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Changes in Post-acute Care in the Medicare Shared Savings Program

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Abstract

Importance—Post-acute care is thought to be a major source of wasteful spending. The extent to which accountable care organizations (ACOs) can limit post-acute spending has implications for the importance and design of other payment models that include post-acute care.

Objective—To assess changes in post-acute spending and utilization associated with provider participation as ACOs in the Medicare Shared Savings Program (MSSP) and the pathways by which they occurred.

Design and Setting—Using fee-for-service Medicare claims from 2009–2014, we conducted difference-in-difference comparisons of beneficiaries served by ACOs with beneficiaries served by local non-ACO providers (control group) before vs. after entry into the MSSP. We estimated differential changes separately for cohorts of ACOs entering the MSSP in 2012, 2013, and 2014.

Participants—Random 20% sample of beneficiaries with 25,544,650 patient-years, 8,395,426 hospital admissions, and 1,595,352 SNF stays from 2009–2014.

Exposure—Patient attribution to an ACO in the MSSP.

Main Outcomes and Measures—Post-acute spending, discharge to a facility, length of SNF stays, readmissions, use of highly-rated SNFs, and mortality, adjusted for patient characteristics.

Results—For the 2012 cohort of ACOs, MSSP participation was associated with an overall reduction in post-acute spending (differential change in 2014 for ACOs vs. control group: $-\$106/\text{beneficiary}$ or -9.0% ; $P=0.003$) that was driven by differential reductions in inpatient utilization,

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Disclosures

Dr. McWilliams reports having served as an expert witness for the Federal Trade Commission and serving as a consultant to Abt Associates for an evaluation of the ACO Investment Model. Dr. Grabowski reports serving on the Scientific Advisory Board for NaviHealth. Drs. Gilstrap, Stevenson, Chernew, and Huskamp have no potential conflicts of interest to disclose.

Data Access and Analysis

Dr. McWilliams had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

discharges to facilities rather than home (−0.6 percentage points or −2.7%; $P=0.03$), and length of SNF stays (−0.60 days/stay or −2.2%; $P=0.002$). Reductions in SNF use and length of stay were due largely to within-hospital or within-SNF changes in care specifically for ACO patients. MSSP participation was associated with smaller significant reductions in SNF spending in 2014 for the 2013 ACO cohort but not in the 2013 or 2014 cohort's first year of participation. Estimates were similar for ACOs with and without financial ties to hospitals. MSSP participation was not associated with significant changes in 30-day readmissions, use of highly-rated SNFs, or mortality.

Conclusion and Relevance—Participation in the MSSP has been associated with significant reductions in post-acute spending without ostensible deterioration in quality. Spending reductions were more consistent with clinicians working within hospitals and SNFs to influence care for ACO patients than with hospital-wide initiatives by ACOs or use of preferred SNFs.

Spending on post-acute care accounts for much of the wide geographic variation in Medicare spending and has more than doubled since 2001.^{1,2} The rapid growth in post-acute spending has been driven by increasing use of care in skilled nursing facilities (SNFs),² which are the most common type of post-acute facility used and are reimbursed by Medicare on a per diem basis. Excessive use of post-acute SNF care is thought to be a major source of wasteful spending and natural target for providers participating in new payment models that reward providers for reducing spending below a budget, such as the Medicare accountable care organization (ACO) programs and Bundled Payments for Care Improvement initiative.³

Through the first full year of operation, evaluations of the Medicare ACO programs—including the Pioneer model and Medicare Shared Savings Program (MSSP)—found proportionately larger savings in SNF spending than in other spending categories, suggesting that ACOs are indeed focusing on post-acute care in their strategies to reduce spending.^{4,5} These early gains are consistent with expectations that wasteful spending is easier to cut when more abundant and with the stronger incentives that ACOs have to limit use of services they do not provide relative to services they do provide.^{4–7} Specifically, because most ACOs do not include SNFs in their organization or ACO contract,^{8,9} shared-savings bonuses achieved by lowering spending on SNF care are typically not offset by foregone fee-for-service profits.

The early reductions in SNF spending also suggest that organizations can successfully influence care in facilities they do not own.^{4,5,10,11} For example, ACOs can direct patients to a preferred network of more efficient SNFs and can employ, or partner with, clinicians and case managers to follow patients in SNFs.^{12–14} Research to date, however, has not demonstrated the extent of post-acute savings in the ACO programs after 2013, the source of these savings, or the strategies used to achieve them.

METHODS

Study Overview

In the MSSP, ACOs receive shared-savings bonuses if they hold total Medicare spending sufficiently below a budget (or benchmark) and meet minimum performance standards. Using Medicare claims from 2008–2014, we conducted difference-in-differences comparisons to estimate changes in post-acute spending and utilization associated with

participation in the MSSP. Specifically, we compared beneficiaries served by MSSP ACOs with beneficiaries in ACO service areas served by non-participating providers (the control group) before vs. after the start of ACO contracts. We separately examined each cohort of ACOs entering the MSSP in 2012, 2013, and 2014, as previous evaluations have demonstrated that savings differ by year of entry.^{5,11}

We conducted 4 sets of analyses. First, to obtain overall population estimates, we analyzed inpatient, post-acute facility, and home health spending among all beneficiaries, with patient-years as the units of analysis. Second, to eliminate changes in use of post-acute care due to changes in hospital admission rates, we analyzed post-acute care use and spending conditional on hospitalization, with admissions as the units of analysis. Third, to isolate spending reductions due to shorter length of SNF stays, we analyzed SNF spending and length of stay conditional on discharge to a SNF, with SNF stays as the units of analysis. Fourth, we analyzed 30-day readmissions, use of highly-rated SNFs, and mortality to assess related changes in quality of care.

We then conducted additional analyses to further characterize mechanisms for changes in post-acute care. Specifically, we tested whether changes in post-acute care for hospitalized ACO patients were the result of hospital-wide changes or changes in care selectively affecting ACO patients within hospitals. In a related subgroup analysis, we compared results between ACOs with and without financial ties to hospitals. While independent physician groups without such ties might still influence discharge planning for their patients within hospitals,¹⁰ ACOs that are financially integrated with hospitals are more likely to have the additional option of implementing hospital-wide strategies. Finally, we assessed the extent to which changes in SNF spending and length of stay were due to use of different SNFs vs. changes in care for ACO patients within SNFs.

Study Population

For each study year from 2009–2014, we analyzed data from Medicare claims and enrollment files for a random 20% sample of fee-for-service beneficiaries continuously enrolled in Parts A and B in that year (while alive for decedents) and in the previous year (to assess preexisting conditions). Using previously described methods and the CMS ACO Provider-level Research Identifiable File, which defines each ACO as a collection of provider taxpayer identification numbers (TINs) and CMS Certification Numbers (for safety-net providers),^{5,15} we attributed each beneficiary in each study year to the ACO or non-ACO TIN accounting for the most allowed charges for office visits with a primary care physician during that year (eAppendix). In sensitivity analyses, we modified definitions of ACOs to address potential bias from changes in constituent TINs and physicians over time (eAppendix). We excluded beneficiaries without a visit with a primary care physician.

Study Variables

Acute and Post-Acute Care Spending and Use—For analyses of all beneficiaries in our study sample, we assessed annual per-beneficiary Medicare spending for inpatient care, care in post-acute facilities (overall and by facility type), and home health care initiated in the community (outpatient) vs. after a hospitalization or post-acute facility stay (post-acute).

Facility types included SNFs, inpatient rehabilitation facilities (IRFs), and long-term care hospitals (LTCHs).

For admission-level analyses, we assessed the following for the post-acute period: discharge to a facility vs. home; spending for facility stays and number of covered days spent in a facility (by facility type); and spending for home health care and number of days of home health care. We defined the post-acute period to begin at hospital discharge and end at the conclusion of any episode of post-acute care (inclusive of facility to facility transfers and home health care following hospital or post-acute facility stays), at the start of another hospitalization if the patient was hospitalized while receiving post-acute care, or at discharge if no post-acute care was provided. Admissions without any post-acute facility or home health care contributed zeroes to analyses of spending and use during the post-acute period. In addition, we determined the diagnosis-related group (DRG) payment weight, inpatient spending, and length of stay for each admission to test whether reductions in admissions achieved by ACOs led to changes in case mix among patients admitted in the post-contract period. For analyses of post-acute SNF stays, we assessed spending per stay and length of stay.

Quality of Care—We examined 3 measures to detect potential changes in quality of care associated with MSSP participation. First, we assessed annual mortality in the beneficiary-level analysis of the full study sample. Second, for both admission-level and SNF stay-level analyses, we assessed readmissions within 30 days of hospital discharge. We examined readmissions because they are included as a quality measure in ACO contracts and because reductions in readmission rates could mechanically lengthen post-acute facility stays and thus influence interpretation of results. Third, for SNF stay-level analyses, we determined the star rating for the SNF to which beneficiaries were discharged from publicly available Nursing Home Compare data.¹⁶ The star rating is a composite of ratings from health inspections, 16 quality measures, and staffing, blending both short and long stays. We used pre-contract data from 2011 to create an indicator for being discharged to a four-star or five-star (highly-rated) facility.

Patient Characteristics—From Master Beneficiary Summary Files for each study year, we assessed age, sex, race/ethnicity,^{17,18} Medicaid coverage, disability as the original reason for Medicare eligibility, and end-stage renal disease. From the Chronic Conditions Data Warehouse (CCW), which draws from diagnoses since 1999 to describe accumulated disease burden,¹⁹ we assessed the presence of each of 27 conditions by the start of each study year. From diagnoses in the preceding year of claims, we calculated a Hierarchical Condition Categories (HCC) risk score for each beneficiary in each study year.²⁰ We determined whether beneficiaries were long-term nursing home residents in the prior year using a validated claims-based algorithm.²¹ Finally, from U.S. Census data,²² we assessed area-level sociodemographic characteristics.

ACO Subgroup Comparison—For a pre-specified subgroup comparison, we used CMS descriptions and information on organizations' websites to categorize ACOs as financially integrated with hospitals (e.g., integrated delivery systems and physician-hospital organizations) vs. independent physician groups, some of which partner with hospitals in

ACO contracts but are not owned by hospitals or health systems. Because baseline levels of efficiency have been predictive of ACO savings,^{4,5,11} we adjusted this subgroup comparison for differences in spending reductions associated with baseline SNF use (eAppendix).

Statistical Analysis

We fit linear regression models predicting each dependent variable as a function of ACO fixed effects (omitting the control group as the reference group), fixed effects for the beneficiary's hospital referral region (HRR) of residence, year fixed effects, interactions between HRR and year fixed effects, the patient characteristics listed in Table 1, and indicators for each ACO cohort in each post-contract year. For each ACO cohort, the last set of indicators estimated changes from the pre-contract period to each post-contract year for beneficiaries attributed to ACOs that differed from local concurrent changes for beneficiaries attributed to non-ACO providers (the estimate of interest). Interactions between these indicators and ACO subgroups were added for subgroup comparisons. The ACO fixed effects adjusted for pre-contract differences between each ACO and the control group and for changes in the distribution of beneficiaries across ACOs. The HRR by year fixed effects adjusted for geographic differences between the ACO and control groups and for HRR-specific changes in use of acute or post-acute care in the control group.

Thus, we used pre-contract levels for ACOs and local concurrent changes from the pre-contract to post-contract period in the control group to establish counterfactuals that would be expected in the absence of MSSP participation, and we estimated changes that differed from this expectation (i.e., the differential change or the change attributable to MSSP participation). The pre-contract period in the model differed by ACO cohort: 2009–2011 for the 2012 cohort, 2009–2012 for the 2013 cohort, and 2009–2013 for the 2014 cohort. Models of admissions and SNF stays additionally included DRG fixed effects. We used robust variance estimators to account for clustering within ACOs (for the ACO group) or HRRs (for the control group).²³

We conducted admission-level analyses with and without fixed effects for each hospital by year combination to determine the extent to which differential changes in post-acute care were due to within-hospital changes in care specifically for ACO patients vs. hospital-wide changes affecting post-acute care for all admitted patients (by comparing estimates from models with and without the fixed effects). We similarly conducted SNF stay-level analyses with and without SNF fixed effects to determine the extent to which differential changes in SNF spending and length of stay were due to discharges of ACO patients to different facilities vs. changes in care specifically for ACO patients within SNFs.

As pre-specified in our study protocol, we took several measures to limit the number of statistical tests that were conducted for supporting inferences. First, we focused on SNF-related variables as our main outcomes and considered spending on SNF care to be the primary outcome, because SNF spending was the main source of post-acute savings in Medicare ACO programs in their first full year of operation.^{4,5} Second, we conducted admission-level analyses only for ACO cohorts with significant differential changes in SNF spending in beneficiary-level analyses, and we conducted SNF stay-level analyses only for ACO cohorts with significant differential changes in admission-level analyses. Third, we

considered tests of differential changes in 2014 as primary, given evidence of growing savings in the MSSP from 2013 and 2014.¹¹ We present 2013 estimates for descriptive purposes, except that we pooled estimates across 2013 and 2014 in subgroup comparisons to enhance precision. We treated 2012 as a transition year for the 2012 ACO cohort, effectively excluding it from both the pre-contract and post-contract periods, because ACOs in this cohort entered in April or July rather than January.

We conducted additional analyses to explore potential sources of bias. First, we compared trends in each outcome between each ACO cohort and the control group during the pre-contract period. Similar pre-contract trends would support our assumption that changes from the pre-contract to post-contract periods would have been similar for the ACO and control groups in the absence of the ACO programs. Second, we tested whether patient characteristics and inpatient admission characteristics differentially changed from the pre-contract to post-contract period in the ACO groups relative to the control group.

RESULTS

Beneficiary-level analyses included 25,544,650 patient-years from 2009–2014, with approximately 19% of beneficiaries attributed to ACOs annually on average. Admission-level analyses included 8,395,426 admissions, and SNF-level analyses included 1,595,352 SNF stays. In analyses adjusted for geography only, differences in patient characteristics between ACO-attributed beneficiaries and the control group in the pre-contract period were mostly small (eTable 1) and changed minimally from the pre-contract period to 2014 (Table 1). In analyses of admissions and SNF stays, differential changes in patient characteristics, DRG payment weights, spending per admission, and admission length of stay also were minimal (Table 1). Adjusted pre-contract trends in all dependent variables were similar for ACO-attributed beneficiaries and the control group, as were adjusted pre-contract means for most measures (Tables 2–4, eTables 2–3).

Beneficiary-level Analysis

2012 Entry Cohort—In comparisons of ACOs entering the MSSP in 2012 with the control group, MSSP participation was associated with reductions in total annual inpatient spending (differential change in 2014 for ACOs vs. control group: $-\$77/\text{beneficiary}$ or -2.3% of the pre-contract mean; $P=0.006$) and post-acute spending in facilities ($-\$106/\text{beneficiary}$ or -9.0% ; $P=0.003$), the latter driven mostly by reduced spending on SNF care (Table 2). MSSP participation also was associated with a differential reduction in spending in 2014 for home health care in the outpatient setting ($-\$16/\text{beneficiary}$ or -3.1% ; $P=0.03$) but not the post-acute setting ($\$2/\text{beneficiary}$ or 1.9% ; $P=0.31$). Differential changes in 2013 in inpatient and SNF spending were significant but smaller (Table 2).

2013 and 2014 Entry Cohorts—For ACOs entering the MSSP in 2013 (eTable 2), MSSP participation was associated with a significant reduction in SNF spending in 2014 (differential change in 2014: $-\$27/\text{beneficiary}$ or -3.3% ; $P=0.01$) but not inpatient spending ($-\$33/\text{beneficiary}$ or -1.0% ; $P=0.28$) and with no significant differential changes in 2013. For the 2014 entry cohort (results not tabulated), MSSP participation was not associated with a significant change in either inpatient spending ($-\$8/\text{beneficiary}$ or -0.2% ; $P=0.78$) or

SNF spending (\$4/beneficiary or 0.5%; $P=0.66$) in 2014, so admission-level and SNF stay-level analyses were not pursued.

Admission-level Analysis

2012 Entry Cohort—For the 2012 entry cohort of ACOs, MSSP participation was associated with significant reductions in 2014 in the proportion discharged to a post-acute facility (differential change in 2014: -0.6 percentage points or -2.7% ; $P=0.03$), spending on SNF care in the post-acute period ($-\$124$ /admission or -5.6% ; $P=0.002$), days in a SNF during the post-acute period (-0.22 /admission or -4.1% ; $P=0.02$), and use of LTCHs (Table 3). Estimates were largely unchanged after adjustment for hospital-level means in the year of admission, indicating that reductions in SNF use were due to different treatment of ACO-attributed patients within hospitals.

2013 ACO Entry Cohort—For the 2013 MSSP cohort (eTable 3), the differential change in 2014 in post-acute SNF spending was not statistically significant ($-\$50$ /admission or -2.3% ; $P=0.07$), so SNF stay-level analyses were not pursued.

SNF Stay-level Analysis

For the 2012 entry cohort of ACOs (Table 4), MSSP participation was associated with significant reductions in spending per SNF stay (differential change in 2014: $-\$393$ /stay or -3.5% ; $P<0.001$) and length of SNF stay (-0.60 days/stay or -2.2% ; $P=0.002$). Adjustment for the SNF to which patients were discharged reduced these estimates by 23–25%, indicating that most of these reductions were due to changes in care specifically for ACO patients within SNFs rather than shifts to different SNFs.

Subgroup Analysis

Estimated reductions in inpatient and SNF spending associated with MSSP participation were consistently greater in the 2012 and 2013 entry cohorts for independent physician groups than for ACOs financially integrated with hospitals, but these differences were not statistically significant (Figure, eFigure).

Quality of Care

MSSP participation was not associated with differential changes in mortality (Table 2, eTable 2), 30-day readmissions (Tables 3–4, eTable 3), or the proportion of patients discharged to 4-star or 5-star SNFs (Table 4).

DISCUSSION

Spending on post-acute SNF care for patients of ACOs entering the MSSP in 2012 or 2013 was significantly reduced in 2014 relative to local concurrent changes among patients served by non-participating providers. Consistent with changes in total Medicare spending associated with MSSP participation,¹¹ reductions in SNF spending grew with longer ACO participation, and later entrants required more time to achieve reductions than early entrants. Reductions in spending on SNF care for ACO patients were due in part to lower use of inpatient care, in part to lower rates of discharge to SNFs, and in part to shorter length of

SNF stays. Adjustment for the hospital or SNF to which patients were admitted revealed that reductions in SNF use and length of stay for ACO patients were largely due to within-hospital changes in care specifically for ACO patients, as opposed to hospital-wide efforts, and to changes in care within SNFs for ACO patients, as opposed to use of different SNFs. Post-acute spending reductions were achieved without ostensibly compromising or improving quality of care for ACO patients, based on mortality, readmissions, and use of highly-rated SNFs.

Reductions in spending on SNF care associated with MSSP participation were statistically similar for independent physician groups and organizations financially integrated with hospitals, with higher estimates for independent groups contributing to their greater overall savings, as previously described.^{5,11} On one hand, financial integration with hospitals offers ACOs potential economies of scale for discharge planning and forming preferred SNF networks. On the other, hospitals in ACOs have weak incentives to pursue hospital-wide strategies to limit wasteful post-acute care because patients attributed under an organization's ACO contract typically account for only a small proportion of admissions to the organization's hospitals. Moreover, compared with hospital-integrated ACOs, ACOs that are independent physician groups report similar capacity for influencing inpatient care—and thus decisions about post-acute care at discharge—presumably by staffing admissions directly or using hospitalist groups or care managers to influence their patients' inpatient care.¹⁰ Our results are consistent with ACOs using similar strategies to shorten length of SNF stays, such as employing or partnering with clinicians to follow patients in SNFs.

Thus, although hospitals may ostensibly be better positioned to influence post-acute care than physician groups, they may have limited financial incentives to develop strategies that differ from those available to physician groups.⁷ Incentives for hospitals in ACOs may change as bundled payment initiatives expand, but our results suggest that financial integration with hospitals is not necessary for ACOs to achieve sizable savings in the post-acute setting. These findings in turn provide valuable information for clinicians considering employment changes to meet the challenges of payment reform and for practices trying to gauge their potential reach of influence and success under new payment models.

Our study also has important implications for Medicare payment policy and antitrust law enforcement. Under current and proposed payment programs that bundle acute and post-acute care (e.g., the Bundled Payments for Care Improvement initiative), hospitals keep any savings within the bundle for patients attributed to an MSSP ACO.^{24,25} Because ACOs may be able to achieve post-acute savings independently, however, our results suggest that ACOs should keep some, if not all, of the savings in cases of overlap with bundled payment programs—ideally to the extent savings are attributable to ACO efforts. More generally, bundled payment programs that place hospitals at risk for post-acute spending may not be the only viable strategy to curb excessive post-acute care. Our findings also challenge claims by providers that mergers and acquisitions involving acute or post-acute facilities are necessary for achieving more efficient post-acute care under new payment models. More generally, the ability of ACOs to curb post-acute spending exemplifies the potential for providers to influence care across multiple settings without necessarily establishing common ownership over the full continuum of care, as few ACOs own SNFs.

Our study has several limitations. First, the MSSP is a voluntary program and ACOs likely differ from non-participating providers. Post-acute spending levels and trends were similar for ACO and non-ACO providers during the pre-contract period, however, and we would not expect ACOs to lower use of post-acute care without an incentive to do so. Second, reductions in SNF use and length of stay for ACO patients conditional on hospital or SNF admission could have been due to differential changes in case mix resulting from reductions in hospital or SNF admissions. However, we found no evidence of differential changes in patient characteristics, consistent with hospital and SNF admission rates falling in proportion to patients' risk of admission.²⁶ Third, our analysis did not support inferences about substitution of post-acute settings. For example, our finding of lower use of post-acute facilities for ACO patients with no change in use of post-acute home health care could be due to both a substitution of post-acute home care for facility care and an accompanying reduction in both post-acute and outpatient home care for other patients, but our results reflect only the net effects.

CONCLUSION

Participation in the MSSP has been associated with significant reductions in post-acute spending without ostensible changes in quality, suggesting gains in health care value. Post-acute spending reductions were more consistent with efforts by clinicians working within hospitals and SNFs to influence care for ACO patients than with hospital-wide initiatives by ACOs or use of preferred SNFs. Understanding such early successes can support regulatory policy that enhances rather than inhibits the effectiveness of payment and delivery system reforms.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure. Differential Changes in SNF Spending in Post-contract Period by ACO Subgroup and Cohort, Admission-level Analysis

Differential changes in SNF spending in the post-acute period are displayed by ACO subgroup, with more negative estimates indicating greater spending reductions. Displayed subgroup estimates are for the pooled 2013–2014 post-contract period and are provided separately for the 2012 (blue) and 2013 (red) entry cohorts of MSSP ACOs, with the number of ACOs in each subgroup, overall and by cohort, provided in parentheses. Error bars indicate 95% confidence intervals. Overall, differential reductions in SNF spending for independent physician groups (differential change pooled across cohorts and 2013 and 2014: $-\$114$; $P=0.02$) and organizations financially integrated with hospitals ($-\$67$; $P=0.003$) were similar ($P=0.38$ for subgroup difference in estimates).

Table 1

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

Patient Characteristic	Unadjusted pre-contract mean ^b			Differential change from pre-contract period to 2014 for ACOs vs. control group					
	Overall sample of patients (N = 12,650,860 patient-years)	Admissions (N = 4,418,002)	SNF stays (N = 814,996)	Overall sample of patients (ACO N in 2014 = 330,585)	Admissions (ACO N in 2014 = 97,881)	SNF stays (ACO N in 2014 = 20,448)	Overall sample of patients (ACO N in 2014 = 284,698)	Admissions (ACO N in 2014 = 82,395)	SNF stays (ACO N in 2014 = 17,425)
Age, y	72.2	73.7	79.3	0.1	0.1	0.2	0.1 ⁱ	0.0	0.0
Female sex, %	58.9	58.5	66.1	-0.3 ^h	0.0	-0.2	-0.1	-0.3	-0.2
Race or ethnic group ^c , %									
Non-Hispanic white	83.5	81.9	86.7	-0.1	-0.3	-0.5	-0.3	-0.2	-0.5
Non-Hispanic black	8.5	10.6	8.1	0.0	0.1	0.6 ^h	0.2	0.1	0.0
Hispanic	4.7	4.9	3.3	0.1	0.3 ^h	0.1	0.1	0.1	0.2
Other	3.2	2.5	1.9	-0.1	-0.1	-0.1	0.0	0.0	0.2
Medicaid recipient, %	16.0	24.2	28.1	-0.3	-0.1	0.4	-0.1	-0.1	0.9 ^h
Disabled ^d , %	21.8	24.9	16.5	-0.2	-0.1	-0.2	-0.4 ⁱ	-0.6 ^h	-0.4
End-stage renal disease, %	1.0	5.0	3.8	0.0	0.2	-0.1	0.0	0.5 ⁱ	0.6 ^h
Long-term nursing home resident, %	1.4	3.1	7.0	-0.3	-0.4	-0.5	0.0	0.1	0.1
No. of CCW conditions ^e	5.7	7.8	8.6	0.0	0.0	0.0	0.0 ⁱ	0.0	0.0
HCC risk score ^f	1.23	2.13	2.21	0.00	0.01	0.01	0.01 ⁱ	0.00	0.01
ZCTA-level characteristic									
% below FPL	9.1	9.6	9.1	0.0	0.0	0.1	0.0 ^h	0.1	0.1
% with high school degree	75.4	74.2	75.6	-0.2 ^h	-0.1	-0.3 ^h	-0.1	-0.1	0.0
% with college degree	19.4	18.3	19.0	-0.2 ⁱ	-0.2	-0.2	0.0	-0.1	0.2
DRG payment weight ^g	-	1.57	1.74	-	0.00	0.02	-	0.00	-0.01

Patient Characteristic	Unadjusted pre-contract mean ^b			Differential change from pre-contract period to 2014 for ACOs vs. control group					
	Overall sample of patients (N = 12,650,860 patient-years)	Admissions (N = 4,418,002)	SNF stays (N = 814,996)	2012 MSSP entry cohort (N=114 ACOs)			2013 MSSP entry cohort (N=106 ACOs)		
				Overall sample of patients (ACO N in 2014 = 330,585)	Admissions (ACO N in 2014 = 97,881)	SNF stays (ACO N in 2014 = 20,448)	Overall sample of patients (ACO N in 2014 = 284,698)	Admissions (ACO N in 2014 = 82,395)	SNF stays (ACO N in 2014 = 17,425)
Acute admission length of stay, ^g days	-	6.17	8.05	-	-0.01	0.13 ^j	-	0.02	0.07
Acute admission spending, ^g \$	-	8,406	9,934	-	-16	140	-	-26	-51

^a Means and percentages were adjusted for geography to reflect comparisons within hospital referral regions. There were no significant differential changes in patient characteristics for the 2014 ACO cohort, which are not shown. ZCTA denotes ZIP Code tabulation area. FPL denotes federal poverty level. DRG denotes diagnosis related group.

^b Pre-contract means are presented for years 2009–2011 for consistency, but in estimation of differential changes, the pre-contract period extended through 2012 for the 2013 cohort and through 2013 for the 2014 cohort. Pre-contract means provide a basis for calculating differential changes as relative percentages.

^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 Chronic Conditions Data Warehouse (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/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. For each beneficiary in each study year, we assessed the HCC score based on enrollment and claims data in the prior year.

^g DRG payment weights, length of stay, and inpatient spending were used as additional measures to assess whether case mix for the admission-level and SNF stay-level analyses differentially changed as a result of differential changes in admission and SNF stay rates. For the analysis of SNF stays, these measures were assessed for the admission preceding each SNF stay.

^h Statistically different from zero at a P<0.05 level.

ⁱ Statistically different from zero at a P<0.01 level.

^j Statistically different from zero at a P<0.001 level.

Table 2

Patient-level analysis: acute and post-acute care spending and mortality for 2012 entry cohort of MSSP ACOs vs. control group^a

	Unadjusted pre-contract mean	Adjusted pre-contract difference, ACOs-control group (N = 11,279,358 patient-years)	P value	Adjusted pre-contract difference in annual trend, ACOs-control group (N = 11,279,358 patient-years)	P value	Differential change in post-contract period for ACOs vs. control group		
						Post-year 2013 (ACO N = 332,859)		Post-year 2014 (ACO N = 330,585)
						Estimate (95% CI)	P value	
Spending, \$								
Acute inpatient care ^b	3,400	45	0.24	-10	0.55	-48 (-100,4)	0.07	-77 (-132, -22)
Facility	2,923	28	0.37	-10	0.50	-42 (-86,2)	0.06	-68 (-114, -21)
Professional	477	17	0.04	0	0.95	-6 (-15,4)	0.26	-9 (-19,1)
Post-acute facility care								
Facility	1,172	88	0.18	3	0.72	-63 (-133,8)	0.08	-106 (-176, -35)
SNF	1,136	78	0.17	2	0.77	-58 (-119,4)	0.07	-100 (-161, -38)
IRF	813	56	0.31	-8	0.23	-57 (-114, -1)	0.05	-75 (-133, -17)
LTCH	202	10	0.13	5	0.07	6 (-4,16)	0.23	-8 (-20,4)
Professional	121	12	0.03	5	0.21	-6 (-17,4)	0.24	-17 (-28, -5)
Home health								
Post-acute	37	10	0.27	1	0.03	-5 (-14,4)	0.29	-6 (-15,3)
Outpatient	630	19	0.09	-4	0.46	-12 (-27,3)	0.12	-14 (-31,2)
Mortality, %	108	-2	0.49	0	0.81	1 (-3,5)	0.60	2 (-2,6)
	522	20	0.03	-3	0.47	-13 (-27,1)	0.06	-16 (-31, -1)
	3.24	-0.07	0.42	0.01	0.81	-0.02 (-0.11,0.08)	0.70	0.00 (-0.10,0.11)

^a SNF denotes skilled nursing facility. IRF denotes inpatient rehabilitation facility. LTCH denotes long-term care hospital.

^b Inpatient facility spending did not include capital, disproportionate hospital, or indirect medical education payments. To adjust for between-hospital differences in Medicare payments for admissions in the same diagnosis-related group, we standardized inpatient facility spending by calculating a national mean payment for each DRG and summing mean payments across admissions for each beneficiary rather than actual Medicare payments. Estimates were not appreciably changed by this standardization.

Admission-level analysis among hospitalized patients: post-acute care spending and use for 2012 entry cohort of MSSP ACOs vs. control group^a

Table 3

Measure of post-acute care spending or use	Unadjusted pre-contract mean	Adjusted pre-contract difference, ACOs–control group (N = 3,947,563 admissions)	P value	Adjusted pre-contract difference in annual trend, ACOs–control group (N = 3,947,563 admissions)	P value	Differential change in post-contract period for ACOs vs. control group			
						Post-year 2013 (ACO N = 102,649)		Post-year 2014 (ACO N = 97,881)	
						Estimate (95% CI)	P value	Estimate (95% CI)	P value
Discharge setting, %									
Facility	22.6	0.6	0.28	0.1	0.40	–0.2 (–0.6,0.3)	0.47	–0.6 (–1.1,0.0)	0.03
SNF	18.5	0.4	0.53	0.0	0.92	–0.2 (–0.6,0.3)	0.48	–0.4 (–0.9,0.1)	0.15
IRF	3.3	0.1	0.28	0.1	0.20	0.1 (–0.1,0.2)	0.46	–0.1 (–0.3,0.1)	0.32
LTCH	0.9	0.1	0.02	0.0	0.05	–0.1 (–0.1,0.0)	0.09	–0.1 (–0.2,0.0)	0.03
Home	77.4	–0.6	0.28	–0.1	0.40	0.2 (–0.3,0.6)	0.47	0.6 (0.0,1.1)	0.03
Spending during post-acute period, \$									
SNF	2,207	95	0.32	7	0.59	–97 (–175, –19)	0.01	–124 (–200, –48)	0.002
IRF	525	12	0.46	11	0.18	18 (–11,46)	0.22	–15 (–47, –16)	0.34
LTCH	338	37	0.02	15	0.09	–22 (–48,4)	0.09	–43 (–73, –13)	0.005
Home health care	549	–3	0.77	1	0.86	6 (–9,21)	0.42	1 (–13,14)	0.94
Days during post-acute period, no.									
SNF	5.34	0.22	0.38	–0.02	0.73	–0.17 (–0.36,0.03)	0.09	–0.22 (–0.41, –0.04)	0.02
IRF	0.47	0.01	0.51	0.01	0.32	0.02 (0.00,0.04)	0.12	–0.01 (–0.04,0.01)	0.24
LTCH	0.27	0.02	0.04	0.01	0.04	–0.01 (–0.03,0.01)	0.28	–0.02 (–0.04,0.00)	0.02
Home health care	7.94	–0.21	0.23	–0.11	0.18	0.14 (–0.10,0.39)	0.26	0.09 (–0.14,0.31)	0.46
30-day readmission, %	17.6	–0.2	0.17	0.0	0.96	0.1 (–0.2,0.4)	0.71	0.1 (–0.2,0.5)	0.41

^aSNF denotes skilled nursing facility. IRF denotes inpatient rehabilitation facility. LTCH denotes long-term care hospital.

Table 4

SNF stay-level analysis among patients discharged to a SNF: SNF spending, length of stay, readmissions, and proportion discharged to highly-rated facilities for 2012 entry cohort of MSSP ACOs vs. control group^a

	Unadjusted pre-contract mean	Adjusted pre-contract difference, ACOs-control group (N = 727,839 SNF stays)	P value	Adjusted pre-contract difference in annual trend, ACOs-control group (N = 727,839 SNF stays)	P value	Differential change in post-contract period for ACOs vs. control group			
						Post-year 2013 (ACO N = 21,243)		Post-year 2014 (ACO N = 20,448)	
						Estimate (95% CI)	P value	Estimate (95% CI)	P value
Spending for SNF stay, \$	11,206	178	0.15	-14	0.76	-320 (-461, -179)	<.001	-393 (-558, -229)	<.001
SNF stay length of stay, days	27.07	0.43	0.18	-0.11	0.35	-0.55 (-0.90, -0.21)	0.002	-0.60 (-0.99, -0.22)	0.002
30-day readmission, %	21.2	-0.2	0.17	0.2	0.49	-0.4 (-1.0, 0.3)	0.28	0.6 (-0.1, 1.2)	0.08
Discharged to 4-star or 5-star SNF, %	45.5	0.6	0.54	0.7	0.03	1.2 (0.3, 2.1)	0.01	1.2 (0.1, 2.3)	0.03

^aSNF denotes skilled nursing facility. IRF denotes inpatient rehabilitation facility. LTCH denotes long-term care hospital.