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Medicare ACO Program Savings Not Driven by Fewer Hospitalizations for Ambulatory Care-sensitive Conditions or Concentrated among High-risk Patients

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Abstract

It has been widely assumed that better management and coordination of care for chronic conditions and high-risk patients would be the leading mechanisms for savings in accountable care organizations (ACOs), specifically by reducing acute care needs through enhanced outpatient and preventive care. We examined the extent to which changes in spending and hospitalizations for ACO patients in the Medicare Shared Savings Program (MSSP) are consistent with this expectation. By 2014, participation in the MSSP was associated with significant reductions in total Medicare fee-for-service reimbursements for ACO patients but with proportionally smaller reductions in hospitalizations and some increases in hospitalizations for ambulatory care-sensitive conditions. In addition, spending reductions were not clearly concentrated among high-risk patients. Spending reductions for high-risk patients accounted for only 38% of the total reduction among ACOs entering the MSSP in 2012, and spending reductions among 2013 entrants were almost entirely concentrated among lower-risk patients. These findings suggest that, on average, care coordination and management efforts focused on ambulatory care-sensitive conditions and high-risk patients have not been the major drivers of early savings in the MSSP.

In the Medicare accountable care organization (ACO) programs, participating groups of providers have incentives to hold spending below a financial benchmark and improve quality of care. By 2014, ACOs in the Medicare Shared Savings Program (MSSP) achieved reductions in Medicare fee-for-service expenditures that exceeded shared-savings bonuses paid to ACOs, constituting net savings to Medicare.^{1,2} Although the evidence of program-wide savings has grown clearer,^{1–6} the mechanisms by which ACOs have achieved these savings have not been fully elucidated.

Better management and coordination of care for costly conditions and high-cost patients have been presumed to be major mechanisms for savings and are widely emphasized in

ACOs' efforts to lower spending.⁷⁻⁹ Specifically, by achieving better intermediate clinical outcomes such as blood pressure control, filling gaps in outpatient and preventive care, improving communication and information exchange across specialties and care settings, and engaging patients in treatment plans, care coordination and management efforts could prevent costly complications or exacerbations of chronic conditions and reduce patients' need for acute inpatient care through more timely and comprehensive outpatient care. These strategies are supported by quality measures in ACO contracts that focus predominantly on care coordination, prevention, and at-risk populations with specific conditions, particularly cardiovascular disease and diabetes.¹⁰

Based on research to date, however, the pattern of savings achieved by ACOs has not clearly suggested that coordination and management of chronic conditions and high-risk patients have been the major drivers. Much of the savings have been due to lower use of overused services such as skilled nursing facility (SNF) care, high-priced hospital outpatient departments, and home health care.^{5,11} Reductions in inpatient spending for ACO patients have been proportionally smaller,¹¹ and several studies through 2013 found minimal or no reductions in hospitalizations for ambulatory care-sensitive conditions (ACSCs).³⁻⁵ For high-risk patients with multiple conditions, one study found greater absolute reductions in hospitalizations in 2013 than for lower-risk patients but similar relative reductions.³ This pattern would be expected from interventions that reduce hospitalizations for all patients proportional to their risk of hospitalization, and not necessarily from interventions focused exclusively on high-risk patients.

It is possible that some ACOs have successfully lowered patients' needs for acute care through better outpatient management of chronic conditions and risk factors, but these early program-wide results across all ACOs in the Medicare Shared Savings Program (MSSP) or Pioneer model suggest that such successes have not been common. Nevertheless, because development of effective care management strategies and patient engagement may take time, savings from these strategies could grow with longer participation in the ACO programs. Thus, savings from better outpatient management of chronic conditions may not have been evident in early evaluations through 2013 despite the early widespread focus among ACOs on care management for chronically ill patients and on reducing hospitalizations for specific ACSCs.⁸

Using data through 2014, the third year of the MSSP, we quantified changes in hospitalization rates, hospitalizations for ACSCs, and total spending associated with provider participation in the MSSP, and compared changes for patients with higher vs. lower predicted spending. Although we did not evaluate specific interventions, these analyses assessed the consistency of observed changes in spending and hospitalizations with patterns that would be expected if better management and coordination of care for chronic conditions and high-risk patients were major drivers of program-wide savings.

STUDY DATA AND METHODS

For each year from 2009–2014, we analyzed Medicare claims and enrollment data for a random 20% sample of fee-for-service beneficiaries. In each year, we used the Centers for

Medicare and Medicaid Services (CMS) ACO Provider-level Research Identifiable File to attribute each beneficiary to the ACO (defined as a collection of taxpayer identification numbers [TINs] and, for safety net providers, CMS Certification Numbers [CCNs]) or the non-ACO provider TIN or CCN accounting for the most allowed charges for the beneficiary's office visits with a primary care physician, following previously described methods.⁵ Beneficiaries attributed to Pioneer ACOs were excluded.

For each beneficiary in each year, we assessed total Part A and B Medicare spending, inpatient admissions for any reason, and admissions for ACSCs as defined by the Agency for Healthcare Research and Quality.¹² Our analysis focused specifically on admissions for ACSCs included as MSSP quality measures—admissions for congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) or asthma—and on ACSCs related to cardiovascular disease and diabetes, since these conditions are the focus of many other MSSP quality measures.¹⁰

For each outcome, we conducted difference-in-differences comparisons of changes for ACO-attributed beneficiaries from before to after the start of ACO contracts with concurrent changes for beneficiaries attributed to non-ACO providers (control group). We used linear regression to adjust for patients' clinical and sociodemographic characteristics, ACO fixed effects, and fixed effects for each hospital referral region (HRR) by year combination. The ACO fixed effects adjusted for any change in the distribution of patients across ACOs and the HRR by year fixed effects isolated changes for ACO patients that differed from local concurrent changes in the control group. We estimated differential changes separately for each entry cohort of ACOs (106 entering in April or July of 2012, 114 entering in January of 2013, and 115 entering in January of 2014), allowing a different pre-contract period for each cohort (2009–2011 for the 2012 entry cohort, 2009–2012 for the 2013 cohort, and 2009–2013 for the 2014 cohort). Further details of the methodological approach we followed have been previously described.^{1,5,11}

We conducted separate analyses of total annual Medicare spending and hospitalizations for high-risk and low-risk patients, defining high-risk patients as those in the highest quartile of both chronic condition counts (assessed from the Chronic Conditions Data Warehouse [CCW] indicators in the Master Beneficiary Summary File) and Hierarchical Condition Category (HCC) risk scores; all other patients were categorized as low-risk. We report differential changes in 2014 (after 1–2.75 years of MSSP participation depending on the cohort) both in absolute terms and as a percentage of pre-contract means.

In a sensitivity analysis, we used diagnoses from claims two years prior to each study year, rather than one year prior, to determine HCC scores, and we assessed cumulative diagnoses of chronic conditions in the CCW through two years prior to each study year, rather than through one year prior. By risk-stratifying patients in the post-contract period based on information present before the first full year of operation of the MSSP, use of earlier claims fully allowed effects of the MSSP on spending for the high-risk group to be mediated by interventions that could lower HCC scores and condition counts below the thresholds we used for categorizing patients as high-risk. Since some ACOs may identify patients at high risk of high spending based on their prior utilization, in another sensitivity analysis we

categorized the sample in each study year based on whether beneficiaries were in the top quintile of spending two years prior. Because these alternative methods of risk stratification used earlier claims, however, they predicted spending in each study year less strongly than more recent claims, resulting in a high-risk group that differed slightly less from the low-risk group.

In summary, by examining hospitalizations specifically for relevant ACSCs, examining total hospitalizations and spending separately for high-risk and low-risk patients, employing various methods for risk-stratifying patients, and considering estimates in absolute and relative terms, our analyses characterized the extent to which ACO strategies focusing on specific conditions or high-risk patients manifested in program-wide changes in spending and hospitalizations disproportionately for conditions and groups likely to be targeted by such strategies.

Limitations

As in other evaluations of Medicare ACO programs, the voluntary nature of the programs presented a source of potential selection bias. Provider organizations that participate in the ACO programs differ in many respects from non-participating providers. It is unlikely that providers could know in advance whether their future spending trends would be favorable relative to their financial benchmarks and base participation decisions on that knowledge, but the differences between participating and non-participating providers could have been systematically related to changes in outcomes and utilization that would be expected in the absence of ACO program participation.

We conducted additional analyses to explore the potential for selection and other sources of bias. First, we compared pre-contract trends in each outcome between the ACO and control groups to determine if ACO providers were on a different trajectory before program entry. Difference-in-difference comparisons assume that differences in the pre-period would remain constant in the post-period in the absence of an intervention; similar trends in the pre-period support this assumption. Second, we assessed whether MSSP participation was associated with differential changes in the patients served by ACOs. Third, following previously described methods,⁵ we modified ACO definitions to account for changes in the TINs used by provider groups and the physician composition of TINs. Fourth, we adjusted estimates for HCC scores and CCW condition counts derived from claims two or more years prior to each study year to minimize bias from ACO effects on diagnosis, complications, or coding intensity.

We could not directly assess whether providers chose to participate in the MSSP because they wanted to implement, or were already planning to implement, care management strategies and sought to maximize rewards for their efforts. While this selection mechanism limits the generalizability of our results to providers with the capacity to implement such strategies, it does not threaten the internal validity of our results as reflecting the effects of changes in provider behavior supported by the changes in incentives established by the MSSP.¹³ In addition, we would not expect providers to significantly lower fee-for-service spending for their patients without a change in incentives that at least mitigates the losses from doing so.

STUDY RESULTS

The analysis included 25,546,996 patient-years from 2009–2014, with 17.2% of beneficiaries attributed to MSSP ACOs annually on average. In comparisons adjusted only for HRR, differences between patients attributed to ACOs vs. non-ACO providers were mostly small, and any differences changed minimally from the pre-contract to post-contract period (Exhibit 1 and Appendix Exhibits 1–2).¹⁴ Adjusted pre-contract spending and admission rates between ACO-attributed patients and the control group were similar in almost all analyses, as were pre-contract trends (Exhibit 2). Participation in the MSSP was associated with significant differential reductions in 2014 Medicare spending in the 2012 entry cohort (adjusted differential change: –\$298/beneficiary or –3.1% of the pre-contract mean; $P<0.001$) and 2013 entry cohort (–\$107/beneficiary or –1.1%; $P=0.03$ but not the 2014 entry cohort (–\$41/beneficiary or –0.4%; $P=0.35$) (Exhibit 2).

The differential change in acute inpatient admissions was proportionally smaller than the differential reduction in total spending in the 2012 entry cohort (–0.0055 admissions/beneficiary or –1.6%; $P=0.04$) and was not significant in the 2013 cohort (–0.0025 admissions/beneficiary or –0.7%; $P=0.20$) or 2014 cohort (0.0011 admissions/beneficiary or 0.3%; $P=0.63$). MSSP participation was not associated with a significant differential change in the overall proportion of patients hospitalized for an ACSC in the 2012 or 2013 entry cohort and was associated with a significant differential increase in the proportion hospitalized for an ACSC in the 2014 cohort (0.07 percentage points or 2.4% of the pre-contract mean; $P=0.04$) (Exhibit 2). In analyses of hospitalizations for specific ACSCs, MSSP participation was associated with a significant differential reduction in the proportion of patients hospitalized for COPD (–0.05 percentage points or 4.8% of the pre-contract mean; $P=0.03$) but significant differential increases in the proportion hospitalized for CHF (0.05 percentage points or 3.6%; $P=0.05$) and cardiovascular disease or diabetes (0.07 percentage points or 3.5%; $P=0.02$) in the 2012 cohort. MSSP participation was associated with no significant differential changes in the proportion of patients hospitalized for these conditions in the 2013 or 2014 cohorts.

Compared with lower-risk patients in the same HRR, high-risk patients (16.5% of the sample) had more chronic conditions (10.25 vs. 4.83), higher HCC scores (2.84 vs. 0.92), higher annual spending (\$22,695 vs. \$7,123/beneficiary), more total admissions annually (0.879 vs. 0.247/beneficiary), and more admissions annually for ACSCs (0.213 vs. 0.034/beneficiary) (Exhibit 3; $P<0.001$ for all comparisons). In the 2012 entry cohort, differential reductions in spending were greater for high-risk patients (–\$686/beneficiary; $P<0.001$) than low-risk patients (–\$207/beneficiary; $P=0.001$) in absolute terms ($P=0.001$ for difference in differential reductions), but relative reductions as a percentage of mean pre-contract spending were similar (–3.0% vs. –2.9%) (Exhibits 2 and 4). Differential reductions in spending and admissions in the 2013 cohort were due almost entirely to reductions among low-risk patients (Exhibits 2 and 4). We obtained substantively similar results when using modified ACO definitions, deriving HCC scores and condition counts from earlier claims for risk stratification and regression adjustments, and when defining high-risk patients as those in the top 20% of prior spending.

DISCUSSION

In concert with other evidence,^{11,15} these findings suggest that early savings in the MSSP have not accrued in the areas that would be expected if they were driven by care management for high-risk patients and prevention of hospitalizations for ACSCs or hospitalizations in general. Among ACOs entering in 2012, reductions in per-beneficiary spending were greater among high-risk patients, but also significant and similar in relative terms among the much larger group of lower-risk patients. Thus, spending reductions for high-risk patients accounted for only 38% of the aggregate reduction in that cohort.

While targeted efforts to enhance outpatient and preventive care for high-risk patients may have contributed to lower spending for the high-risk group, the proportionally similar spending reductions for high-risk and low-risk patients are also consistent with efforts to limit service use among all patients. Such efforts could target specific services (e.g., post-acute care) rather than specific patients but nevertheless affect high-risk patients more per patient in absolute terms because they use more services. Developing the infrastructure necessary to support better management of high-risk patients also could have had spillover effects on lower-risk patients, and our categorization of high-risk and low-risk patients may differ from methods of risk prediction used by ACOs — methods that certainly vary across ACOs. Nevertheless, if high-risk care management programs were driving the bulk of savings in the MSSP, we would expect that various efforts to identify high-risk patients and manage their care would, on average, disproportionately affect spending for the groups of high-risk patients we identified using various approaches (in both absolute and relative terms), as the high-risk patients we identified had much higher spending and more conditions than other, lower-risk, patients in our study sample. Of note, the average HCC score and proportion dually eligible for Medicaid among high-risk patients in our study sample were similar to averages among high-risk patients enrolled in a high-risk care management program implemented by one of the largest Pioneer ACOs.¹⁶ Yet, not only were relative reductions in spending similar for high-risk and lower-risk patients in the 2012 cohort of MSSP ACOs, the spending reduction in the 2013 entry cohort was almost entirely concentrated among lower-risk patients.

Moreover, if care management efforts by ACOs in the MSSP produced savings that were substantial but not concentrated among the high-risk patients in our study because ACOs use less sophisticated methods for identifying high-risk patients than we did, we would still expect to see reductions in hospitalizations for ACSCs, as these conditions are a widespread focus of ACOs, encouraged by the quality measures in ACO contracts, and heavily concentrated among high-risk patients.^{8,10} Yet, MSSP participation was consistently not associated with overall reductions in hospitalizations for ACSCs across the 3 entry cohorts, and there were some modest but statistically significant increases in these hospitalizations in the 2012 and 2014 cohorts. These findings are consistent with care coordination and management efforts, on average, either having minimal effects on the risk of hospitalization or acting to increase the use of inpatient care by improving access and filling gaps in care for high-needs patients, at least enough to offset reductions in hospitalizations achieved for these patients through the prevention of complications and exacerbations.

The increases in admissions for ACSCs also call into question the validity of using these admissions as measures of ambulatory care quality. Particularly since the Medicare ACO programs have been associated with improvements in overall care ratings and access to care reported by chronically ill patients,¹⁷ it is unlikely that the increases in admissions for ACSCs in the 2012 and 2014 cohorts represented a deterioration in quality of care as a result of care management efforts. In contrast, the increases may have reflected care improvements.

Our findings do not preclude the possibility that care management efforts focused on high-risk patients and chronic conditions may have produced significant savings in some ACOs or that refinement of such efforts may do so more effectively in the future. Our study objective was not to isolate the causal effect of these efforts, or specific programs, on spending but rather to determine whether they have been the main drivers of program-wide savings. The pattern of program-wide changes in spending and hospitalizations are inconsistent with prevalent care management strategies generating major contributions to savings in the MSSP through risk modification and prevention of hospitalizations among patients with chronic conditions and high needs. Our findings also do not preclude the possibility that some care coordination and management programs may have contributed to spending reductions by including strategies to lower utilization directly (e.g., efforts to curb excessive use of skilled nursing facilities or systems to divert patients from emergency departments to outpatient offices), but such strategies may be more accurately described as utilization management, even if included in a care management program organizationally.

Our study lacked data on the specific strategies employed by each ACO, but such information may not necessarily support stronger conclusions about strategy effectiveness by permitting comparisons across ACOs employing different strategies. Because ACOs generally employ multiple strategies simultaneously, many of which may go unmeasured by assessments of ACO behavior, it may be very challenging to attribute differences in savings between ACOs to any one difference in strategy. In addition, greater savings could actually cause greater employment of care management strategies, rather than the reverse, if ACOs invest shared-savings bonuses in quality-improving activities.

Together, our study and prior studies demonstrate that by 2014 the MSSP was associated with a reduction in hospitalizations that was modest (1.6%) and observed only in the 2012 entry cohort, a modest reduction in inpatient spending only in the 2012 entry cohort that explained only 25.8% of the total spending reduction achieved by that cohort,¹¹ no significant reductions in readmissions,¹¹ minimal increases in medication use and adherence among patients with cardiovascular disease or diabetes,¹⁸ largely unchanged if not higher rates of hospitalization for common chronic conditions that are the focus of MSSP quality measures, and total spending reductions that were not clearly and consistently concentrated among high-risk patients. This pattern of findings is not one that would be expected if MSSP savings were driven primarily by care coordination and management efforts that target specific conditions and/or high-risk groups and that aim to keep patients out of the hospital.

Policy Implications

Our study has implications for ACO payment policy and physicians practicing in ACOs. In general, our findings are consistent with the notion that strategies to improve quality may be more distinct from strategies to lower spending than descriptions of the ACO model would suggest.^{5,9} Widespread efforts to improve management of chronic conditions for ACO patients have not been associated with program-wide reductions in hospitalizations for chronic conditions even though they have probably enhanced access and patient experiences.^{6,17} Accordingly, a greater focus on patient experiences, clinical outcomes, and structural measures of practice transformation in assessments of ACO quality may encourage valuable care management and coordination efforts more effectively than utilization-based measures like admissions for ACSCs.

Decoupling rewards for quality improvement from the achievement of savings also may better align ACO incentives with quality improvement efforts that may not result in substantial savings or may even increase utilization. Currently, ACOs in the MSSP are only rewarded for quality improvement if they achieve sufficient savings.

These policy changes may be additionally important for primary care physicians practicing in ACOs who may be increasingly burdened with care management tasks for patients with high needs or specific conditions. Since their efforts may not translate into significant financial gains for their ACO — even if they enhance patient care — they may not be adequately compensated. Thus, in assessing ACO performance in the MSSP, a greater focus on patient experiences and outcomes that are not utilization-based may better reward physician efforts or better support the implementation of practice models that improve care without placing additional demands on primary care physicians' time.

Conclusion

Although our study could not directly quantify the savings attributable to specific strategies taken by ACOs in the MSSP, our findings from program-wide assessments are inconsistent with the expectation that savings would be driven by efforts to identify patients with chronic conditions or risk of high spending and lower their spending and need for inpatient care by providing them with enhanced management and coordination of care. As the Medicare ACO programs evolve and stakeholders seek to learn and disseminate effective strategies, it will be important to understand the drivers of quality improvements and spending reductions achieved by ACOs and to use evidence to guide payment policy and provider strategy.

Notes

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Appendix

Appendix Exhibit 1

Low-risk Patients: Differential changes in patient characteristics from pre-contract period to 2014 for ACO-attributed patients vs. control group^a

Patient Characteristic	Unadjusted Precontract Mean ^b	Adjusted Precontract Difference, ACOs vs. Control Group			Differential Change from Precontract Period to 2014 for ACOs vs. Control Group		
		2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort
Age, y	71.2	0.4 **	0.4 *	−0.2	0.0	0.1 **	0.1
Female sex, %	59.3	0.6 ***	0.3	0.2	−0.4 **	−0.2	0.0

Patient Characteristic	Unadjusted Precontract Mean ^b	Adjusted Precontract Difference, ACOs vs. Control Group			Differential Change from Precontract Period to 2014 for ACOs vs. Control Group		
		2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort
Race or ethnic group ^c , %							
Non-Hispanic white	83.7	-0.9	0.3	0.1	-0.2	-0.3	-0.3
Non-Hispanic black	8.3	-0.2	-0.1	0.5	0.1	0.3	0.1
Hispanic	4.6	0.2	-0.4	-0.2	0.1	0.0	0.1
Other	3.4	0.9	0.3	-0.4	0.0	0.1	0.1
Medicaid recipient, %	18.4	-0.8	-1.9 *	-0.3	0.0	-0.1	0.2
Disabled ^d , %	21.6	-2.0 **	-1.9 **	0.1	-0.1	-0.4 **	-0.1
End-stage renal disease, %	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Long-term nursing home resident, %	0.8	0.1	-0.2 ***	-0.1	-0.1	0.0	0.0
No. of CCW conditions ^e	4.82	0.00	-0.03	-0.05	-0.01	0.02 *	-0.01
HCC risk score ^f	0.924	-0.003	-0.007 **	-0.002	0.002	0.009 **	0.000
ZCTA-level characteristic							
% below FPL	9.0	-0.5 **	-0.5 **	-0.4 *	0.0	0.0	0.0
% with high school degree	75.8	1.0 *	1.2 **	1.0 *	-0.2 **	-0.1	0.0
% with college degree	19.7	0.7	0.9 *	1.3 **	-0.3 **	0.0	0.0

Abbreviations: ACOs, accountable care organizations; CCW, Chronic Conditions Data Warehouse; HCC, Hierarchical Condition Categories; ZCTA, zip code tabulation area; FPL, federal poverty level.

^a Means and percentages were adjusted for geography to reflect comparisons within hospital referral regions.

^b Precontract means are presented for years 2009–2011 for consistency, but in estimation of differential changes, the precontract period extended through 2012 for the 2013 cohort and through 2013 for the 2014 cohort.

^c Race or ethnic group was determined from Medicare master beneficiary summary files.

^d Indicates that disability was the original reason for Medicare eligibility.

^e Chronic conditions from the CCW included 27 conditions: acute myocardial infarction, Alzheimer's disease, Alzheimer's disease and related disorders or senile dementia, anemia, asthma, atrial fibrillation, benign prostatic hyperplasia, chronic kidney disease, chronic obstructive pulmonary disease, depression, diabetes, heart failure, hip or pelvic fracture, hyperlipidemia, hypertension, hypothyroidism, ischemic heart disease, osteoporosis, rheumatoid arthritis/osteoarthritis, stroke/transient ischemic attack, breast cancer, colorectal cancer, endometrial cancer, lung cancer, prostate cancer, cataracts, and glaucoma. Indicators for all 27 conditions were included in analytic models, as well as indicators of having multiple (2 through 9) conditions. Counts of conditions presented in the table include all conditions except cataracts and glaucoma. The presence of each condition was assessed as of the outset of each year (i.e., diagnoses present in the CCW prior to the study year).

^f Hierarchical Condition Categories (HCC) risk scores are derived from demographic and diagnostic data in Medicare enrollment and claims files, with higher scores indicating higher predicted spending in the subsequent year.

* Statistically different from zero at a P<0.05 level

** Statistically different from zero at a P<0.01 level

*** Statistically different from zero at a P<0.001 level

Appendix Exhibit 2

High-risk Patients: Differential changes in patient characteristics from pre-contract period to 2014 for ACO-attributed patients vs. control group^a

Patient Characteristic	Unadjusted Precontract Mean ^b	Adjusted Precontract Difference, ACOs vs. Control Group			Differential Change from Precontract Period to 2014 for ACOs vs. Control Group		
		2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort
Age, y	77.2	0.3 *	0.2	-0.2	0.0	0.2 *	0.0
Female sex, %	56.6	0.8	-0.1	0.2	0.0	-0.1	-0.2
Race or ethnic group ^c , %							
Non-Hispanic white	81.7	-1.8	0.0	0.0	0.0	-0.1	-0.1
Non-Hispanic black	9.4	0.1	-0.5	0.4	-0.1	0.0	0.0
Hispanic	6.1	0.3	-0.5	-0.4	0.3	0.0	0.0
Other	2.9	1.4	1.0	0.0	-0.1	0.1	0.1
Medicaid recipient, %	28.2	0.4	-2.5 *	-1.7	-0.6	-0.5	0.0
Disabled ^d , %	22.3	-1.3 *	-1.3 **	0.0	-0.3	-0.8 **	0.1
End-stage renal disease, %	3.8	0.1	0.0	0.1	0.3 *	0.0	0.0
Long-term nursing home resident, %	4.6	1.3	-1.0 ***	-0.9 ***	-0.8	-0.2	0.0
No. of CCW conditions ^e	10.25	0.01	-0.02	-0.02	-0.02	-0.03 **	-0.03 **
HCC risk score ^f	2.839	-0.003	0.007	0.002	0.008	-0.020 **	0.003
ZCTA-level characteristic							
% below FPL	9.7	-0.4 *	-0.5 **	-0.5 **	0.1	0.1	0.0
% with high school degree	74.4	0.6	1.2 *	0.9 *	-0.2	-0.2	0.0
% with college degree	18.9	0.6	1.0 *	0.9 *	-0.2	0.0	0.0

Abbreviations: ACOs, accountable care organizations; CCW, Chronic Conditions Data Warehouse; HCC, Hierarchical Condition Categories; ZCTA, zip code tabulation area; FPL, federal poverty level.

^a Means and percentages were adjusted for geography to reflect comparisons within hospital referral regions.

^b Precontract means are presented for years 2009–2011 for consistency, but in estimation of differential changes, the precontract period extended through 2012 for the 2013 cohort and through 2013 for the 2014 cohort.

^c Race or ethnic group was determined from Medicare master beneficiary summary files.

^d Indicates that disability was the original reason for Medicare eligibility.

^e Chronic conditions from the CCW included 27 conditions: acute myocardial infarction, Alzheimer's disease, Alzheimer's disease and related disorders or senile dementia, anemia, asthma, atrial fibrillation, benign prostatic hyperplasia, chronic kidney disease, chronic obstructive pulmonary disease, depression, diabetes, heart failure, hip or pelvic fracture, hyperlipidemia, hypertension, hypothyroidism, ischemic heart disease, osteoporosis, rheumatoid arthritis/osteoarthritis, stroke/transient ischemic attack, breast cancer, colorectal cancer, endometrial cancer, lung cancer, prostate cancer, cataracts, and glaucoma. Indicators for all 27 conditions were included in analytic models, as well as indicators of having multiple (2 through 9) conditions. Counts of conditions presented in the table include all conditions except cataracts and glaucoma. The presence of each condition was assessed as of the outset of each year (i.e., diagnoses present in the CCW prior to the study year).

^f Hierarchical Condition Categories (HCC) risk scores are derived from demographic and diagnostic data in Medicare enrollment and claims files, with higher scores indicating higher predicted spending in the subsequent year.

* Statistically different from zero at a P<0.05 level

**
 Statistically different from zero at a $P < 0.01$ level

 Statistically different from zero at a $P < 0.001$ level

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Exhibit 4.

Differential Changes in Spending and Hospitalizations from Pre-contract Period to 2014 for High-risk vs. Low-risk Patients, as Percentages of Pre-contract Means

SOURCE: Authors' analysis of 2009–2014 Medicare claims

NOTES:

Differential changes in annual Medicare spending and hospitalizations per beneficiary are displayed for high-risk and low-risk patients in relative terms, as percentages of pre-contract means for each group. Error bars indicate 95% confidence intervals.

Differential changes in patient characteristics from pre-contract period to 2014 for ACO-attributed patients vs. control group^a

Exhibit 1

Patient Characteristic	Unadjusted Pre-contract Mean ^b	Adjusted Pre-contract Difference, ACOs vs. Control Group			Differential Change from Pre-contract Period to 2014 for ACOs vs. Control Group		
		2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort
Mean age, y	72.2	0.4**	0.3	-0.2	0.0	0.1***	0.0
Female sex, %	58.9	0.7***	0.3	0.2	-0.3*	-0.2	-0.1
Race or ethnic group ^c , %							
Non-Hispanic white	83.5	-1.1	0.2	0.1	-0.2	-0.3	-0.3
Non-Hispanic black	8.5	-0.2	-0.2	0.5	0.0	0.2	0.1
Hispanic	4.7	0.2	-0.4	-0.2	0.1	0.0	0.1
Other	3.2	1.0	0.4	-0.3	0.0	0.1	0.1
Medicaid recipient, %	15.3	-0.6	-2.1**	-0.6	-0.1	-0.1	0.1
Disabled ^d , %	21.8	-1.9**	-1.8**	0.1	-0.1	-0.5**	-0.1
End-stage renal disease, %	1.0	0.0	0.0	0.0	0.1**	0.0	0.0
Long-term nursing home resident, %	1.4	0.3	-0.3***	-0.2***	-0.3	0.0	0.0
Mean no. of CCW conditions ^e	5.70	0.00	-0.06	-0.08	0.00	0.03**	-0.02
CHF, %	24.5	-0.8	-1.0**	-1.5***	0.2	0.2	0.0
COPD or asthma, %	30.1	-1.1**	-1.6***	-1.0*	0.4**	0.3*	-0.1
CVD or diabetes, %	64.8	-0.4	-0.8*	-1.3**	-0.1	0.3*	0.0
Mean HCC risk score ^f	1.231	-0.005	-0.017**	-0.014	0.005	0.011**	0.000
ZCTA-level characteristic							
% below FPL	9.1	-0.4**	-0.5**	-0.4**	0.1	0.0	0.0
% with high school degree	75.4	0.9*	1.2**	1.0*	-0.2**	-0.1	0.0
% with college degree	19.4	0.7	0.9*	1.2**	-0.3**	0.0	0.0

SOURCE: Authors' analysis of 2009–2014 Medicare claims

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NOTES:

Abbreviations: ACOs, accountable care organizations; CCW, Chronic Conditions Data Warehouse; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; HCC, Hierarchical Condition Categories; ZCTA, zip code tabulation area; FPL, federal poverty level.

^a Means and percentages were adjusted for geography to reflect comparisons within hospital referral regions.

^b Precontract means are presented for years 2009–2011 for consistency, but in estimation of differential changes, the precontract period extended through 2012 for the 2013 cohort and through 2013 for the 2014 cohort.

^c Race or ethnic group was determined from Medicare master beneficiary summary files.

^d Indicates that disability was the original reason for Medicare eligibility.

^e Chronic conditions from the CCW included 27 conditions: acute myocardial infarction, Alzheimer's disease, chronic obstructive pulmonary disease, depression, diabetes, heart failure, hip or pelvic fracture, hyperlipidemia, hypertension, hypothyroidism, ischemic heart disease, osteoporosis, rheumatoid arthritis/osteoarthritis, stroke/transient ischemic attack, breast cancer, endometrial cancer, lung cancer, prostate cancer, cataracts, and glaucoma. Indicators for all 27 conditions were included in analytic models, as well as indicators of having multiple (2 through 9) conditions. Counts of conditions presented in the table include all conditions except cataracts and glaucoma. The presence of each condition was assessed as of the onset of each year (i.e., diagnoses present in the CCW prior to the study year).

^f Hierarchical Condition Categories (HCC) risk scores are derived from demographic and diagnostic data in Medicare enrollment and claims files, with higher scores indicating higher predicted spending in the subsequent year.

* Statistically different from zero at a $P < 0.05$ level

** Statistically different from zero at a $P < 0.01$ level

*** Statistically different from zero at a $P < 0.001$ level

Exhibit 2

Changes in Spending and Hospitalizations From the Pre-contract Period to 2014 for ACO-Attributed Patients vs. Control Group

Unadjusted Precontract Mean ^a	Adjusted Pre-contract Difference, ACOs vs. Control Group			Adjusted Pre-contract Difference in Trend, ACOs vs. Control Group			Differential Change from Pre-contract Period to 2014 for ACOs vs. Control Group		
	2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort	2012 entry cohort	2013 entry cohort	2014 entry cohort
9,624	135	15	23	-6	-5	2	-298***	-111*	-41
22,686	446	29	63	56	-120	12	-686***	-37	-43
7,127	73	10	17	-19	20	-4	-207**	-108*	-40
0.341	0.0016	0.0030	0.0014	-0.0015	0.0000	0.0007	-0.0055*	-0.0025	0.0011
0.878	0.0060	0.0035	0.0065	-0.0043	0.0035	0.0016	-0.0178*	0.0074	-0.0023
0.249	0.0007	0.0029	0.0003	-0.0009	0.0004	0.0005	-0.0030	-0.0038*	0.0014
21.6%	0.09	0.24	0.15	-0.11	-0.01	0.02	-0.30***	-0.13	-0.05
44.9%	0.09	0.26	0.28	0.08	0.26	0.05	-0.68*	0.17	-0.15
17.1%	0.08	0.24*	0.12	-0.14*	0.03	0.01	-0.22*	-0.18	-0.03
2.9%	-0.05	0.00	-0.03	0.02	0.01	0.02	0.03	-0.01	0.07*
1.3%	-0.03	0.03*	0.03	0.03	0.01	0.01	0.05*	-0.01	0.01
1.0%	0.00	-0.04*	-0.03	-0.03	0.01	0.00	-0.05*	-0.01	0.02
2.0%	-0.05*	0.03	0.00	0.04	0.00	0.02*	0.07*	0.01	0.04

analysis of 2009–2014 Medicare claims

a, accountable care organizations; ACSCs, ambulatory care-sensitive conditions; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; diabetes mellitus

are presented for years 2009–2011 for consistency, but in estimation of differential changes, the precontract period extended through 2012 for the 2013 cohort and through 2013 for the contract means provide a basis for calculating differential changes as relative percentages.

Medicare spending differ somewhat from previously reported estimates¹ because of revisions to ACO definitions subsequently released by CMS.

cardiovascular disease or diabetes include hospitalization for uncontrolled diabetes, short-term complications of diabetes, long-term complications of diabetes, lower-extremity amputation, angina without procedure, and congestive heart failure. The summary indicator of hospitalization for an ACSC additionally includes hospitalization for COPD or asthma.¹²

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* Statistically different from zero at a $P<0.05$ level
** Statistically different from zero at a $P<0.01$ level
*** Statistically different from zero at a $P<0.001$ level

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Exhibit 3**Pre-contract Differences between High-risk vs. Low-risk Patients^a**

	Pre-contract Mean ^b	
	Low-risk Patients	High-risk Patients
Age, y	71.2	77.2 ***
Female sex, %	59.3	56.6 ***
Race or ethnic group ^c , %		
Non-Hispanic white	83.8	81.8
Non-Hispanic black	8.4	9.5 ***
Hispanic	4.5	5.9
Other	3.3	2.8 ***
Medicaid recipient, %	13.7	23.2 ***
Disabled ^d , %	21.6	22.3 ***
End-stage renal disease, %	0.4	3.8 ***
Long-term nursing home resident, %	0.8	4.7 ***
No. of CCW conditions ^e	4.83	10.25 ***
HCC risk score ^f	0.92	2.84 ***
ZCTA-level characteristic		
% below FPL	9.0	9.7 ***
% with high school degree	75.6	74.3 ***
% with college degree	19.6	18.8 ***
Total annual Medicare spending, \$	7,123	22,695 ***
Annual hospitalizations		
Hospitalizations, No.	0.247	0.879 ***
1 hospitalization, %	17.2	45.0 ***
Annual hospitalizations for ACSCs		
Hospitalizations, No.	0.034	0.213 ***
1 hospitalization, %	2.9	14.9 ***

SOURCE: Authors' analysis of 2009–2014 Medicare claims

NOTES:

Abbreviations: CCW, Chronic Conditions Data Warehouse; HCC, Hierarchical Condition Categories; ZCTA, zip code tabulation area; FPL, federal poverty level; ACSCs, ambulatory care-sensitive conditions.

^aMeans and percentages were adjusted for geography to reflect comparisons within hospital referral regions.

^bPre-contract means are presented for years 2009–2011.

^cRace or ethnic group was determined from Medicare master beneficiary summary files.

^d Indicates that disability was the original reason for Medicare eligibility.

^e Chronic conditions from the CCW included 27 conditions: acute myocardial infarction, Alzheimer's disease, Alzheimer's disease and related disorders or senile dementia, anemia, asthma, atrial fibrillation, benign prostatic hyperplasia, chronic kidney disease, chronic obstructive pulmonary disease, depression, diabetes, heart failure, hip or pelvic fracture, hyperlipidemia, hypertension, hypothyroidism, ischemic heart disease, osteoporosis, rheumatoid arthritis/osteoarthritis, stroke/transient ischemic attack, breast cancer, colorectal cancer, endometrial cancer, lung cancer, prostate cancer, cataracts, and glaucoma. Indicators for all 27 conditions were included in analytic models, as well as indicators of having multiple (2 through 9) conditions. Counts of conditions presented in the table include all conditions except cataracts and glaucoma.

^f Hierarchical Condition Categories (HCC) risk scores are derived from demographic and diagnostic data in Medicare enrollment and claims files, with higher scores indicating higher predicted spending in the subsequent year.

p<0.001 for test of difference between high-risk and low-risk groups, except for Non-Hispanic white (p=0.12) and Hispanic (p=0.28)