SECOND EVALUATION REPORT

TECHNICAL APPENDICES

Next Generation Accountable Care Organization Model Evaluation

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Appendix A: Glossary of Acronyms and Terms

Exhibit A. Glossary of Acronyms and Terms

Acronym	Definition
ACA	Patient Protection and Affordable Care Act of 2010
ACO	Accountable Care Organization
ACSC	Ambulatory care-sensitive condition
A/D	Aged and disabled
AHA	American Hospital Association
AIPBP	All-inclusive population-based payment
APM	Alternative payment model
AWV	Annual wellness visit
BETOS	Berenson-Eggers Type of Service categories, used to analyze Medicare costs
BPCI	Bundled Payments for Care Initiative Model
BY	Baseline year
CAH	Critical access hospital
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CCR	Coordinated care reward
CCW	Chronic Conditions Data Warehouse
CJR	Comprehensive Joint Replacement Model
CPC, CPC+	Comprehensive Primary Care Model, Comprehensive Primary Care Plus Model
DID	Difference-in-differences (design)
DME	Durable medical equipment
DRG	Diagnosis-related group
E&M	Evaluation and management visit (hospital outpatient and/or office visit)
ED	Emergency department
EDB	Enrollment data base
EHR	Electronic health record
ESRD	End-stage renal disease
FAI	Financial Alignment Initiative Model
FFS	Medicare fee-for-service
FQHC	Federally qualified health center
GEM	Generalized equivalence mapping
GLM	Generalized linear model
GPCI	Geographic pricing cost index
GPRO	Group Practice Reporting Option
HCC	Hierarchical condition category (risk score)
HHA	Home health agency
HHI	Herfindahl-Hirschman Index
HICN	Health insurance claims number (Medicare beneficiary identification)
HIE	Health information exchange
HRR	Hospital referral region
HS	Hospice
IAH	Independence at Home Model
ICD	International classification of diseases
IDN	Integrated delivery network
IDR	Integrated Data Repository

Acronym	Definition
IDS	Integrated delivery (health) system
IP	Inpatient
IRF	Inpatient rehabilitation facility
IT	Information technology, health information technology (HIT)
LLP	Limited liability partnership
LTCH	Long-term care hospital
MAPCP	Multi-Payer Advanced Primary Care Practice Model
MBSF	Master Beneficiary Summary File
MDE	Minimum detectable effect
MDM	Master data management
MD-PPAS	Medicare Data on Provider Practice and Specialty
MIP	Monthly infrastructure payment
MIPAA	Medicare Improvements for Patients and Providers Act of 2008
SSP	Medicare Shared Savings Program
MU	Meaningful use
NGACO	Next Generation Accountable Care Organization
NPI	National provider identifier
NPPES	National Plan and Provider Enumeration System
OCM	Oncology Care Model
PB	Provider-based determination
PBP	Population-based payment
PBPM	Per beneficiary per month
PECOS	Provider Enrollment, Claim, and Ownership System
PQRS	Physician Quality Reporting System
PY	Performance year
QEM	Qualified evaluation and management visit
RHC	Rural health clinic
RIF	Medicare Research Identifiable Files
SNF	Skilled nursing facility
TIN	Tax identification number
VM	Value modifier payment adjustment
VRDC	Virtual Research Data Center
ZCTA	ZIP code tabulation area

Appendix B: Accountable Care Organizations (ACOs) Participating in the Model in Performance Year (PY) 2

This appendix volume summarizes characteristics of 44 ACOs that participated in the NGACO model during the 2017 performance year (PY2) and were financially liable for shared savings or losses. We refer to ACOs who joined the NGACO model in 2016 as the "2016 cohort" and ACOs who joined the NGACO model in 2017 as the "2017 cohort." As a result, the second performance year includes:

- Sixteen of the eighteen NGACOs that began the model in 2016 remained in the model in 2017. Two NGACOs from the 2016 cohort, Order of Saint Francis (OSF) HealthCare System and Prospect ACO CA, withdrew from the model after 2016.
- Twenty-eight second-cohort NGACOs joined the NGACO model in 2017 and remained throughout the performance year.

Exhibit B.1 summarizes the model feature elections by each cohort and model-wide in the second performance year.

Exhibit B.1. Number of ACOs Participating in the NGACO Model in 2017 (PY2) and Their Model Feature Elections by Cohort and Model-Wide

	Number of ACOs	Average Number of Beneficiaries per ACO (Smallest to Largest)	Full Performance Risk (100%)	Benefit Enhancements		
				3-Day SNF Rule Waiver	Post-Discharge Home Visit	Telehealth Expansion
2016 Cohort	16	29,839 (9,500-83,102)	5 (31%)	11 (69%)	4 (25%)	2 (13%)
2017 Cohort	28	26,957 (7,765-88,531)	15 (54%)	22 (79%)	5 (18%)	4 (14%)
Model-Wide	44	28,005 (7,765-88,531)	20 (45%)	33 (75%)	9 (20%)	6 (14%)

NOTE: NGACOs that did not elect full performance risk (100%) elected 80% risk.

Exhibit B.2 summarizes the organizational types by each cohort and model-wide in the second performance year. Examples for each organizational type are also provided.

Exhibit B.2. Number of ACOs by Organizational Type in 2017 (PY2) by Cohort and Model-Wide

NGACO Affiliation	# of NGACOS			Examples
	Model-wide in PY2	2016 Cohort in PY2	2017 Cohort in PY2	
Integrated Delivery System	14	7	7	Park Nicollet Health Services ACO (PNHS) is part of Park Nicollet Health Partners, an IDS located in Minneapolis-St. Paul, MN. Administrative and management functions are part of the IDS and the NGACO is treated as a payer more than as a distinct program. All participating providers in the ACO are employed by the IDS.

NGACO Affiliation	# of NGACOS			Examples
	Model-wide in PY2	2016 Cohort in PY2	2017 Cohort in PY2	
Hospital System	8	2	6	St. Luke's Clinic Coordinated Care ACO is part of the St. Luke's Health system operating in Idaho. It is part of the St. Luke Health Partners, a unit of the health system that manages value-based care contracts. All of its participating providers are employed by the health system.
Physician Practice(s) and Hospital System Partnership	9	4	5	NW Momentum Health Partners ACO (NW Momentum) is a partnership between Physicians of Southwest Washington (PSW), an IPA, and Capital Medical Center, a local hospital. The ACO is administered and managed through the IPA, and most of its participating physicians are contracted.
Physician Practice	13	3	10	Accountable Care Coalition of Southeast Texas Inc. (ACCST) is a physician-owned, non-profit health corporation comprised of three large NCQA Level III Patient Centered Medical Home certified primary care clinics and associated independent single and multi-specialty groups. ACCST contracts with Collaborative Health Systems, LLC (CHS) to provide administrative and management services to the ACO, and all of its participating providers are contracted with the ACO.

Exhibit B.3 lists the names of the 44 ACOs and the year they started in the NGACO model and their risk levels, payment mechanisms, benefit enhancement elections, and organizational type in the second performance year of the model.

Exhibit B.3. List of ACOs Participating in the NGACO Model and Their Model Feature Elections by Cohort in PY2

ACO Organization Name [Abbreviation]	Number of Beneficiaries	Full Performance Risk (100%)	Cap on Savings or Losses (%)	Payment Mechanism	Benefit Enhancements			Organizational Type (Affiliation)
					3-Day SNF Rule Waiver	Post-Discharge Home Visit	Telehealth Expansion	
2016 Cohort								
Accountable Care Coalition of Southeast Texas, Inc. [ACCST]	15,058	■	6.5	PBP	■	■		Physician Practice
Beacon Health, LLC [Beacon]	12,322		10	FFS + IP	■	■	■	Hospital System
Bellin Health DBA Physician Partners, Ltd. (PPL) [Bellin]	9,500		15	FFS	■			IDS
Cornerstone Health Enablement Strategic Solutions, LLC [CHESS]	10,982	■	15	FFS + IP	■			Physician Practice/Hospital
Deaconess Care Integration [Deaconess]	35,094	■	9	FFS	■			Physician Practice/Hospital
Henry Ford Physician Accountable Care Organization [Henry Ford]	24,392		10	FFS + IP	■		■	IDS
Lifeprint (Optum) Accountable Care Organization, LLC [Optum]	34,422		5	PBP	■			Physician Practice
MemorialCare Regional ACO, LLC [MemorialCare]	14,301		5	FFS	■	■		IDS
Park Nicollet Health Services [Park Nicollet]	13,618		5	FFS	■			IDS
Pioneer Valley Accountable Care, LLC [Pioneer Valley]	41,250		5	FFS + IP				Physician Practice/Hospital
Steward Integrated Care Network, Inc. [Steward]	49,792	■	5	PBP	■			IDS
ThedaCare ACO, LLC [ThedaCare]	13,667		5	FFS				Hospital System
Triad HealthCare Network, LLC [Triad]	29,841	■	8	PBP				Physician Practice/Hospital
Trinity Health ACO Inc. [Trinity]	83,102		6.5	FFS + IP				IDS
UniPhy ACO, LLC (originally called Baroma Accountable Care, LLC) [UniPhy]	13,606		5	PBP				Physician Practice

ACO Organization Name [Abbreviation]	Number of Beneficiaries	Full Performance Risk (100%)	Cap on Savings or Losses (%)	Payment Mechanism	Benefit Enhancements			Organizational Type (Affiliation)
					3-Day SNF Rule Waiver	Post-Discharge Home Visit	Telehealth Expansion	
UnityPoint Accountable Care (Iowa Health Accountable Care) [UnityPoint]	76,479		5	PBP	■	■		IDS
2017 Cohort								
Accountable Care Coalition of Chesapeake, LLC [ACCC]	24,284		7.5	PBP	■			Physician Practice
Accountable Care Options, LLC [Accountable Care Options]	9,941	■	15	PBP	■	■		Physician Practice
Allina Integrated Medical Network [Allina]	29,553	■	15	PBP	■		■	Hospital System
ApolloMed ACO, Inc. [APA]	23,838		5	AIPBP	■	■	■	Practices
Arizona Care Network, LLC [Arizona]	22,918		5	FFS		■		Physician Practice/Hospital
Atrius Health, Inc. [Atrius]	30,361	■	5	FFS + IP	■			Physician Practice
Bronx Accountable Healthcare Network IPA, Inc. (Montefiore) [Bronx]	42,509	■	5	FFS + IP	■			Physician Practice
Carilion Clinic Medicare Shared Savings Company, LLC [Carilion]	47,254	■	8.5	FFS				IDS
Dartmouth-Hitchcock Health [Dartmouth-Hitchcock]	19,354		5	FFS	■			Hospital System
Fairview Health Services [Fairview]	15,489		5	FFS	■			IDS
HealthCare Partners (HCP) ACO California, LLC [HCP]	19,578	■	5	FFS				Physician Practice
Hill Physicians Medical Group [Hill]	14,865	■	5	FFS + IP				Physician Practice
Indiana University Health [Indiana U]	41,380	■	5	FFS	■			IDS
Integra Community Care Network, LLC [Integra]	15,550		5	PBP	■			Physician Practice/Hospital
KentuckyOne Health Partners, LLC [KentuckyOne]	27,245	■	10	FFS	■			Hospital System
Michigan Pioneer ACO, LLC [MPACO]	13,475	■	12	FFS + IP				Physician Practice/Hospital

ACO Organization Name [Abbreviation]	Number of Beneficiaries	Full Performance Risk (100%)	Cap on Savings or Losses (%)	Payment Mechanism	Benefit Enhancements			Organizational Type (Affiliation)
					3-Day SNF Rule Waiver	Post-Discharge Home Visit	Telehealth Expansion	
Monarch Health Plan [Monarch]	22,428	■	7.5	FFS	■	■		Physician Practice
National ACO, LLC [NatACO]	16,712		10	PBP	■			Physician Practice
Partners Community Physicians Organization [Partners]	88,531		5	FFS	■		■	IDS
NW Momentum Health Partners ACO [NW Momentum]	7,765		5	FFS + IP	■			Physician Practice/Hospital
Premier Health ACO of Ohio [Premier]	21,157		5	FFS	■			IDS
ProHealth Solutions, LLC [ProHealth]	15,748		5	FFS	■			Hospital System
Prospect ACO Northeast, LLC [ProspectNE]	14,819		5	FFS + IP	■			IDS
Regal Heritage California ACO [RHeritage]	23,107		5	FFS		■	■	Physician Practice
Sharp HealthCare ACO - II, LLC [Sharp]	32,101	■	5	FFS	■			Physician Practice/Hospital
St. Luke's Clinic Coordinated Care, LTD [St. Luke's]	26,951	■	10	PBP	■			Hospital System
UNC Senior Alliance, LLC [UNC]	19,996	■	5	FFS + IP	■			IDS
University of Texas (UT) Southwestern Accountable Care Network [UTSW]	67,880	■	15	FFS + IP	■			Hospital System

NOTES: PBP = population-based payment; AIBPB = all-inclusive population-based payment; FFS+IP = Fee-for-Service with Infrastructure Payments; SNF = skilled nursing facility; NGACOs that did not elect full performance risk (100%) elected 80% risk. Refer to Exhibit B.2 for examples of the ACO organizational types.

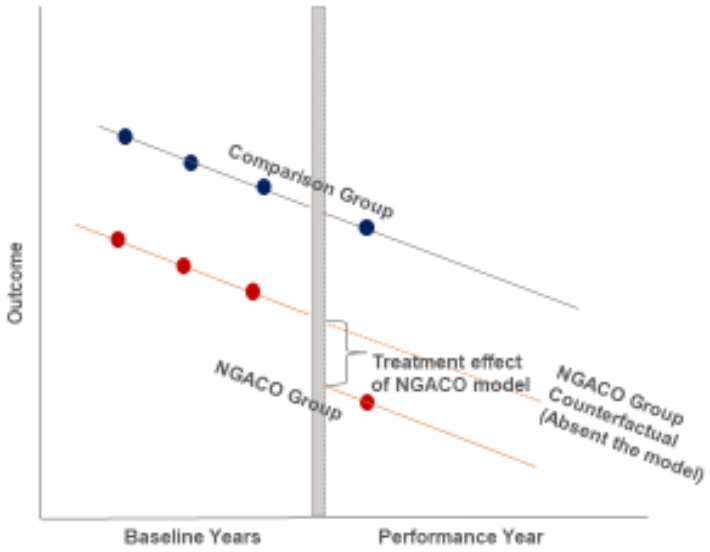
Appendix C: Methodology for Assessing Impacts of the NGACO Model

Study Design

Difference-in-Differences (DID) Design

Using the DID design, we assessed the impact of the NGACO model in PY1 and PY2. As shown in Exhibit C.1, the design compares differences in outcomes for the NGACO and propensity-score-weighted comparison beneficiaries (residing in the same markets) in a performance year against differences in outcomes for the NGACO and comparison groups in three preceding baseline years (BY1, BY2, BY3) for each cohort. A separate comparison group in the baseline period is created for each performance year by identifying beneficiaries who would be eligible for alignment with an NGACO had their care mainly been with NGACO providers. The comparison group is used to obtain an appropriate counterfactual of what would have happened to the NGACO beneficiaries in a performance year in the absence of the NGACO model. The DID design assumes that time-varying and time invariant unobservable factors affect the treatment and comparison group similarly. Together with propensity-score weights, this approach mitigates biases that may result from observed and unobserved differences between the NGACO and comparison group. A key assumption of our DID design is that changes in outcomes from the baseline years to performance year would have been similar in the NGACO and comparison group in the absence of the NGACO model. We test for this assumption of parallel trends across the baseline years for all outcomes and note where the assumptions passed and failed for each cohort and model-wide.

Exhibit C.1. Use of DID to Estimate the NGACO Model's Treatment Effect for Each Cohort



Performance and Baseline Years

As discussed, the analysis employed a DID design to examine changes in outcomes for the NGACO and comparison group beneficiaries in PY1 and PY2 relative to a 3-year baseline period (BY3, BY2, BY1) for each cohort. Exhibit C.2 shows the years acting as performance years and baseline years for both of the NGACO cohorts.

Exhibit C.2. Baseline Years and Performance Years for 2016 and 2017 NGACO and Comparison Group Cohorts

Performance Year	NGACO and Comparison Group	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017
PY1 (CY 2016)	2016 Cohort	BY3	BY2	BY1	PY1	-
PY2 (CY 2017)	2016 Cohort	BY3	BY2	BY1	-	PY2
	2017 Cohort	-	BY3	BY2	BY1	PY2

NOTE: CY = calendar year (January 1 through December 31).

Defining NGACO and Comparison Groups

Exhibit C.3 summarizes how the NGACO and comparison groups are defined for performance years and baseline years in Report Two. For each performance year and its respective baseline years, NGACO beneficiaries and comparison beneficiaries were *prospectively* attributed to the performance-year NGACO providers or providers unaffiliated with any NGACO, respectively.

Exhibit C.3. Summary of NGACO and Comparison Groups in Baseline Years and Performance Years

	Baseline Years	Performance Years
NGACO Group		
All NGACO-aligned FFS beneficiaries	Beneficiaries residing in NGACO market areas in the baseline years prospectively attributed to performance-year NGACO participating providers using the model's alignment rules, and aligned for at least 30 days in the year	Beneficiaries prospectively attributed to NGACO participating providers in a given performance year using the model's alignment rules, situated in NGACO market areas, and aligned for at least 30 days in the year
Comparison Group		
Alignment-eligible FFS beneficiaries in NGACO markets not aligned with NGACOs	Beneficiaries residing in NGACO market areas in the baseline years prospectively attributed to providers unaffiliated with any NGACO during the performance year using NGACO model alignment rules and aligned for at least 30 days in the year	Beneficiaries residing in NGACO market areas prospectively attributed to providers unaffiliated with any NGACO during the performance year using NGACO model alignment rules and aligned for at least 30 days in the year

Alignment Approach

We followed the NGACO model's alignment algorithm to prospectively attribute beneficiaries to the NGACO and comparison groups in our analyses, as summarized below for the second performance year.[1] We use the term *prospective attribution* because the NGACO model's alignment for a performance year and baseline years is based on Medicare claims from a *preceding* 24-month alignment period. We used the alignment algorithm to attribute beneficiaries to an NGACO's participating providers or to non-NGACO providers in each baseline or performance year based on providers who rendered the largest share (in dollars) of the beneficiaries' qualifying evaluation and management (QEM) visits in the alignment period.[2]

Exhibit C.4. Alignment Periods for the Second Performance Year Evaluation

Performance Year	Cohort	Period Type	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017
PY2 (CY 2017)	2016 Cohort		BY3	BY2	BY1	–	PY2
		Alignment Period	July 1, 2010 – June 30, 2012	July 1, 2011 – June 30, 2013	July 1, 2012 – June 30, 2014	–	July 1, 2014 – June 30, 2016
	2017 Cohort		–	BY3	BY2	BY1	PY2
		Alignment Period	–	July 1, 2011 – June 30, 2013	July 1, 2012 – June 30, 2014	July 1, 2013 – June 30, 2015	July 1, 2014 – June 30, 2016

NOTES: The alignment periods were applied to the NGACO and comparison group. CY = calendar year (January 1 through December 31). BY= base year; PY = performance year

We used the following seven steps to implement the alignment algorithm:

1. We identified alignment-eligible NGACO participating providers in PY2 and alignment-eligible non-NGACO providers in each BY or PY. Alignment-eligible providers in PY2 were identified as practitioners within practices or, in the case of federally qualified health centers, rural health clinics, and critical access hospitals, practitioners within facilities.[3] In defining the baseline providers, we identified the alignment-eligible providers by combinations of tax identification number (TIN) and national provider identifier (NPI) or CMS certification number (CCN) and NPI for the 2017 cohort. However, to define the baseline for the second year of the 2016 cohort, we identified the alignment-eligible providers by NPI alone to more comprehensively capture their practitioners' performance over time (because TIN-NPI and CCN-NPI combinations can change over time). Alignment-eligible

[1] A full description of the alignment algorithm is available from: RTI International. *Next Generation ACO Model Benchmarking Methods* (Appendix A). December 15, 2015. Available at https://innovation.cms.gov/Files/x/nextgenaco-methodology.pdf.

[2] QEM codes consist of the following: 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99324, 99325, 99326, 99327, 99328, 99334, 99335, 99336, 99337, 99339, 99340, 99341, 99342, 99343, 99344, 99345, 99347, 99348, 99349, 99350, 99495, 99496, 99490, G0402, G0438, G0439.

[3] Federally qualified health centers, rural health clinics, and critical access hospitals were identified based on billing codes 77, 71, and 85, respectively, on outpatient claims. Practitioners billing through CAHs included those that receive payment from Medicare through the Optional Payment Method, where the CAH bills for facility and professional outpatient services to Medicare when physicians or practitioners reassign billing rights to them.

practitioners had selected primary care or specialist designations.[4] Alignment for the comparison group in each cohort mirrored the approach used for the NGACO group.

2. We identified alignment-eligible beneficiaries at the beginning of each BY or PY using the enrollment database. Alignment-eligible beneficiaries had to: (1) be alive; (2) be covered by Medicare Parts A and B; (3) not be in a Medicare Advantage or other Medicare managed care plan; (4) not have Medicare as their secondary payer; (5) reside in the United States; and (6) have at least one paid claim for a QEM service during the two-year alignment period.

3. For all alignment-eligible beneficiaries in the BY and PY, we used Medicare claims to determine the total allowable charges for all QEM services received from each NGACO or non-NGACO provider during the alignment period. Charges from the earliest alignment year were weighted by one-third, and those in the recent alignment year were weighted by two-thirds to obtain the total weighted allowable charges for each alignment-eligible beneficiary.

4. We aligned each eligible beneficiary to an NGACO or non-NGACO provider according to the NGACO model's alignment rules based on the percentage of the beneficiary's weighted allowable charges for QEM services over the alignment period. The alignment rules give precedence to primary care specialists over other selected specialists and used recency of the QEMs to break ties.

5. We attributed voluntarily aligned beneficiaries to the NGACO in PY.[5] Voluntarily aligned beneficiaries were also aligned with the NGACOs in the baseline years if they were deemed to be alignment-eligible at the beginning of those years.[6] Voluntary alignment took precedence over claims alignment.

6. We checked the match between our aligned beneficiaries and the NGACO program analysis contractor's list of prospectively aligned beneficiaries in PY2. For our analysis, we retained NGACO PY2 beneficiaries who matched with the program analysis contractor's prospectively aligned beneficiary list in PY2. We had a match rate of 99 percent with the program analysis contractor's prospectively aligned population.

7. We excluded NGACO and comparison beneficiaries based on the NGACO model's exclusion criteria to determine their duration of alignment with the NGACO or comparison group in each BY or PY. A beneficiary was aligned with an NGACO or comparison group for all months of a baseline or performance year until he or she met an exclusion criterion.[7] In PYs, we also excluded beneficiaries

[4] Primary care practitioners included those with specialty codes 01, 08, 11, 37, 38, 50, 89, and 97. Specialists included those with specialty codes 06, 12, 13, 16, 23, 25, 26, 27, 29, 39, 46, 70, 79, 82, 83, 84, 86, 90, and 98.

[5] The proportion of NGACO voluntarily aligned beneficiaries was 1.02 percent for PY2 (0.62 percent for the 2017 cohort and 1.63 percent for the 2016 cohort), and 0.67 percent for PY1 (for the 2016 cohort).

[6] The following proportion of 2016 cohort NGACO PY2 beneficiaries were voluntarily aligned in baseline years: 0.72 percent for BY1, 0.77 percent for BY2, and 0.82 percent for BY3. The following proportion of the 2017 cohort NGACO PY2 beneficiaries were voluntarily aligned in baseline years: 1.74 percent for BY1, 1.67 percent for BY2, and 1.57 percent for BY3.

[7] A beneficiary was deemed aligned with the NGACO or comparison group during the performance year or baseline year from the beginning of the year until he or she had: (1) died; (2) had Medicare as a secondary payer during any month of a performance year or baseline year; (3) lost Medicare Part A or Part B during any month of a performance year or baseline year; (4) transitioned to Medicare Advantage or other managed care plan during any month of a performance year or baseline year; (5)

identified by the program analysis contractor for exclusion from the model on a quarterly basis under the model's alignment rules.[8] We restricted NGACO and comparison beneficiaries to those in hospital referral regions (HRRs) containing 1% or more of PY NGACO aligned beneficiaries. Beneficiaries who met exclusion criteria were retained in our evaluation from the beginning of the year until the date they met an exclusion criterion.[9] We identified the date a beneficiary's alignment ended for the year (alignment end-date) either as his or her date of exclusion from alignment or the last day of the calendar year. For each BY or PY, a beneficiary was aligned with the NGACO or comparison group from the first day of the year until the alignment end-date. We had a match rate of over 94 percent of the final population used by the program analysis contractor for financial reconciliation in PY2.[10]

Refinements to Evaluation Design, Rationale, and Implications for Timing of Reports

Since the First Annual Report, we have made two refinements to our evaluation design to assess the NGACO model's impact on spending and utilization in each performance year. We summarize these refinements, their rationale, and the cause for the delay of this report, from December 2018 to December 2019.

1. **The baseline for each NGACO cohort is updated for every performance year to reflect the baseline performance of the participating providers in the performance year of interest.** Going from PY1 to PY2, the 2016 cohort of NGACOs changed their mix of participating practices and practitioners (dropping specialists and adding primary care practitioners). Because NGACO beneficiaries in PY2 are aligned with PY2 participating providers, after examination we concluded that the baseline for the 2016 cohort should be updated to capture the historical performance of all of the ACOs' PY2 participating providers. Therefore, we updated the PY2 baseline for the 2016 cohort to capture care delivered before the start of the NGACO model by all PY2 practitioners and correctly assess the impact of the 2016 cohort in PY2 on Medicare spending. This method is similar to what was done for the evaluation of the Pioneer ACO Model. Updating the baseline for the 2016 cohort in PY2 required redoing alignment, propensity-score weighting, parallel-trends tests, and DID estimations, which delayed the production of this report.

2. **The NGACO and comparison group beneficiaries in each year are determined by prospective attribution to NGACO and non-NGACO providers, respectively; the comparison group does not exclude beneficiaries based on their concurrent assignment to Shared Savings Program**

resided in a non-U.S. location during any month of a performance year or baseline year; or (6) was aligned to another Medicare shared-savings initiative in the performance year. Prior to financial reconciliation, the program analysis contractor excludes NGACO-aligned beneficiaries who moved outside of an NGACO's extended service area during a performance year or received a majority of QEM services from a provider located outside of an NGACO's extended service area during a performance year. For the evaluation, we do not apply the latter exclusions to the NGACO or comparison group in the performance year or baseline year.

[8] The program analysis contractor shares lists of excluded beneficiaries on a quarterly basis with NGACOs to inform them of the beneficiary population that the ACOs are responsible for, so that the ACOs can suitably target their care coordination and care management efforts. Under the model, ACOs do not have any financial responsibility for excluded beneficiaries. Therefore, beneficiaries excluded by the program analysis contractor were also excluded from the evaluation beyond their date of exclusion.

[9] In contrast, the program analysis contractor excluded such beneficiaries from financial calculations for the year.

[10] This discrepancy is likely due to differences in timing of enrollment information and claims used for quarterly exclusions by the program analysis contractor and for the evaluation.

(SSP) ACOs. Our criteria for the comparison group are summarized in Exhibit C.3. We use the NGACO alignment approach to identify Medicare Fee-for-Service (FFS) beneficiaries prospectively aligned at the beginning of a baseline year or performance year to non-NGACO providers, employing claims from the two preceding years. In the First Annual Report, beneficiaries assigned to SSP ACOs were excluded from the comparison group. In the current evaluation report, SSP beneficiaries were allowed to be included in NGACO comparison groups. The decision to include SSP ACO beneficiaries in conventional FFS care, against which the NGACO model is being compared, acknowledges the prevalence of SSP beneficiaries in NGACO market areas as well as the program's progression into a common part of the traditional Medicare program.

In this Second Evaluation Report, we revised the construction of the comparison group so that it did not exclude beneficiaries based on concurrent assignment to SSP ACOs for two reasons:

1. The SSP ACO exclusion used in the First Annual Evaluation Report's (AR1) evaluation design is applied inconsistently between the treatment and comparison groups. NGACO alignment is prospective, and under the evaluation design used in AR1, beneficiaries retrospectively assigned to SSP ACOs were excluded from the comparison group. However, in the NGACO treatment group, beneficiaries who otherwise would have been assigned to SSP ACOs because of qualified evaluation and management (E&M) service use from SSP providers are retained in the treatment group per the model's alignment rules.

2. The systematic exclusion of concurrently assigned SSP ACO beneficiaries from the comparison group that were prospectively attributed to non-ACO providers contributed to the failure of the parallel trends tests for total Medicare spending. This finding was problematic for the evaluation because the lack of parallel trends in the baseline years violated an important assumption of the DID impact analyses, and estimated impacts on Medicare spending could not be attributed solely to the NGACO Model. When files including SSP ACO beneficiaries in the comparison group were used, the trends in the baseline years were parallel.

In summary, for the Second Report, we improve the conceptual similarity between the NGACO and comparison groups, defining them using the prospective alignment approach alone without applying any concurrent SSP ACO exclusions to the comparison group. This refinement is congruent with the prospective approach to alignment and risk-adjustment employed in the evaluation, tackles the issue of non-parallel trends in the baseline years, and yields interpretable impact estimates for total Medicare spending from robust DID models. We made these refinements to the comparison group to calculate cumulative results for the 2016 cohort in PY1 and PY2, as well as for the 2017 cohort in PY2 for the production of the Second Report.

NGACO and Comparison Group Providers

We discuss below the providers used for determining the aligned NGACO and comparison beneficiaries in performance years and baseline years for the 2016 and 2017 cohorts.

2016 and 2017 NGACO Cohorts in PY2. We identified providers participating in the 2016 and 2017 NGACO cohorts in PY2 (2017) using data from the program analysis contractor. These providers were

required to be practitioners (i.e., identified by NPIs) with primary care or specialist designations, according to the model's alignment rules in PY2, within either NGACO practices (as determined by TINs) or federally qualified health centers, rural health clinics, or critical access hospitals delivering outpatient services (i.e., identified by CCNs). The complete set of NGACO participating providers in PY2 was identified by their TIN-NPI and CCN-NPI combinations for the 44 NGACOs with financial liability for shared savings in 2017.

- For the 16 NGACOs in the 2016 cohort, participating providers in PY2 were defined as providers retained by the NGACOs from PY1, plus new providers who joined the NGACOs in PY2.
- For the 28 NGACOs in the 2017 cohort, participating providers in PY2 were defined as providers who joined these NGACOs in PY2, their first year in the model.

2016 and 2017 NGACO Cohorts in Baseline Period. The group of providers used to align beneficiaries to NGACOs during the baseline period was composed of all alignment eligible participating providers in PY2. The baseline period varies by cohort, as follows:

- For the 2016 cohort, all alignment eligible participating providers active in PY2 were used to align beneficiaries to the cohort's baseline years (2013-2015). This approach places greater emphasis on the baseline performance of individual practitioners participating in PY2 (the second model year for this cohort) than the practice associations that were present under NGACO because practitioner-practice combinations (TIN-NPIs and CCN-NPIs) observed in later performance years are less likely to be observed in the baseline years.
- For the 2017 cohort, participating providers in the baseline years were those participating practitioners within participating practices (TIN-NPIs and CCN-NPIs) in PY2.

2016 and 2017 Cohort Comparison Groups in PY2. For both the 2016 and 2017 cohorts, the comparison group of providers in PY2 included providers who were not affiliated with any Medicare ACO in the given year (see Exhibit C.6). Providers who left the NGACO model after PY1 are eligible for inclusion in the comparison group in subsequent years.

2016 and 2017 Cohort Comparison Groups in Baseline Period. Comparison group providers in the baseline years comprised providers who were not NGACO providers in PY2, as well as providers who were not in Medicare ACOs in the respective baseline years. As with the performance years, the comparison group in the baseline years may include providers who formerly participated in a Medicare ACO. We assume that once providers leave a Medicare ACO and return to usual FFS Medicare, they are valid representatives of the comparison group.

NGACO Market Areas for Evaluation of the Model

For the purpose of this evaluation, we defined an NGACO's market area as the collection of HRRs where 1 percent or more of an NGACO's aligned population of beneficiaries resided in the PY.[11] By defining the NGACOs' market areas using HRRs, we examine of the impact of the NGACO model in market areas

[11] Hospital referral regions are Medicare FFS markets representing catchment areas around tertiary medical centers. For an average NGACO with 10,000 aligned beneficiaries in 2017, geographically contiguous HRRs where 500 or more of its beneficiaries resided in 2017 were considered to comprise the NGACO's market.

where NGACOs have a meaningful footprint, using a sizable comparison group of non-NGACO beneficiaries in the same markets. HRRs have been used to define markets in prior ACO evaluations.[12] Exhibit C.5 lists the HRRs that comprise the markets for the 44 NGACOs in PY2. We limited our evaluation to NGACO and comparison group beneficiaries located in these market areas. To ensure that comparison beneficiaries drawn from the same markets were similar to NGACO beneficiaries, we propensity score weighted them on observed demographics, disease burden, and ZIP code-level community characteristics, as discussed in the section on propensity score weighting.

Exhibit C.5. NGACO's Market Areas for Evaluation of the Model in the PY2

NGACO	# of HRRs in the Market Area	State and City of HRRs Comprising the Market Area
2016 Cohort		
ACCST	2	TX: Beaumont, Houston
Baroma	4	FL: Fort Lauderdale, Jacksonville, Miami, Orlando
Beacon	2	ME: Bangor, Portland
Bellin	3	MI: Marquette; WI: Appleton, Green Bay
CHESS	3 [a]	NC: Greensboro, Hickory, Winston-Salem
Deaconess	3 [a]	IN: Evansville, Indianapolis; KY: Owensboro
Henry Ford	5	MI: Ann Arbor, Dearborn, Detroit, Pontiac, Royal Oak
MemorialCare	2 [a]	CA: Los Angeles, Orange County
Optum	3	AZ: Mesa, Phoenix, Sun City
Park Nicollet	2	MN: Minneapolis, St. Paul
Pioneer Valley	3	CT: Hartford; MA: Springfield, Worcester
Steward	4 [a]	MA: Boston, Worcester; NH: Manchester; RI: Providence
ThedaCare	4 [a]	WI: Appleton, Green Bay, Marshfield, Neenah
Triad	3 [a]	NC: Durham, Greensboro, Winston-Salem
Trinity	13 [a]	IL: Blue Island, Chicago, Hinsdale, Joliet, Melrose Park; MI: Muskegon; NJ: Camden, Hackensack, Morristown, New Brunswick, Newark; OH: Columbus; PA: Philadelphia
UnityPoint	8 [a]	IA: Cedar Rapids, Davenport, Des Moines, Iowa City, Sioux City, Waterloo; IL: Peoria, Springfield
2017 Cohort		
ACCC	6	DC: Washington; DE: Wilmington; MD: Baltimore, Takoma Park; VA: Arlington, Charlottesville
Accountable Care Options	2	FL: Fort Lauderdale, Miami
Allina	2	MN: Minneapolis, St. Paul
APA	4	CA: Los Angeles, Orange County, San Bernardino, Ventura
Arizona	3	AZ: Mesa, Phoenix, Sun City
Atrius	4	MA: Boston, Worcester; NH: Manchester; RI: Providence
Bronx	5	NJ: Hackensack, Ridgewood; NY: Bronx, Manhattan, White Plains
Carilion	5	NC: Durham, Winston-Salem; VA: Charlottesville, Lynchburg, Roanoke
Dartmouth-Hitchcock	3	MA: Boston; NH: Lebanon, Manchester
Fairview	3	MN: Duluth, Minneapolis, St. Paul

[12] McWilliams, J. Michael, Michael E. Chernew, Bruce E. Landon, and Aaron L. Schwartz. "Performance differences in year 1 of pioneer accountable care organizations." *New England Journal of Medicine* 372, no. 20 (2015): 1927-1936. McWilliams, J. Michael, Laura A. Hatfield, Michael E. Chernew, Bruce E. Landon, and Aaron L. Schwartz. "Early performance of accountable care organizations in Medicare." *New England Journal of Medicine* 374, no. 24 (2016): 2357-2366.

NGACO	# of HRRs in the Market Area	State and City of HRRs Comprising the Market Area
HCP	3	CA: Los Angeles, Orange County, San Bernardino
Hill	7	CA: Alameda County, Contra Costa County, Sacramento, San Francisco, San Jose, San Mateo County, Stockton
Indiana U	3	IN: Indianapolis, Lafayette, Muncie
Integra	2	MA: Boston; RI: Providence
KentuckyOne	2	KY: Lexington, Louisville
Monarch	4	CA: Los Angeles, Orange County, San Bernardino, San Diego
MPACO	5	MI: Ann Arbor, Dearborn, Detroit, Pontiac, Royal Oak
NatACO	9	AZ: Phoenix; CA: Los Angeles, Orange County; CO: Boulder, Denver; PA: Philadelphia; TN: Jackson, Memphis, Nashville
Northwest	3	WA: Olympia, Seattle, Tacoma
Partners	5	MA: Boston, Springfield, Worcester; NH: Manchester; RI: Providence
Premier	4	OH: Cincinnati, Columbus, Dayton, Kettering
ProHealth	2	WI: Madison, Milwaukee
ProspectNE	3	CT: Hartford, New Haven; RI: Providence
RHeritage	7	CA: Bakersfield, Los Angeles, Palm Springs/Rancho Mira, San Bernardino, San Diego, San Luis Obispo, Ventura
Sharp	1	CA: San Diego
St. Luke's	2	ID: Boise; UT: Salt Lake City
UNC	4	NC: Durham, Greensboro, Hickory, Raleigh
UTSW	2	TX: Dallas, Fort Worth

NOTES: [a] Denotes a change in hospital referral region (HRR) assignment from PY1: CHESS no longer includes Charlotte, NC; Deaconess no longer includes Paducah or Louisville, KY; MemorialCare no longer includes San Bernardino, CA; Steward added Manchester, NH; ThedaCare no longer includes Milwaukee, WI; Triad no longer includes Hickory, NC; Trinity added Chicago and Hinsdale, IL and no longer includes Muskegon, MI; UnityPoint added Davenport and Iowa City, IA.

Other Considerations

In constructing the analytic data set, we included several binary indicator variables that flag certain characteristics of beneficiaries that relate to participation in Medicare initiatives in baseline and performance years. These analytic flags include the following:

- **Participation in other CMMI initiatives:** For both the comparison group and NGACO groups, we identified whether these beneficiaries participated in other concurrent CMMI shared-savings initiatives [Comprehensive Primary Care Plus (CPC+), Comprehensive Primary Care (CPC), Financial Alignment Initiative (FAI), Independence at Home (IAH), and Multi-Payer Advanced Primary Care Practice (MAPCP)] and episodic initiatives (Bundled Payments for Care Improvement, Oncology Care Model, Comprehensive Joint Replacement). In this report, we present descriptive statistics on participation for both the 2016 and 2017 cohorts. We include covariates in our regression models to adjust for participation in other concurrent CMMI shared-savings initiatives but do not adjust for episodic initiatives.
- **Access to care from providers:** To ensure that comparison beneficiaries had similar access to care as the beneficiaries in the NGACO group, we defined a measure of access to providers as the number of alignment-eligible providers per 1,000 population, located within 10 miles of a beneficiary's ZIP code. This variable was included in our propensity score model, discussed below.

- **Additional beneficiary exclusions:** We applied the following inclusion and exclusion criteria to beneficiaries in the NGACO and comparison groups in each year. Beneficiaries were required to be 18 years or older, and must have been aligned with the group for at least one month in the year.

Data Sources

Exhibit C.6 shows the data used for the construction of the NGACO and comparison groups.

Exhibit C.6. Analytic File Construction: Data Sources and Rationale

Data (Years)	Rationale	Source(s)
NGACO participating and preferred provider lists (2017)	Identify the participating and preferred providers. NGACO beneficiaries were attributed to alignment eligible participating providers. Preferred providers were excluded from the non-ACO providers to which comparison beneficiaries were attributed.	CMS
NGACO attributed and excluded beneficiary lists	Identify the beneficiaries who were either aligned with an NGACO provider or who were excluded because of model exclusion criteria.	CMS
Beneficiaries in other Medicare shared savings initiatives (2013–2017)	Identify the beneficiaries in other Medicare shared savings initiatives. We flagged or excluded these beneficiaries from the comparison group of beneficiaries attributed to non-NGACO providers.	CMS
Beneficiaries in SSP, Pioneer, and NGACOs (2013-2017)	Used to calculate Medicare ACO penetration rate in HRR.	CMS
Medicare beneficiary summary and claims files (2010–2017)	Identify the NGACO and comparison group beneficiaries, their characteristics, and outcomes including spending, utilization, and quality. Also used to calculate Medicare Advantage penetration rate in HRR.	CMS
Provider Enrollment, Chain, and Ownership System; National Plan and Provider Enumeration System; and Medicare Data on Provider Practice and Specialty (2012–2016)	Identify individual providers (by NPIs) associated with practices (by TINs) and their specialties. Also used to compute measures of provider density by ZIP code and market competition (physician practice HHI and alignment-eligible providers per 1,000 population in HRR).	CMS
AHA survey data (2012–2016)	Calculate hospital competition in market (HHI) and acute care hospital beds per 1,000 population in HRR.	AHA
American Community Survey (2012–2016)	Identify the sociodemographic characteristics of communities (ZIP code tabulation area) where NGACO and comparison beneficiaries reside.	Census Bureau
Dartmouth Atlas ZIP code-HRR crosswalks (2012–2016)	Identify markets (HRRs) in relation to ZIP codes where NGACO and comparison beneficiaries reside.	Dartmouth Institute
ZIP code-ZIP code tabulation area crosswalks (2015–2017)	Link beneficiary ZIP code with community characteristics, which is at ZIP code tabulation area level (earlier versions of the crosswalks are not available).	HRSA

NOTES: AHA = American Hospital Association; HRR = hospital referral region; HRSA = Health Resources and Services Administration; HHI = Herfindahl-Hirschman Index.

Propensity Score Weighting

Because beneficiaries in our evaluation were not randomized to the NGACO and comparison groups, we used propensity score methods to ensure that the beneficiaries in the two groups were similar in their

observed characteristics.[13] This mitigates bias arising from differences in observed characteristics of NGACO and comparison beneficiaries. The propensity score is the predicted probability of a beneficiary being in the NGACO group in a year, conditional on a set of characteristics observed at the beginning of that year. We describe our approach to estimating propensity scores for beneficiaries in the NGACO and comparison groups in each baseline and performance year. The observed characteristics we considered for the propensity score included beneficiaries' demographic characteristics and disease burden as well as their community characteristics (ZIP code) and market (HRR) variables. For each NGACO and each baseline or performance year, we estimated propensity scores for beneficiaries in the NGACO and corresponding comparison group. We used logit models to predict the probability of a beneficiary being in the NGACO group (propensity score) based on the following characteristics:

- **Beneficiary characteristics** in the reference year included age, gender, race/ethnicity (white, black, Hispanic, Asian, other), disability, end-stage renal disease status, Medicaid dual-eligibility, Part D coverage, number of months aligned with the NGACO or comparison group in the year, death in the year, and disease burden at the end of the prior year. We defined a beneficiary's disease burden using 62 chronic condition indicators available on the Master Beneficiary Summary File in the Chronic Conditions Data Warehouse Virtual Data Research Center. These included 27 common chronic conditions and 35 other chronic or potentially disabling conditions the beneficiary had in the preceding year.[14] We did not use the hierarchical condition category risk score to measure a beneficiary's disease burden because it was deemed to be more susceptible to changes in provider coding practices than the chronic condition indicators.[15] We did not include utilization and cost in the reference or prior year, as these outcomes were assessed in our analysis of impacts of NGACO incentives; their inclusion would be expected to attenuate effects or dampen impacts.
- **Community characteristics** included rurality, density of providers within 10 miles per 1,000 population, and neighborhood socioeconomic characteristics (percentage of people living below the poverty line, percentage with high school and college education, and median income) of the beneficiary's ZIP code.
- **Market characteristics** included indicator variables for HRRs within which the beneficiaries reside.

After estimating propensity scores, we empirically tested various propensity score matching (one-to-one and one-to-many, both without and with replacement) and weighting methods to assess how they balanced the NGACO and comparison groups on the observed covariates, while allowing us to assess the average treatment effect on the treated.[16] Weighting the comparison beneficiaries by the odds of the propensity score offered the best covariate balance for each NGACO across a performance year and its

[13] Austin PC. An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behav Res.* 2011;46(3):399–424.

[14] CMS Chronic Condition Data Warehouse. *Chronic Condition Algorithms*. Available at: https://www.ccwdata.org/documents/10280/19139421/ccw-chronic-condition-algorithms.pdf; CMS Chronic Condition Data Warehouse. *Other Chronic or Potentially Disability Condition Algorithms*. Available at: https://www.ccwdata.org/documents/10280/19139421/other-condition-algorithms.pdf .

[15] RTI International. *Evaluation of the CMS-HCC Risk Adjustment Model Final Report*. 2011 Available at: https://www.cms.gov/Medicare/HealthPlans/MedicareAdvtgSpecRateStats/downloads/evaluation_risk_adj_model_2011.pdf .

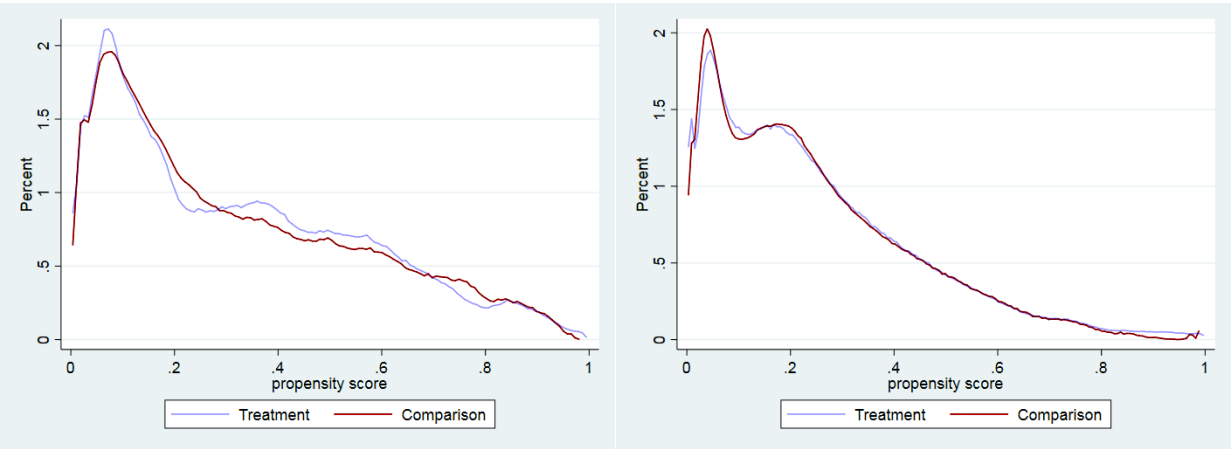
[16] Stuart EA. Matching methods for causal inference: A review and a look forward. *Stat Sci.* 2010;25(1):1; Hirano K, Imbens GW, Ridder G. Efficient estimation of average treatment effects using the estimated propensity score. *Econometrica.* 2003;71(4):1161–1189.

baseline years.[17] NGACO beneficiaries were assigned a weight of one, while the comparison beneficiaries were assigned weights of $PS_i/(1-PS_i)$, where PS_i is the beneficiary's propensity score.

Finally, we implemented additional checks of our results to assess the impact of weighting the comparison group by odds of the propensity score. First, because comparison beneficiaries with large weights could inordinately influence our results, we confirmed that a very small proportion of comparison group beneficiaries had large weights.[18] Second, covariates in the propensity score model were included in the DID models to obtain accurate impact estimates if the former were potentially misspecified.[19]

Exhibit C.7 shows graphs of the common support in the estimated propensity scores for the respective cohort's treatment (NGACO) and comparison group in Report Two. Specifically, the y-axis in each graph is the kernel density estimate of the probability density function of the propensity score.

Exhibit C.7. Common Support of the Propensity Score in PY2 and Baseline Years by Cohort



Measures of Spending, Utilization, and Quality

Exhibit C.8 details definitions for the 22 claims-based outcome measures for which we assess the NGACO model's impacts in the Second Report – total Medicare spending, seven categories of Medicare spending by care setting and service, 11 utilization measures, and three quality-of-care measures.

[17] We assessed covariate balance by looking at standardized differences for the covariates before and after matching or weighting. The method that yielded the lowest standardized difference of means across all covariates, with standardized differences <0.25 for all covariates, was considered to offer the best covariate balance.

[18] Less than 0.4 percent of the comparison beneficiaries had weight greater than three.

[19] Bang H, Robins JM. Doubly robust estimation in missing data and causal inference models. *Biometrics.* 2005;61(4):962–973.

Exhibit C.8. Definitions for Claims-Based Outcome Measures Assessed using DID Design

Measure	Definition
Medicare Spending[a]	
Total Medicare Parts A and B spending per beneficiary per year	Total Medicare Parts A and Part B spending per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare *paid amount* on Parts A and B claims from the start of the year until the end of the year or until the end date for beneficiary alignment (i.e., until she or he was excluded because of alignment exclusion criteria), for the treatment or comparison group.
Medicare spending on acute care inpatient hospitals per beneficiary per year	Total Medicare spending on acute care inpatient hospitals per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on facility claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group. Spending on Part B professional services in this setting is excluded.
Medicare spending on SNF per beneficiary per year	Total Medicare spending on SNFs, including swing beds, per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on SNF claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group. Spending on Part B professional services in this setting is excluded.
Medicare spending on other post-acute care facilities per beneficiary per year	Total Medicare spending on other inpatient post-acute care facilities (long-term care hospitals and inpatient rehabilitation hospitals) per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on facility claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group. Spending on Part B professional services in these settings is excluded.
Medicare spending on outpatient facilities per beneficiary per year	Total Medicare spending for outpatient facilities (including hospital outpatient department, emergency department [ED], ambulatory surgical centers, federally qualified health centers, and rural health centers) per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on facility claims from the start of the year until the end of the year or until the date the beneficiary remained aligned with the treatment or comparison group. Spending on Part B professional services in these settings is excluded.
Medicare spending on physician and professional services per beneficiary per year	Total Medicare Part B professional spending per beneficiary per year aligned with an NGACO or comparison group. Includes spending for physician and non-physician professional services and ancillary services, including ambulance, anesthesia, labs, imaging, and drugs administered in physician offices. Spending includes Medicare paid amount on Part B claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group.
Medicare spending on home health services per beneficiary per year	Total Medicare spending on home health services per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on home health services claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group. Spending on Part B professional services in the home setting is excluded.
Medicare spending on durable medical equipment per beneficiary per year	Total Medicare spending on durable medical equipment per beneficiary per year aligned with an NGACO or comparison group. Spending includes Medicare paid amount on durable medical equipment claims from the start of the year until the end of the year or until the last day the beneficiary remained aligned with the treatment or comparison group.
Utilization	
Acute care hospital stays per 1,000 beneficiaries per year	Number of acute care hospital stays per 1,000 beneficiaries per year aligned with an NGACO or comparison group. Stays that included transfers between facilities were counted as one stay. Stays that commenced after the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
SNF stays per 1,000 beneficiaries per year	Number of SNF stays per 1,000 beneficiaries per year aligned with an NGACO or comparison group. SNF stays that commenced after the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.

Measure	Definition
SNF days per 1,000 beneficiaries per year	Number of SNF days per 1,000 beneficiaries per year aligned with an NGACO or comparison group. SNF days after the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
ED visits (including observation stays) per 1,000 beneficiaries per year	Number of ED visits, including observational stays, per 1,000 beneficiaries per year aligned with an NGACO or comparison group. Visits that included transfers between ED facilities were counted as one visit. ED visits resulting in hospital stays were excluded. Visits from the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
E&M visits (excluding visits in acute care hospital and ED) per 1,000 beneficiaries per year	Number of nonhospital E&M visits from primary care or specialist providers per 1,000 beneficiaries per year aligned with an NGACO or comparison group (defined by BETOS codes for E&M visits, which include M1A, M1B, M4A, M4B, M5A, M5B, M5C, M5D, M6; E&M visits in acute care hospitals and EDs are excluded). Visits from the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
Procedures per 1,000 beneficiaries per year	Count of procedures per 1,000 beneficiaries per year aligned with an NGACO or comparison group. These were computed using the BETOS codes on the carrier and outpatient claims, and were specified as the number of claims for a beneficiary with code "PXX" incurred between the beneficiary's alignment start and end dates in each year.
Tests per 1,000 beneficiaries per year	Count of tests per 1,000 beneficiaries per year aligned with an NGACO or comparison group. These were computed using the BETOS codes on the carrier and outpatient claims, and were specified as the number of claims for a beneficiary with code "TXX" incurred between the beneficiary's alignment start and end dates in each year.
Imaging Services per 1,000 beneficiaries per year	Count of imaging per 1,000 beneficiaries per year aligned with an NGACO or comparison group. These were computed using the BETOS codes on the carrier and outpatient claims, and were specified as the number of claims for a beneficiary with code "IXX" incurred between the beneficiary's alignment start and end dates in each year.
Beneficiaries with Annual Wellness Visit (AWV) per 1,000 beneficiaries per year	Number of beneficiaries with an AWV in the year, per 1,000 beneficiaries aligned with an NGACO or comparison group. This measure reflects the likelihood of beneficiaries receiving an AWV visit in the year. AWV codes on Medicare claims include G0438 (for the initial visit) and G0439 (for subsequent visits). Annual wellness visits can be included in the E&M visit count.
Home health episodes per 1,000 beneficiaries per year	Number of episodes of home health for a beneficiary during the period aligned with the NGACO/comparison group. Episodes include sum of *60-day home health episodes, as well as home health episodes with low-utilization payment adjustments and partial episode payment adjustments*. Episodes from the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
Home health visits per 1,000 beneficiaries per year	Number of home health visits per 1,000 beneficiaries aligned with an NGACO or comparison group. The number of home health visits **for** *physical/occupational/speech therapy, skilled nursing, and medical social services and from home health aides* were identified based on lines with revenue center codes 420–449 and 550–599. Visits from the start of the year until the end of the year, or until the date the beneficiary remained aligned with the treatment or comparison group, are counted towards the measure.
Quality of Care	
Beneficiaries with hospitalizations for Ambulatory Care Sensitive Conditions (ACSC) per 1,000 beneficiaries per year	Number of beneficiaries with one or more ACSC acute care hospitalizations in the year, per 1,000 beneficiaries aligned with an NGACO or comparison group. This measure reflects the likelihood of beneficiaries being hospitalized for ACSCs during the year. ACSC hospitalizations include diabetes short-term complications, diabetes long-term complications, chronic obstructive pulmonary disease or asthma in older adults, hypertension, heart failure, dehydration, bacterial pneumonia, urinary tract infection, uncontrolled diabetes, asthma in younger adults, and lower-extremity amputation among patients with diabetes.[b]

Measure	Definition
Beneficiaries with unplanned 30-day readmissions per 1,000 beneficiaries per year	Number of beneficiaries with one or more occurrences of unplanned hospital readmissions within 30 days of discharge in the year, per 1,000 beneficiaries aligned with an NGACO or comparison group. This measure reflects the likelihood of beneficiaries having unplanned readmissions in the year. We used CMS's risk-standardized all condition readmission measure for ACOs to identify eligible hospitalizations and unplanned readmissions.[c] The denominator for this measure was limited to NGACO and comparison beneficiaries with one or more eligible hospitalizations in the year.
Beneficiaries with hospital readmissions from SNF, per 1,000 beneficiaries per year	Number of beneficiaries with one or more occurrences of unplanned hospital readmissions within 30 days of admission to SNF in the year (immediately after a preceding hospitalization), per 1,000 beneficiaries aligned with an NGACO or comparison group. The measure reflects the likelihood of beneficiaries having unplanned 30-day readmissions following a SNF stay during the year. We used CMS's SNF Readmission Measure to identify eligible SNF admissions and unplanned readmissions occurring within 30-days of SNF admission.[d] The denominator for this measure was limited to NGACO and comparison beneficiaries with one or more eligible SNF admissions in the year.

NOTES: [a] All Medicare spending is expressed in 2017 dollars and is based on Medicare paid amounts on claims; we do not exclude any outlier payments nor do we use standardized payments. Our models adjust for health, demographic, and market characteristics. For providers in ACOs that opted for population-based payments or all-inclusive-population-based-payments, we used the actual amount Medicare would have paid for services absent the population-based payments. Findings were consistent to sensitivity analyses that excluded payments above the 99th percentile.

[b]Agency for Healthcare Research and Quality. Prevention Quality Overall Composite Technical Specifications. *Prevention Quality Indicator 90*, Version 6.0, 2016. Available at: http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V60-ICD09/TechSpecs/PQI_90_Prevention_Quality_Overall_Composite.pdf; For claims prior to October 1, 2015, with ICD-9 codes, we used Version 5.0 of *Prevention Quality Indicator 90*. For claims after October 1, 2015 with ICD-10 codes, we used Version 6.0 of *Prevention Quality Indicator 90*.

[c] Centers for Medicare & Medicaid Services. *A Blueprint for the CMS Measures Management System, ACO #8: Risk-Standardized All Condition Readmission*. Version 1.0, 2012. Available at: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/Downloads/Measure-ACO-8-Readmission.pdf.

[d] Smith L, West S, Coots L, Ingber M, Reilly K, Feng Z, Etlinger A, et al. Skilled nursing facility readmission measure (SNFRM) NQF# 2510: All-cause risk-standardized readmission measure. Waltham, MA: RTI International; 2015. Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/SNFRM-Technical-Report-3252015.pdf.

ACSC = ambulatory care sensitive condition; AWV= annual wellness visit; BETOS = Berenson-Eggers Type of Service; E&M = evaluation and management; ED = emergency department; SNF = skilled nursing facility.

Analytic Approach to Estimate Impacts of the NGACO Model

Exhibit C.9 summarizes the models used for the 22 claims-based outcome measures for the 2016 cohort (18 NGACOs) in PY1 and both the 2016 and 2017 cohorts (44 NGACOs) in PY2. Outcome measures for spending and utilization were modeled as continuous variables, using generalized linear models (GLMs). For outcomes where more than 20 percent of the sample had zero values, we used two-part models, with a probit model to assess the likelihood of a nonzero outcome and GLM to assess levels of the outcome for those with nonzero outcomes. For outcome variables modeled with GLMs, we determined the appropriate distributional form using a modified Park test.[20] This test examined the heteroscedasticity of the error term to ascertain the appropriate distribution. One utilization measure (beneficiaries with AWV) and three quality-of-care measures were modeled as binary measures.[21]

[20] Manning W, Mullahy J. Estimating log models: To transform or not to transform? *J Health Econ*. 2001;20:461–494.

[21] A Medicare beneficiary is eligible for a single wellness visit annually, so this utilization measure was modeled as a binary variable. For ambulatory care sensitive condition hospitalizations, unplanned 30-day readmissions, and unplanned 30-day SNF readmissions, few beneficiaries had events, and fewer had more than one event. We chose to model these as binary measures, whether or not the beneficiary had the event during the year.

Exhibit C.9. Models Used for Specific Outcome Measures

Outcome Measure	Model Used
Spending	
Total Medicare spending	GLM: Gamma distribution and log link
Physician services spending	GLM: Poisson distribution and log link
Outpatient facility spending Acute care hospital facility spending Other post-acute care facility spending Home health spending	TPM: first part probit; second part GLM with gamma distribution and log link
SNF spending	TPM: first part probit; second part GLM with Poisson distribution and log link
Durable medical equipment spending	TPM: first part probit; second part GLM with Gaussian distribution and log link
Utilization	
Acute care hospital admissions ED visits including observation stays SNF days SNF stays Home health visits Home health episodes	TPM: first part probit; second part GLM with negative binomial distribution and log link
E&M visits (excluding inpatient hospital and ED) Procedures Tests Imaging	GLM; Poisson distribution and log link
Beneficiaries with Annual Wellness Visit	Logit
Quality of Care	
Beneficiaries with ACS hospitalizations Beneficiaries with unplanned 30-day readmissions Beneficiaries with unplanned 30-day SNF readmissions	Logit

NOTES: E&M = evaluation and management; ED = emergency department; GLM = generalized linear model; SNF = skilled nursing facility; TPM = two-part model.

Difference-in-Differences Regression Models for Estimating impacts in PY1 and PY2. We estimated impacts using DID regression models for the 2016 cohort in PY1 and for both cohorts (2016 and 2017) in PY2 separately. The model-wide impact in PY2 was calculated by weighting the impact estimates for the two cohorts by their respective proportion of NGACO beneficiaries in the year.

We report impact estimates in a performance year as relative increases or relative decreases, in relation to the NGACO counterfactual absent the model. While all outcomes are at the beneficiary level, we describe impacts as relative increases or decreases for NGACOs, as the intervention was at the ACO level. We report two sets of impact estimates for PY2: model-wide and for the two cohorts.

Equation C.1 shows the general specification of the DID model that we used to estimate impacts of the NGACO model in a given performance year.

Equation C.1: DID model for estimating impact in a given performance year, with fixed effects for years, controlling for beneficiary, community characteristics, and hospital referral region (HRR) fixed effects

$$g\,[E(Y_{ijkt})] = \beta_0 + \beta_1 NGACO_j + \delta_1 BY2_t + \delta_2 BY1_t + \delta_3 PY_t + \theta_1\, NGACO_j * PY_t + \Upsilon BENE_{ijkt} + \Lambda Community_{jkt} + \Pi HRR_k + \varepsilon_{ijkt}$$

Wherein:

- Y is the outcome for the i^{th} beneficiary in NGACO or comparison group *j*, in market *k*, in year *t*. We model Y with appropriate distributional form and link function *g*, based on the spending, utilization, or quality-of-care outcome, as discussed below.
- β_0 is the intercept.
- $NGACO_j$ is the binary indicator for being in the NGACO group in either performance years or baseline years. It is set to the value of one if the beneficiary is aligned with an NGACO PY2 provider. The coefficient β_1 captures the fixed difference between the NGACO and comparison group.
- $BY2$, $BY1$, and PY are fixed effects for each year (with $BY3$ as reference) whose coefficients $(\delta_1, \delta_2, \delta_3)$ capture changes in the NGACO and comparison group over time.
- Coefficient θ_1 is the DID estimate for $NGACO_j * PY_t$, the binary indicator for being in the NGACO group in a given performance year of the NGACO model. The θ_1 coefficient is the impact of NGACO model on its providers' beneficiaries. Because most NGACOs prior participation in SSP or the Pioneer ACO Model, this estimate should be interpreted as the marginal effect of the NGACO Model over prior Medicare ACO models.
- $BENE$ and $Community$ are sets of beneficiary and community characteristics with coefficient sets Υ and Λ, respectively (as discussed below).
- HRR is a fixed effect for each HRR with coefficient vector Π, to control for time-variant differences across markets.
- ε_{ijkt} is the random error term.

Because we are interested in estimating the average treatment effect for the NGACO group, our models included weights for the comparison to make it comparable to the NGACO group on the beneficiary and market-level covariates specified below.

We provide details below of the estimation of the cohort-level models based on Equation C.1. All models were estimated using *Stata 15*.[22]

Cohort-level models. Impacts at the cohort level were estimated as follows:

- Beneficiary-level covariates included age, gender, race/ethnicity, disability, end-stage renal disease status, dual-eligibility, number of months of alignment in the year, death in the year, and disease burden at the end of the preceding year (using indicators for 62 chronic conditions). We also included the square of months aligned because outcomes could increase nonlinearly based on the number of months a beneficiary was aligned with the NGACO or comparison group in a given baseline or performance year. We also included variables that accounted for NGACO and comparison

[22] StataCorp. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP; 2015.

beneficiaries' participation in other shared-savings CMMI initiatives during the baseline years and performance year. These initiatives included CPC+, CPC, FAI, IAH, and MAPCP.[23]

- Community-level covariates included number of alignment-eligible providers within 10 miles per 1,000 population, percent of population in poverty, percent of population with a college education, and urban/rural status based on beneficiary ZIP code.
- We clustered standard errors at the level of the NGACO's market for the treatment and comparison groups, respectively, because outcomes could be correlated within these clusters.[24]

Post-estimation calculations. We performed the following four post-estimation calculations:

- Because we used nonlinear models for the outcome variables, we employed the approach suggested by Puhani (2012) to express the DID theta coefficient in Equation C.1 as the estimated outcome for the treated NGACO group relative to its expected outcome absent the treatment.[25] We calculated these results using post-estimation predictions, computing the marginal effect for all treated beneficiaries and subtracting the marginal effect for these beneficiaries with the DID interaction term set to zero.[26] We computed confidence intervals using the delta method.[27]
- We expressed the estimated impact as a percentage of the expected outcome for the NGACO group in a given performance year absent the model. We computed the percentage change from the DID coefficient for outcomes estimated with log-linear models.[28] For outcomes estimated with two-part models, we computed the predicted level of outcomes for NGACO beneficiaries in a given performance year absent NGACO incentives by summing the adjusted mean for the comparison group in that performance year and the adjusted difference between the NGACO and the comparison group in the baseline years. We obtained the latter from the average predicted and adjusted outcomes for the NGACO and comparison group in the baseline years, which we calculated post-estimation.
- We used post-estimation marginal effects to predict the average adjusted outcomes (e.g., the conditional means) for the NGACO and comparison group in the baseline period (all baseline years) and performance year. We report these for the NGACO and comparison group in Appendix D alongside the impact estimates to understand whether the latter were driven by improved performance for the NGACO group or deteriorating performance for the comparison group or both.
- Finally, we expressed impact estimates for measures of spending and utilization from our annual models as per beneficiary per month and per 1,000 beneficiaries per month, respectively. We

[23] We excluded variables that captured participation of NGACO and comparison beneficiaries in overlapping episodic CMMI initiatives (Oncology Care Model, Comprehensive Bundle Payments for Care Improvement, and Comprehensive Joint Replacement) because they were indicative of care that could take place based on certain health needs, so their inclusion resulted in the failure of parallel trends for total spending for one or more cohorts. We also did not flag beneficiaries in the comparison group who were assigned to Shared Savings Program ACOs because NGACO alignment rules disallowed NGACO beneficiaries from also being assigned to other ACOs and resulted in the failure of parallel trends for total spending for one or more cohorts.

[24] Bertrand M, Duflo E, Mullainathan S. How Much Should We Trust Differences-in-Differences Estimates. *Q J Econ.* 2003;119(1):249–275. Cameron AC, Miller DL. *Robust Inference with Clustered Data*. University of California, Department of Economics; 2010. Working Papers, No. 10(7).

[25] Puhani PA. The treatment effect, the cross difference, and the interaction term in nonlinear "difference-in-differences" models. *Econ Lett*. 2012;115(1):85–87.

[26] Karaca-Mandic P, Norton EC, Dowd B. Interaction terms in nonlinear models. *Health Serv Res.* 2012;47(1pt1):255–274.

[27] Dowd BE, Greene WH, Norton EC. Computation of standard errors. *Health Serv Res.* 2014;49(2):731–750.

[28] For a log-linear model with a dummy variable D: $ln[E(Y)] = a + bX + cD + \varepsilon$; if D switches from 0 to 1, then the percentage impact of D on Y is $100[exp(c) - 1]$, where c is the coefficient on the dummy variable.

calculated the per-month estimates by dividing the annual impact estimates for these measures by the average months of alignment for the NGACO beneficiaries in the performance year.

Testing the assumption of parallel trends in the baseline years. A key assumption of the DID design is that the NGACO and the comparison group had similar trends in outcomes during the baseline years before the onset of the NGACO incentives. This assumption of parallel trends allows the comparison group to establish a reliable counterfactual for the NGACO group in a given performance year in the absence of the NGACO model. We tested this assumption using Equation C.2, which extended Equation C.1 by including leading interaction terms for NGACO treatment effects in BY1 and BY2 (relative to BY3). We assessed whether the coefficient θ_{-2} for the leading interaction term in BY1 was significantly different from zero ($p<0.05$). If this was significantly different, the assumption of parallel trends did not hold.

Equation C.2: DID model with leading interaction terms, controlling for beneficiary, HRR, and community characteristics

$$g\left[E\left(Y_{ijkt}\right)\right] = \beta_0 + \beta_1 NGACO_j + \delta_1 BY2_t + \delta_2 BY1_t + \delta_3 PY_t + \theta_{-2} NGACO_j * BY1_t + \theta_1 NGACO_j * PY_t + \gamma BENE_{ijkt} + \Lambda Community_{jkt} + \Pi HRR_k + \varepsilon_{ijkt}$$

For this evaluation, we determined that the DID estimate for a performance year was valid if the trends between the NGACO and comparison group were parallel between BY1 and BY3, and θ_{-2} did not reach statistical significance ($p<0.05$). Our assumption allowed the NGACO providers and organizations to outperform or underperform on outcomes relative to the comparison group mid-baseline (BY2 vs BY3). However, the NGACO and comparison groups were required to have similar trends in the year immediately prior to start of the NGACO model in the event that the treatment group underwent any marked changes prior to start of the model.[29]

Calculating net impacts of the model on Medicare spending. In addition to estimating the gross impact of the NGACO model in reducing total Medicare Parts A and B spending, we used publicly available data on the financial performance of the NGACOs to calculate the net impact of the NGACO model on Medicare spending. This net estimate considers shared savings payments by Medicare to NGACOs in 2016 and 2017.

Sensitivity checks. We conducted the following sensitivity checks to assess the robustness of our estimated impacts for the 2016 cohort in PY1 and the 2016 and 2017 cohorts in PY2. Results from our sensitivity checks are presented in Appendix D, Exhibit D.9.

- **Main analysis:** We used a gamma distribution with log link to model total Medicare spending per beneficiary per year for the beneficiaries in our study. The gamma distribution was better at modeling the higher spenders compared with alternative distributions.[30] To assess the NGACOs' impact on the entirety of Medicare (Parts A and B) spending for their beneficiaries, we did not cap spending in our main analyses.

[29] Ashenfelter O. Estimating the Effect of Training Programs on Earnings. *Rev Econ Stat.* 1978;60:47–50.

[30] The modified Park test showed the gamma distribution had the best fit for modeling total Medicare spending for beneficiaries in our study.

- **Sensitivity analysis 1:** We capped Medicare spending at the 99th percentile to assess the robustness of impact estimates to the possibility of random variation in the highest spenders between the NGACO and comparison groups. The model-wide impacts in PY2 for total spending were largely unchanged (Exhibit D.8).

Estimation of Model-Wide and Cohort-Level Cumulative Impact as of PY1 and PY2

The impact estimates were weighted by the proportion of NGACO beneficiaries in each cohort in the performance years to get the cumulative impacts, as shown in Exhibit C.10. We estimated the **model-wide** cumulative impact in PY1 and PY2 by weighting impact estimates from DID regressions to evaluate:

- 2016 cohort in PY1 (18 ACOs);
- 2016 cohort in PY2 (16 ACOs); and
- 2017 cohort in PY2 (28 ACOs).

We similarly estimated the cumulative impact of the **2016 cohort** in PY1 and PY2 by weighting the DID impact estimates for:

- 2016 cohort in PY1 (18 ACOs); and
- 2016 cohort in PY2 (16 ACOs).

In calculating the cumulative estimates:

- We assumed that the DID estimates for the cohorts and performance years were independent.
- We computed PBPY, aggregate, percentage impacts, and conditional means for the NGACO and comparison groups [in BYs and PY(s)] was done with the cohort-level DID estimates.
- We tested the significance of the cumulative impact estimates by determining the two-sided p-value based on the normal cumulative distribution function z-score:

$$z - score = \frac{x-\mu}{\sigma}$$

where X is the cumulative DID estimate, μ is zero, and σ is the standard error of the cumulative DID estimate.

Cumulative impacts for outcomes where any of the contributing impact estimates were uninterpretable due to failure of parallel trends, were considered uninterpretable and are not reported.

Exhibit C.10. Treatment Group Sizes and Their Contributions to the Cumulative Impact Estimates

		2016 Cohort in PY1		2016 Cohort in PY2		2017 Cohort in PY2	
	Total number of beneficiaries	Number of beneficiaries	Proportion	Number of beneficiaries	Proportion	Number of beneficiaries	Proportion
Model-Wide PY1 + PY2	1,709,394	477,179	0.2792	477,426	0.2793	754,789	0.4416
Model-Wide PY2	1,232,215	-	-	477,426	0.3875	754,789	0.6125
2016 Cohort PY1 + PY2	954,605	477,179	0.4999	477,426	0.5001	-	-

Appendix D: Exhibits to Support Claims-Based Analysis

Appendix D includes exhibits that supported the analyses of our claims-based research presented in Report 2. In summary, these tables provide the difference-in-differences results model-wide and for the two cohorts in PY2 (2017), and cumulatively in PY1 and PY2 (2016 & 2017). We present impacts for spending, utilization, and quality of care results for all 22 outcome measures studied both model-wide and for both cohorts. We also present conditional means for the base and performance years as well as aggregate estimates. This chapter is organized as follows:

- **Exhibit D.1 – D.2** Descriptive Characteristics of NGACO Beneficiaries and Propensity-Score-Weighted Comparators in PY2
- **Exhibit D.3 – D.6** Estimated Impact and Aggregate Impact of NGACO Model in PY2
- **Exhibit D.7** Estimated Gross and Net Impact on Medicare Spending of the NGACO Model in PY2
- **Exhibit D.8** Sensitivity Analysis: Impact in PY2 After Truncating Total Gross Medicare Spending at 99th Percentile
- **Exhibit D.9 – D.11** Estimated Cumulative Impact of NGACO Model in PY1 and PY2
- **Exhibit D.12** Estimated Cumulative Gross and Net Impact on Medicare Spending of the NGACO Model in PY1 and PY2
- **Exhibit D.13** Breakout of NGACO group's Total Medicare Gross Spending in Baseline Years, Across Care Settings

In each table, the DID estimate is the estimated relative change per beneficiary per year (for spending), per 1,000 beneficiaries per year (for utilization counts), or per 1,000 beneficiaries per year (for beneficiaries' quality-of-care outcomes). The "% Impact" is the percentage impact relative to expected outcome for the NGACO group in PY(s) absent the NGACO model. The aggregate impact is the estimated relative change for all beneficiaries aligned with the NGACO in PY(s).

Spending outcomes reflect Medicare paid amounts in 2017 dollars. For providers in NGACOs that opted for population-based payments, we used the amount Medicare would have paid for these services. Medicare spending in facilities settings [outpatient, acute care hospital, SNF, other post-acute care facilities (including long-term care hospitals, inpatient rehabilitation hospitals)] excludes spending for professional services.

Exhibit D.1. Descriptive Characteristics of the 2016 Cohort's NGACO-Aligned and Propensity Score-Weighted Comparison Beneficiaries

	Baseline Years		PY2		Differential Change
	NGACO	Comparison	NGACO	Comparison	
Number of beneficiaries	1,400,402	1,398,371	477,426	476,719	-
Total person-months	16,153,072	16,253,284	5,490,945	5,532,278	-
Variables Included in Propensity Score Models					
Mean months of alignment (±SD)	11.5 ± 1.9	11.6 ± 1.8	11.5 ± 1.9	11.6 ± 1.8	-0.015**
Mean Age (years ± SD)	73.1 ± 12.3	73.2 ± 12.4	73.2 ± 11.7	73.3 ± 11.9	-0.081**
Gender (%)					
Male	41.9	41.9	42.4	42.3	0.039
Race/Ethnicity (%)					
White	85.4	85.7	85.1	85.4	0.042
Black	7.1	6.9	6.9	6.8	-0.052
Hispanic	4.8	4.6	4.4	4.2	-0.071
Asian	1.4	1.4	1.5	1.5	0.017
Other	1.4	1.4	2.1	2.1	0.062*
Disability/ESRD (%)					
Disability	14.7	14.7	13.4	13.3	0.150
ESRD	1.0	1.0	0.9	1.0	-0.001
Coverage (%)					
Any dual eligibility	20.7	21.0	18.8	19.2	-0.086
Any Part D coverage	71.2	71.7	76.8	77.5	-0.197
Chronic Conditions					
Mean no. of chronic conditions (± SD)	5.0 ± 3.5	5.1 ± 3.6	5.3 ± 3.7	5.4 ± 3.7	-0.024**
Alzheimer's/dementia (%)	8.7	9.1	8.4	8.9	-0.156*
Chronic kidney disease (%)	17.0	17.2	23.6	24.1	-0.329**
COPD (%)	11.2	11.3	11.6	11.7	-0.015
Congestive heart failure (%)	12.9	13.1	12.6	12.9	-0.154
Diabetes (%)	29.0	28.9	28.1	28.0	-0.081
Ischemic heart disease (%)	28.1	28.1	26.3	26.6	-0.235*
Depression (%)	17.9	18.1	19.7	20.0	-0.088
RA/OA (%)	32.3	32.4	34.5	34.7	-0.080
Stroke/TIA (%)	3.6	3.7	3.5	3.6	-0.042
Cancer (%)	9.1	9.2	9.3	9.4	-0.021
Mortality (%)					
Death in reference period	4.1	4.8	3.9	4.8	-0.241***

	Baseline Years		PY2		Differential Change
	NGACO	Comparison	NGACO	Comparison	
Community Characteristics					
Median income ($ ± SD)	59104.5 ± 23092.5	59349.8 ± 24045.4	62310.5 ± 24290.3	62602.9 ± 25321.6	-46.988
Below poverty line (% ± SD)	13.0 ± 8.7	12.9 ± 8.5	12.7 ± 8.5	12.5 ± 8.4	0.030
Bachelor's degree or higher (% ± SD)	28.9 ± 15.7	29.1 ± 16.1	30.9 ± 16.0	31.0 ± 16.6	0.067
Rurality (%)	18.8	18.8	18.3	18.2	0.014
Alignment-eligible providers within 10-mile radius of beneficiary ZIP code (per 1,000 population ± SD)‡	2.0 ± 1.2	2.0 ± 1.4	2.3 ± 1.3	2.3 ± 1.5	0.001
Variables Excluded from Propensity Score and Regression Models ±					
HRR Characteristics					
ACO penetration rate (% ± SD)	26.7 ± 16.1	26.9 ± 16.3	38.9 ± 11.3	38.8 ± 11.5	0.248***
Medicare Advantage penetration rate (% ± SD)	28.7 ± 13.7	28.9 ± 13.7	33.2 ± 13.8	33.6 ± 13.9	-0.148***
Practice HHI (± SD)	426.1 ± 412.6	427.7 ± 410.4	476.4 ± 439.6	475.1 ± 434.7	2.857**
Alignment-eligible providers (per 1,000 population ± SD)	1.4 ± 0.3	1.4 ± 0.3	1.9 ± 0.5	1.9 ± 0.5	0.004***
Participation in Medicare ACOs (%)					
NGACO	0.0	0.0	100.0	0.0	-
Pioneer	20.2	0.0	0.0	0.0	-
MSSP	36.5	12.5	0.0	7.9	-
Participation in Other CMMI Initiatives (%)					
Financial Alignment Demonstration	0.0	0.0	0.0	0.0	-
Independence at Home	0.0	0.1	0.0	0.1	-
Comprehensive Primary Care (including CPC+)	0.9	0.6	0.0	0.0	-
Multipayer Advanced Primary Care	0.0	0.0	0.0	0.0	-
Participation in Episodic CMS Initiatives (%)					
Bundled Payments for Care Improvement (BPCI) Initiative	0.6	0.5	2.1	1.8	-
Comprehensive Care for Joint Replacement (CJR) Model	0.0	0.0	0.1	0.2	-
Oncology Care Model	0.0	0.0	3.0	3.3	-

NOTES: p<0.1* p<0.05**, p<0.01***. † Where the relative change is less than 0.1, we do not denote statistical significance. COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; HHI = Herfindahl-Hirschman Index, a measure of the degree of market concentration or competition (higher HHI means more concentrated market, while lower HHI means more competitive market). The denominator for ACO penetration rate is the number of Medicare FFS beneficiaries with Part A and B coverage; the denominator for the MA penetration rate is total number of Medicare beneficiaries with Part A and B coverage. SSP = Medicare Shared Savings Program; OA = osteoarthritis; RA = rheumatoid arthritis; SD = standard deviation; TIA = transient ischemic attack. Community characteristics are at the ZIP code level. ‡ Alignment eligible providers per 1,000 persons based on the total population (not restricted to the Medicare population ± These HRR characteristics are not included in propensity score or DID regression models; rather, we account for changes in these HRR characteristics over time by including HRR fixed effects along with year fixed effects, in our PS and DID analysis. HRR characteristics are weighted to the proportion of NGACO and comparison beneficiaries in the HRRs in the BYs and PY.
SOURCE: NORC analysis of Medicare enrollment and claims data, 2013-2017 and ancillary data.

Exhibit D.2. Descriptive Characteristics of the 2017 Cohort's NGACO-Aligned and Propensity Score-Weighted Comparison Beneficiaries in Second Performance and Baseline Years

	Baseline Years		PY2		Differential Change
	NGACO	Comparison	NGACO	Comparison	
Number of beneficiaries	1,957,844	1,941,500	754,789	745,916	-
Total person-months	22,580,292	22,610,444	8,680,661	8,665,697	-
Variables Included in Propensity Score Models					
Mean months of alignment (± SD)	11.5 ± 1.9	11.6 ± 1.7	11.5 ± 1.9	11.6 ± 1.8	-0.004
Mean age (years ± SD)	73.3 ± 11.9	73.4 ± 11.9	73.5 ± 11.5	73.7 ± 11.5	-0.103***
Gender (%)					
Male	41.5	41.6	42.0	42.0	0.076
Race/Ethnicity (%)					
White	78.4	79.3	78.9	79.6	0.277***
Black	7.7	7.5	7.4	7.1	0.038
Hispanic	6.5	6.2	6.0	5.8	-0.105**
Asian	5.3	5.0	5.0	4.9	-0.237***
Other	2.1	2.1	2.7	2.6	0.027
Disability/ESRD (%)					
Disability	14.2	14.0	13.1	12.6	0.162**
ESRD	1.1	1.1	1.0	1.1	-0.009
Coverage (%)					
Any dual eligibility	22.4	21.9	20.2	20.1	-0.410***
Any Part D coverage	72.1	72.6	75.4	76.2	-0.258***
Chronic Conditions					
Mean number of chronic conditions (± SD)	5.2 ± 3.7	5.2 ± 3.7	5.4 ± 3.8	5.4 ± 3.8	-0.029***
Alzheimer's/dementia (%)	9.3	9.4	9.2	9.6	-0.226***
Chronic kidney disease (%)	19.3	19.3	24.3	24.5	-0.191**
COPD (%)	10.7	10.7	10.8	11.0	-0.102
Congestive heart failure (%)	13.5	13.6	13.0	13.3	-0.155**
Diabetes (%)	29.4	29.2	29.0	28.9	-0.110
Ischemic heart disease (%)	28.0	28.1	27.2	27.4	-0.208**
Depression (%)	18.6	18.6	19.5	19.6	-0.041
RA/OA (%)	33.4	33.3	35.3	35.4	-0.211**
Stroke/TIA (%)	3.7	3.7	3.6	3.7	-0.059
Cancer (%)	9.4	9.5	9.5	9.7	-0.051
Mortality (%)					
Death in reference period	3.8	4.4	3.7	4.6	-0.305***
Community Characteristics					
Median income ($ ± SD)	66089.3 ± 26987.0	66908.5 ± 28917.5	68874.2± 27965.7	69738.1 ± 30023.8	-44.686
Below poverty line (% ± SD)	13.1 ± 8.8	12.9 ± 8.9	12.6 ± 8.4	12.4 ± 8.5	0.019
Bachelor's degree or higher (% ± SD)	16.0	16.2	15.4	15.8	-0.244***
Rurality (%)	11.3	11.8	11.7	12.1	0.155**
Alignment-eligible providers within 10-mile radius of beneficiary ZIP code (per 1,000 population ± SD)‡	2.0 ± 1.2	2.0 ± 1.2	2.2 ± 1.3	2.2 ± 1.3	0.016***

	Baseline Years		PY2		Differential Change
	NGACO	Comparison	NGACO	Comparison	
Variables Excluded from Propensity Score and Regression Models ±					
Hospital Referral Region (HRR) Characteristics					
ACO penetration rate (% ± SD)	27.3 ± 13.7	27.4 ± 13.7	33.2 ± 12.7	33.2 ± 12.7	0.061**
Medicare Advantage penetration rate (% ± SD)	34.4 ± 14.4	34.3 ± 14.4	36.3 ± 14.2	36.2 ± 14.2	-0.052*
Practice HHI (± SD)	309.6 ± 331.0	310.9 ± 328.4	324.3 ± 337.3	323.9 ± 335.0	1.612*
Alignment-eligible providers (per 1,000 population ± SD)	1.4 ± 0.4	1.5 ± 0.4	1.9 ± 0.6	1.9 ± 0.6	0.003**
Participation in Medicare ACOs (%)					
NGACO	0.0	0.0	100.0	0.0	-
Pioneer ACO	30.0	0.0	0.0	0.0	-
SSP ACO	33.6	8.7	0.0	7.4	-
Participation in Shared Savings CMS Initiatives (%)					
Financial Alignment Demonstration	0.0	0.0	0.0	0.0	-
Independence at Home	0.0	0.1	0.0	0.1	-
Comprehensive Primary Care (including CPC Plus)	0.0	0.9	0.0	2.7	-
Multi-Payer Advanced Primary Care	0.0	0.0	0.0	0.0	-
Participation in Episodic CMS Initiatives (%)					
Bundled Payments for Care Improvement (BPCI) Initiative	0.9	1.0	1.2	1.4	-
Comprehensive Care for Joint Replacement (CJR) Model	0.1	0.1	0.2	0.3	-
Oncology Care Model	0.7	0.7	3.1	3.4	-

NOTES: p<0.1* p<0.05**, p<0.01***. † Where the relative change is less than 0.1, we do not denote statistical significance COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; HHI = Herfindahl-Hirschman Index, a measure of the degree of market concentration or competition (higher HHI means more concentrated market, while lower HHI means more competitive market). The denominator for ACO penetration rate is the number of Medicare FFS beneficiaries with Part A and B coverage; the denominator for the MA penetration rate is total number of Medicare beneficiaries with Part A and B coverage. SSP = Medicare Shared Savings Program; OA = osteoarthritis; RA = rheumatoid arthritis; SD = standard deviation; TIA = transient ischemic attack. Community characteristics are at the ZIP code level. ‡ Alignment eligible providers per 1,000 persons based on the total population (not restricted to the Medicare population). ± These HRR characteristics are not included in propensity score or DID regression models; rather, we account for changes in these HRR characteristics over time by including HRR fixed effects along with year fixed effects, in our PS and DID analysis.
SOURCE: NORC analysis of Medicare enrollment and claims data, 2013-2017 and ancillary data.

Exhibit D.3. Estimated Model-Wide Impact on Medicare Spending, Utilization, and Quality of Care in PY2 (2017)

	Baseline Years:		Model-wide in Performance Year 2:							
	2013-2016		2017		Difference-in-Differences					
	NGACO mean	Comparison mean	NGACO mean	Comparison mean	DID Estimate	NGACO Diff.	Comp Diff.	95% CI	% Impact	p
Spending ($ Per Beneficiary Per Year)										
Total Gross Medicare spending (Part A and B)	13185.30	13501.74	13046.98	13413.58	-50.16	↓	↓	-127.89 , 27.57	-0.40	0.206
Acute care hospital facility	4050.36	4080.63	4064.61	4106.10	-11.23	↑	↑	-51.61 , 29.15	-0.28	0.586
Skilled nursing facility	1102.19	1132.67	1007.51	1046.06	-8.07	↓	↓	-29.39 , 13.25	-0.79	0.458
Other post-acute care facility	435.03	427.49	398.16	405.38	-14.76 **	↓	↓	-27.96 , -1.57	-3.58	0.028
Outpatient facility	2127.96	2197.55	2277.83	2370.18	-22.75	↑	↑	-53.90 , 8.39	-0.99	0.152
Professional services	3119.67	3137.09	3117.51	3142.42	-7.49	↓	↑	-36.44 , 21.46	-0.25	0.612
Home health	-	-	-	-	§	-	-	§	-	-
Durable medical equipment	-	-	-	-	§	-	-	§	-	-
Utilization (Per 1,000 Beneficiaries Per Year)										
Acute care stays	316.23	317.47	316.64	316.85	1.03	↑	↓	-1.71 , 3.77	0.33	0.461
SNF stays	63.65	64.41	61.92	60.62	2.05 ***	↓	↓	0.79 , 3.31	3.43	0.001
SNF days	1527.79	1561.18	1351.82	1377.00	8.21	↓	↓	-23.41 , 39.82	0.61	0.611
ED visits & observation stays	546.13	555.13	563.19	574.64	-2.45	↑	↑	-7.38 , 2.49	-0.43	0.331
E&M visits	-	-	-	-	§	-	-	§	-	-
Procedures	9461.58	9579.76	10537.71	10627.78	28.11	↑	↑	-92.92 , 149.14	0.28	0.649
Tests	-	-	-	-	§	-	-	§	-	-
Imaging services	-	-	-	-	§	-	-	§	-	-
Home health episodes	164.61	162.34	164.89	161.86	0.75	↑	↓	-1.22 , 2.72	0.46	0.454
Home health visits	3998.92	4007.63	3932.80	3971.31	-29.81	↓	↓	-87.37 , 27.74	-0.75	0.310
Beneficiaries with AWV	257.81	214.28	395.98	303.57	48.87 ***	↑	↑	32.90 , 64.84	14.08	0.000
Quality of Care (Per 1,000 Beneficiaries Per Year)										
Beneficiaries with ACSC hospitalizations	43.44	43.77	42.68	42.82	0.19	↓	↓	-0.49 , 0.86	0.44	0.586
Beneficiaries with Unplanned 30-day Readmissions	154.60	154.90	151.99	152.93	-0.64	↓	↓	-3.21 , 1.93	-0.42	0.624
Beneficiaries with Hospital Readmissions from SNF	178.15	177.90	183.43	183.84	-0.66	↑	↑	-5.29 , 3.97	-0.36	0.779

NOTES: Difference-in-differences (DID) impact estimate significant at *p<0.1, **p<0.05, and ***p<0.01. § Denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the DID impact estimate per beneficiary per year. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.4. Estimated Impact of the 2016 Cohort on Medicare Spending, Utilization, and Quality of Care in PY2 (2017)

	Baseline Years:		2016 Cohort in Performance Year 2:							
	2013-2015		2017		Difference-in-Differences					
	NGACO mean	Comparison mean	NGACO mean	Comparison mean	DID Estimate	NGACO Diff.	Comp Diff.	95% CI	% Impact	p
Spending ($ Per Beneficiary Per Year)										
Total Gross Medicare spending (Part A and B)	12486.36	12761.72	12470.22	12694.23	51.35	↓	↓	-66.56, 169.27	0.43	0.393
Acute care hospital facility	3915.59	3947.14	3868.14	3906.57	-6.88	↓	↓	-73.78, 60.02	-0.18	0.840
Skilled nursing facility	1114.89	1129.07	942.66	985.58	-28.75	↓	↓	-70.13, 12.63	-2.96	0.173
Other post-acute care facility	468.69	446.15	430.75	413.15	-4.93	↓	↓	-33.19, 23.32	-1.13	0.732
Outpatient facility	2097.11	2187.09	2309.39	2386.54	12.83	↑	↑	-52.69, 78.35	0.56	0.701
Professional services	2952.89	2952.43	2989.92	2995.78	-6.32	↑	↑	-50.46, 37.82	-0.22	0.779
Home health	-	-	-	-	§	-	-	§	-	-
Durable medical equipment	279.96	278.11	238.48	229.42	7.21	↓	↓	-4.93, 19.36	3.12	0.244
Utilization (Per 1,000 Beneficiaries Per Year)										
Acute care stays	332.46	332.42	324.66	324.57	0.05	↓	↓	-4.64, 4.74	0.02	0.983
SNF stays	67.07	67.44	63.05	61.69	1.72	↓	↓	-0.81, 4.25	2.80	0.183
SNF days	1633.20	1636.27	1333.53	1356.98	-20.38	↓	↓	-82.15, 41.40	-1.50	0.518
ED visits & observation stays	549.83	559.11	581.76	588.65	2.39	↑	↑	-3.30, 8.09	0.41	0.410
E&M visits	-	-	-	-	§	-	-	§	-	-
Procedures	8833.20	9016.30	10185.01	10356.60	11.50	↑	↑	-203.06, 226.06	0.12	0.916
Tests	-	-	-	-	§	-	-	§	-	-
Imaging services	5359.66	5412.53	5097.64	5161.16	-10.65	↓	↓	-52.42, 31.12	-0.22	0.617
Home health episodes	169.25	167.01	159.19	156.47	0.47	↓	↓	-3.04, 3.98	0.30	0.792
Home health visits	4202.36	4183.09	3896.65	3894.29	-16.92	↓	↓	-129.18, 95.34	-0.43	0.768
Beneficiaries with AWV	218.84	192.79	416.51	318.00	72.45***	↑	↑	38.20, 106.71	21.06	0.000
Quality of Care (Per 1,000 Beneficiaries Per Year)										
Beneficiaries with ACSC hospitalizations	45.80	45.75	43.44	43.31	0.09	↓	↓	-0.96, 1.14	0.20	0.871
Beneficiaries with Unplanned 30-day readmissions	155.85	154.59	150.62	151.81	-2.45	↓	↓	-5.45, 0.55	-1.60	0.109
Beneficiaries with Hospital Readmissions from SNF	178.79	176.64	180.15	183.50	-5.50*	↑	↑	-11.74, 0.74	-2.96	0.084

NOTES: Difference-in-differences (DID) impact estimate significant at *p<0.1, **p<0.05, and ***p<0.01. § Denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the DID impact estimate per beneficiary per year. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.5. Estimated Impact of the 2017 Cohort on Medicare Spending, Utilization, and Quality of Care in PY2

	Baseline Years:		2017 Cohort in Performance Year : 2017							
	2014-2016		2017		Difference-in-Differences					
	NGACO mean	Comparison mean	NGACO mean	Comparison mean	DID Estimate	NGACO Diff.	Comp Diff.	95% CI	% Impact	p
Spending ($ Per Beneficiary Per Year)										
Total Gross Medicare spending (Part A and B)	13627.40	13969.82	13411.80	13868.59	-114.37**	↓	↓	-217.04, -11.70	-0.87	0.029
Acute care hospital facility	4135.61	4165.06	4188.88	4232.31	-13.98	↑	↑	-64.52, 36.57	-0.33	0.588
Skilled nursing facility	1094.16	1134.95	1048.53	1084.31	5.01	↓	↓	-17.93, 27.96	0.48	0.669
Other post-acute care facility	413.74	415.68	377.54	400.46	-20.98***	↓	↓	-33.00, -8.96	-5.26	0.001
Outpatient facility	2147.47	2204.17	2257.86	2359.83	-45.26***	↑	↑	-74.73, -15.80	-1.96	0.003
Professional services	3225.17	3253.90	3198.22	3235.17	-8.23	↓	↓	-46.36, 29.91	-0.26	0.672
Home health	765.79	766.77	791.41	793.90	-1.51	↑	↑	-12.35, 9.34	-0.19	0.786
Durable medical equipment	-	-	-	-	§	-	-	§	-	-
Utilization (Per 1,000 Beneficiaries Per Year)										
Acute care stays	305.96	308.02	311.56	311.97	1.65	↑	↑	-1.70, 5.00	0.53	0.334
SNF stays	61.49	62.50	61.21	59.95	2.26***	↓	↓	0.98, 3.54	3.84	0.001
SNF days	1461.12	1513.68	1363.39	1389.67	26.29	↓	↓	-7.43, 60.00	1.97	0.127
ED visits & observation stays	543.79	552.62	551.44	565.78	-5.51	↑	↑	-12.72, 1.70	-0.98	0.134
E&M visits	14283.80	14308.47	14092.31	14236.78	-119.80***	↓	↓	-191.79, -47.81	-0.85	0.001
Procedures	9859.05	9936.16	10760.81	10799.31	38.61	↑	↑	-104.99, 182.22	0.37	0.598
Tests	27143.72	27929.55	26620.92	27383.05	23.71	↓	↓	-202.75, 250.16	0.09	0.837
Imaging services	-	-	-	-	§	↓	↓	§	-	-
Home health episodes	161.67	159.38	168.49	165.27	0.93	↑	↑	-1.40, 3.25	0.55	0.434
Home health visits	3870.24	3896.64	3955.66	4020.03	-37.97	↑	↑	-99.50, 23.56	-0.95	0.227
Beneficiaries with AWV	282.46	227.87	383.00	294.45	33.96***	↑	↑	19.45, 48.46	9.73	0.000
Quality of Care (Per 1,000 Beneficiaries Per Year)										
Beneficiaries with ACSC hospitalizations	41.95	42.51	42.20	42.51	0.25	↑	↑	-0.63, 1.13	0.60	0.576
Beneficiaries with Unplanned 30-day readmissions	153.80	155.09	152.87	153.65	0.51	↓	↓	-3.24, 4.26	0.34	0.789
Beneficiaries with Hospital Readmissions from SNF	177.75	178.68	185.48	184.05	2.35	↑	↑	-4.08, 8.78	1.28	0.474

NOTES: Difference-in-differences (DID) impact estimate significant at *p<0.1, **p<0.05, and ***p<0.01. § Denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the DID impact estimate per beneficiary per year. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.6. Aggregate Impact in PY2 (2017) on Medicare Spending, Utilization, and Quality of Care, Model-Wide and by Cohort

	Model-Wide in PY2 [N=1,232,215]		2016 Cohort in PY2 [N=477,426]		2017 Cohort in PY2 [N=754,789]	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Spending ($)						
Total Gross Medicare spending (Part A and B)	-61,808,224	-157,591,290 , 33,974,842	24,516,415	-31,778,982, 80,811,812	-86,324,636**	-163,817,774, -8,831,497
Acute care hospital facility	-13,834,526	-63,590,507 , 35,921,455	-3,285,496	-35,226,055, 28,655,064	-10,549,030	-48,699,366, 27,601,305
Skilled nursing facility	-9,942,068	-36,213,939 , 16,329,803	-13,725,739	-33,480,788, 6,029,310	3,783,671	-13,535,289, 21,102,630
Other post-acute care facility	-18,191,390**	-34,448,551 , -1,934,229	-2,355,524	-15,845,888, 11,134,840	-15,835,866***	-24,908,037, -6,763,696
Outpatient facility	-28,037,872	-66,418,853 , 10,343,109	6,126,799	-25,154,756, 37,408,354	-34,164,673***	-56,403,335, -11,926,010
Professional services	-9,225,712	-44,900,456 , 26,449,032	-3,016,740	-24,090,257, 18,056,777	-6,208,972	-34,994,196, 22,576,252
Home health	§	§	§	§	-	-
Durable medical equipment	§	§	-	-	§	§
Utilization (Per 1,000 Beneficiaries Per Year)						
Acute care stays	1,270,497	-2,108,090 , 4,649,085	24	-2,215, 2,264	1,246	-1,283, 3,776
SNF stays	2,527,239 ***	979,159 , 4,075,320	821	-388, 2,029	1,707***	739, 2,674
SNF days	10,111,370	-28,843,490 , 49,066,230	-9,728	-39,221, 19,764	19,840	-5,610, 45,290
ED visits & observation stays	-3,015,138	-9,096,915 , 3,066,639	1,142	-1,577, 3,862	-4,157	-9,597, 1,282
E&M visits	§	§	§	§	-	-
Procedures	34,635,677	-114,501,461 , 183,772,815	5,492	-96,946, 107,927	29,144	-79,245, 137,538
Tests	§	§	§	§	-	-
Imaging services	§	§	-	-	§	§
Home health episodes	926,758	-1,499,919 , 3,353,434	226	-1,450, 1,902	701	-1,054, 2,456
Home health visits	-36,735,675	-107,654,438 , 34,183,088	-8,078	-61,674, 45,518	-28,657	-75,100, 17,785
Beneficiaries with AWV	60,220,342 ***	40,539,088 , 79,901,596	34,591***	18,238, 50,944	25,629***	14,678, 36,581
Quality of Care (Per 1,000 Beneficiaries Per Year)						
Beneficiaries with ACSC hospitalizations	230,703	-600,553 , 1,061,958	41	-459, 542	189	-474, 853
Beneficiaries with Unplanned 30-day readmissions	-132,378	-661,213 , 396,458	-197	-437, 44	64	-407, 535
Beneficiaries with Hospital Readmissions from SNF	-38,398	-306,077 , 229,281	-122*	-261, 16	84	-145, 313

NOTES: Difference-in-differences (DID) impact estimate significant at *p<0.1, **p<0.05, and ***p<0.01. Aggregate estimate is the DID impact estimate for all beneficiaries in PY2. § Denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the DID impact estimate per beneficiary per year. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.7. Estimated Impacts of NGACO Model in PY2 (2017) on Gross and Net Medicare Spending

	Model-Wide in PY2	2016 Cohort in PY2	2017 Cohort in PY2
Aggregate gross impact (millions)	-$61.81	$24.52	-$86.32**
Aggregate shared savings (millions)	$177.39	$92.01	$85.38
Aggregate net impact (millions)	$115.58**	$116.53***	-$0.94
95% CI aggregate net impact (millions)	$19.80, $211.37	$60.23, $153.20	-$78.44, $76.55
PBPY net impact	$93.80**	$244.08***	-$1.25
95% CI PBPY net impact	$16.07, $171.54	$126.16, $320.72	-$103.92, $101.42
Percentage net impact	0.716%	1.965%	-0.009%

NOTES: Difference-in-differences (DID) impact estimate significant at *p<0.1, **p<0.05, and ***p<0.01. PBPY estimate is the DID impact estimate per beneficiary per year. Aggregate estimate is the DID impact estimate for all beneficiaries in PY2. Percentage impact is relative to expected average outcome for NGACO beneficiaries in PY2 absent the model. The reported net impacts did not include the total Coordinated Care Reward payments made by CMS to NGACO beneficiaries in PY2.

Exhibit D.8. Sensitivity Analysis: Impact in PY2 After Truncating Total Gross Medicare Spending at 99th Percentile

		N = 1,232,215			N = 477,426			N = 754,789		
Total Gross Medicare Spending	**Rationale**	**Model-Wide Impact in PY2**			**2016 Cohort in PY2**			**2017 Cohort in PY2**		
Main Analysis		**PBPY Estimate ($)**	**95% CI**	**% Impact**	**PBPY Estimate ($)**	**95% CI**	**% Impact**	**PBPY Estimate ($)**	**95% CI**	**% Impact**
Gamma log link and uncapped	To assess impact over the entire distribution of spenders	-$50.16	-127.89, 27.57	-0.395	$51.35	-66.56, 169.27	0.431	-$114.37	-217.04, -11.70	-0.868
Sensitivity Analysis										
Gamma log link and capped at 99th percentile	Reduces influence of highest-spending beneficiaries	-$58.68	-142.19, 24.83	-0.229	$29.37	-77.92, 136.66	0.257	-$67.03	-163.483, 29.420	-0.5353

NOTES: 95% confidence intervals (CI) DID percentage impact presented. Percentage impact relative to expected average spending for NGACO beneficiaries in 2017 absent the model. PBPY = per beneficiary per year.

Exhibit D.9. Estimated Cumulative Impact Model-Wide on Medicare Spending, Utilization, and Quality of Care in PY1 and PY2 (2016-2017)

	Baseline Years		Cumulative Model-wide in PY1 and PY2 (2016-2017)							
					Difference-in-Differences					
	NGACO mean	Comparison mean	NGACO mean	Comparison mean	DID Estimate	NGACO Diff.	Comp Diff.	95% CI	% Impact	p
Spending ($)										
Total Gross Medicare spending (Parts A and B)	13047.68	13324.84	12861.32	13210.54	-72.06 **	↓	↓	-139.29 , -4.82	-0.57	0.036
Acute care hospital facility	4048.94	4069.47	4043.75	4080.19	-15.90	↓	↑	-48.25 , 16.44	-0.39	0.335
Skilled nursing facility	1124.87	1151.25	1026.82	1060.83	-7.63	↓	↓	-25.19 , 9.94	-0.74	0.395
Other post-acute care facility	454.63	436.99	420.9	418.42	-15.17 ***	↓	↓	-26.59 , -3.74	-3.48	0.009
Outpatient facility	-	-	-	-	§	-	-	§	-	-
Professional services	3097.51	3101.75	3095.08	3100.12	-0.80	↓	↓	-23.46 , 21.86	-0.03	0.945
Home health	-	-	-	-	§	-	-	§	-	-
Durable medical equipment	-	-	-	-	§	-	-	§	-	-
Utilization (Per 1,000 Beneficiaries Per Year)										
Acute care stays	321.72	322.02	320.06	319.47	0.89	↓	↓	-1.27 , 3.05	0.28	0.421
SNF stays	70.63	71.45	68.62	67.18	2.25 ***	↓	↓	1.18 , 3.32	3.39	0.000
SNF days	1780.32	1816.05	1579.13	1610.26	4.60	↓	↓	-23.54 , 32.75	0.29	0.749
ED visits & observation stays	-	-	-	-	§	-	-	§	-	-
E&M visits	-	-	-	-	§	-	-	§	-	-
Procedures	9332.7	9442.49	10284.31	10396.82	-2.72	↑	↑	-92.48 , 87.04	-0.03	0.953
Tests	-	-	-	-	§	-	-	§	-	-
Imaging services	-	-	-	-	§	-	-	§	-	-
Home health episodes	-	-	-	-	§	-	-	§	-	-
Home health visits	4002.53	3990.32	3926.52	3963.91	-49.60 *	↓	↓	-99.21 , 0.02	-1.25	0.050
Beneficiaries with AWV	244.84	205.37	365.71	285.79	40.44 ***	↑	↑	27.88 , 53.00	12.43	0.000
Quality of Care (Per 1,000 Beneficiaries Per Year)										
Beneficiaries with ACSC hospitalizations	43.86	44.13	42.82	42.69	0.39	↓	↓	-0.16 , 0.95	0.93	0.166
Beneficiaries with Unplanned 30-day readmissions	154.64	154.79	151.84	151.81	0.19	↓	↓	-1.86 , 2.24	0.12	0.858
Beneficiaries with Hospital Readmissions from SNF	177.99	177.52	182.33	182.02	-0.16	↑	↑	-4.03 , 3.70	-0.09	0.935

NOTES: Cumulative and difference-in-differences (DID) impact estimates significant at *p<0.1, **p<0.05, and ***p<0.01. § denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the cumulative or DID impact estimate per beneficiary per year. Aggregate estimate is the cumulative or DID impact estimate for all beneficiaries in performance years. Percentage impact is relative to expected average outcome for NGACO beneficiaries in performance years absent the model. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.10. Estimated Cumulative Impact for 2016 Cohort on Medicare Spending, Utilization, and Quality of Care in PY1 and PY2 (Years)

	Base Years		2016 Cohort in PY1 and PY2							
	2013-2015		2016-2017		Difference-in-Differences					
	NGACO mean	Comparison mean	NGACO mean	Comparison mean	DID Estimate	NGACO Diff.	Comp Diff.	95% CI	% Impact	p
Spending ($)										
Total Medicare spending (Part A and B)	12589.31	12814.87	12426.06	12690.23	-38.60	↓	↓	-127.52 , 50.31	-0.32	0.395
Acute care hospital facility	3980.41	3993.88	3929.01	3959.9	-17.43	↓	↓	-59.34 , 24.49	-0.44	0.415
Skilled nursing facility	1149.15	1164.14	1009.66	1042.27	-17.62	↓	↓	-43.31 , 8.07	-1.72	0.179
Other post-acute care facility	486.96	453.83	455.19	432.63	-10.57	↓	↓	-28.68 , 7.54	-2.27	0.253
Outpatient facility	-	-	-	-	§	-	-	§	-	-
Professional services	2996.57	2981.44	3013.54	2993.34	5.07	↑	↑	-22.09 , 32.22	0.17	0.715
Home health	-	-	-	-	§	-	-	§	-	-
Durable medical equipment	291.06	284.08	257.12	245.07	5.07	↓	↓	-3.58 , 13.73	2.01	0.251
Utilization (Per 1,000 Beneficiaries Per Year)										
Acute care stays	334.17	333.09	326.77	325.4	0.28	↓	↓	-2.54 , 3.10	0.09	0.844
SNF stays	77.86	78.53	74.48	72.9	2.24 ***	↓	↓	0.62 , 3.87	3.11	0.007
SNF days	2032.71	2055.12	1749.72	1784.67	-12.54	↓	↓	-55.32 , 30.24	-0.71	0.566
ED visits & observation stays	-	-	-	-	§	-	-	§	-	-
E&M visits	-	-	-	-	§	-	-	§	-	-
Procedures	8916.52	9052.15	9907.56	10078.58	-35.40	↑	↑	-149.16 , 78.36	-0.37	0.542
Tests	-	-	-	-	§	-	-	§	-	-
Imaging services	5365.85	5401.16	5197.33	5223.98	8.66	↓	↓	-22.11 , 39.42	0.17	0.581
Home health episodes	-	-	-	-	§	-	-	§	-	-
Home health visits	4107.13	4064.39	3903.49	3919.53	-58.79	↓	↓	-133.14 , 15.55	-1.48	0.121
Beneficiaries with AWV	215.1	187.57	352.03	278.94	45.57 ***	↑	↑	26.22 , 64.92	14.87	0.000
Quality of Care (Per 1,000 Beneficiaries Per Year)										
Beneficiaries with ACSC hospitalizations	45.38	45.41	43.31	42.83	0.51	↓	↓	-0.21 , 1.22	1.19	0.165
Beneficiaries with Unplanned 30-day readmissions	155.3	154.55	151.04	150.36	-0.07	↓	↓	-2.24 , 2.11	-0.04	0.952
Beneficiaries with Hospital Readmissions from SNF	178.19	176.59	179.82	180.39	-2.17	↑	↑	-6.85 , 2.51	-1.19	0.364

NOTES: Cumulative and difference-in-differences (DID) impact estimates significant at *p<0.1, **p<0.05, and ***p<0.01. § denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the cumulative or DID impact estimate per beneficiary per year. Aggregate estimate is the cumulative or DID impact estimate for all beneficiaries in performance years. Percentage impact is relative to expected average outcome for NGACO beneficiaries in performance years absent the model. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.11. Aggregate Cumulative Impact in PY1 and PY2 (2016 and 2017) on Medicare Spending, Utilization, and Quality of Care, Model-Wide and by Cohort

	Cumulative Model-Wide (PY1 and PY2) [N=1,709,394]		2016 Cohort in PY1 and PY2 [N=954,605]		2017 Cohort in PY2 [N=754,789]	
	Estimate	**95% CI**	**Estimate**	**95% CI**	**Estimate**	**95% CI**
Spending ($)						
Total Gross Medicare spending (Part A and B)	-123,175,478**	-238,107,510 , -8,243,445	-36,850,839	-121,728,168 , 48,026,489	-86,324,636**	-163,817,774, -8,831,497
Acute care hospital facility	-27,185,796	-82,471,909 , 28,100,318	-16,636,765	-56,650,517 , 23,376,986	-10,549,030	-48,699,366, 27,601,305
Skilled nursing facility	-13,034,726	-43,057,640 , 16,988,189	-16,818,396	-41,342,421 , 7,705,628	3,783,671	-13,535,289, 21,102,630
Other post-acute care facility	-25,924,635***	-45,450,145 , -6,399,125	-10,088,769	-27,378,677 , 7,201,139	-15,835,866***	-24,908,037, -6,763,696
Outpatient facility	§	§	§	§	-	-
Professional services	-1,373,084	-40,109,107 , 37,362,938	4,835,887	-21,084,895 , 30,756,670	-6,208,972	-34,994,196, 22,576,252
Home health	§	§	§	§	-	-
Durable medical equipment	§	§	-	-	§	§
Utilization (Per 1,000 Beneficiaries Per Year)						
Acute care stays	1,516,683	-2,176,971 , 5,210,336	270,578	-2,420,976 , 2,962,132	1,246	-1,283, 3,776
SNF stays	3,849,326***	2,018,555 , 5,680,096	2,142,821***	588,731 , 3,696,911	1,707***	739, 2,674
SNF days	7,870,400	-40,245,753 , 55,986,552	-11,969,428	-52,804,118 , 28,865,262	19,840	-5,610, 45,290
ED visits & observation stays	§	§	§	§	-	-
E&M visits	§	§	§	§	-	-
Procedures	-4,650,864	-158,084,586 , 148,782,858	-33,794,644	-142,391,248 , 74,801,959	29,144	-79,245, 137,538
Tests	§	§	§	§	-	-
Imaging services	§	§	-	-	§	§
Home health episodes	§	§	§	§	-	-
Home health visits	-84,783,019*	-169,595,941 , 29,904	-56,125,715	-127,092,620 , 14,841,189	-28,657	-75,100, 17,785
Beneficiaries with AWV	69,130,263***	47,659,198 , 90,601,327	43,501,006***	25,032,921 , 61,969,092	25,629***	14,678, 36,581
Quality of Care (Per 1,000 Beneficiaries Per Year)						
Beneficiaries with ACSC hospitalizations	673,783	-279,150 , 1,626,716	484,559	-199,541 , 1,168,660	189	-474, 853
Beneficiaries with Unplanned 30-day readmissions	53,586	-531,695 , 638,866	-10,639	-358,003 , 336,726	64	-407, 535
Beneficiaries with Hospital Readmissions from SNF	-12,983	-322,853 , 296,887	-96,725	-305,423 , 111,974	84	-145, 313

NOTES: Cumulative and difference-in-differences (DID) impact estimates significant at *p<0.1, **p<0.05, and ***p<0.01. Aggregate estimate is the DID impact estimate for all beneficiaries in PY2. § denotes uninterpretable impact estimate due to failure of parallel trends assumption across base years. PBPY estimate is the cumulative or DID impact estimate per beneficiary per year. Aggregate estimate is the cumulative or DID impact estimate for all beneficiaries in performance years. Percentage impact is relative to expected average outcome for NGACO beneficiaries in performance years absent the model. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facilities and long-term care hospital facilities. Outpatient facility includes hospital outpatient, ED, ambulatory surgical centers, and comprehensive outpatient rehabilitation facilities. Other post-acute care facility includes inpatient rehabilitation facility and long-term care hospital facility. Professional services includes physician, other professional, and ancillary services rendered under Part B. Procedures, Tests, and Imaging Services include counts of services rendered by professionals and outpatient facilities. AWV = annual wellness visit; ED = emergency department; E&M = evaluation and management; PBPY = per beneficiary per year; SNF = skilled nursing facility. ACSC = ambulatory care sensitive conditions; SNF = skilled nursing facility.

Exhibit D.12. Estimated Cumulative Impacts in PY1 and PY2 (2016 and 2017) on Gross and Net Spending, Model-wide and by Cohort

	Cumulative Model-Wide in PY1 and PY2	Cumulative 2016 Cohort in PY1 and PY2	2017 Cohort in PY2
Aggregate gross impact (millions)	-$123.18**	-$36.85	-$86.32**
Aggregate shared savings (millions)	$216.17	$130.79	$85.38
Aggregate net impact (millions)	$92.99	$93.94**	-$0.94
95% CI aggregate net impact (millions)	-$21.94, $207.92	$9.06, $178.81	-$78.44, $76.55
PBPY net impact	$54.40	$98.40**	-$1.25
95% CI PBPY net impact	-$12.84, $121.64	$9.49, $187.32	-$103.92, $101.42
Percentage net impact	0.421%	0.789%	-0.009%

NOTES: Cumulative and difference-in-differences impact estimates significant at *p<0.1, **p<0.05, and ***p<0.01. PBPY estimate is the DID impact estimate per beneficiary per year. Aggregate estimate is the DID impact estimate for all beneficiaries in PY2. Percentage impact is relative to expected average outcome for NGACO beneficiaries in PY2 absent the model. The reported net impacts did not include the total Coordinated Care Reward payments made by CMS to NGACO beneficiaries in PY2.

Exhibit D.13. Breakout of NGACO Group's Total Medicare Gross Spending in Baseline Years, Across Care Settings