%	22.7%	0.5%	-0.7%	1.7%	1.8%
All ESCOs	PY2	26.9%	23.8%	24.7%	20.8%	0.8%*	0.0%	1.6%	3.0%
All ESCOs	PY3	26.9%	23.1%	24.7%	20.4%	0.6%	-0.2%	1.4%	2.2%
Wave 1	PY2	26.9%	23.8%	24.7%	20.8%	0.8%	-0.4%	1.9%	2.9%
Wave 1	PY3	26.9%	23.0%	24.7%	20.4%	0.4%	-0.7%	1.5%	1.6%
Wave 2	PY2	26.4%	23.8%	24.3%	20.8%	0.8%	-0.1%	1.8%	3.1%
Wave 2	PY3	26.4%	23.2%	24.3%	20.4%	0.7%	-0.2%	1.6%	2.6%

Notes: ***p<0.01, **p<0.05, *p<0.1.

[80] This expanded baseline data was not included in the main analysis to maintain consistency with the rest of the report. Inclusion of these years in the main analysis does not significantly change any of the results presented in this section.