

Prospective or Retrospective ACO Attribution Matters for Seriously Ill Patients

Brystana G. Kaufman, PhD, MSPH; William K. Bleser, PhD, MSPH; Robert Saunders, PhD; David Anderson, MSPPM; Courtney H. Van Houtven, PhD; David B. Muhlestein, PhD, JD; Jeffrey Clough, MD; and Mark B. McClellan, MD, PhD

Since 2019, the Medicare Shared Savings Program (MSSP) has allowed accountable care organizations (ACOs) in the Basic or Enhanced tracks to choose either retrospectively or prospectively attributed ACO patient populations.¹ Seriously ill patients with high needs, costs, and functional limitations have a high risk of death and may benefit from ACO care management strategies. Little is known about how ACOs' choice of attribution method affects ACO attribution, and thus incentives for care, for seriously ill Medicare beneficiaries.

Attribution methods in MSSP have evolved over time. Since program inception, CMS required MSSP ACOs to use retrospective assignment, with the exception of the 8% of ACOs in Track 3 or the Next Generation Track, which both started in 2016.² Beginning in 2019, the Pathways to Success MSSP rule allows ACOs an annual attribution choice: retrospective or prospective (potentially supplemented by voluntary patient attribution).¹ Retrospective and prospective options both use claims-based algorithms to attribute patients to an ACO if a plurality of qualifying services over a 12-month period are received from a participating provider. In retrospective attribution, patients are assigned based on care provided during the contract year, and final attribution occurs at the end of the contract performance year (PY). In retrospective attribution, patients who received care from the ACO during the PY are captured in the ACO population. In prospective attribution, patients are assigned at the start of the contract PY based on claims in the prior calendar year, which allows ACOs to know their defined population and provide care management during the PY.

Improving serious illness care is critical to curb the trend of increasing health care expenditures, as the top 5% of spenders account for nearly 60% of health care costs.³⁻⁵ Most patients with serious illness have multiple comorbidities and functional limitations, which require medical and social services from providers and caregivers.⁶⁻¹⁰ As a result, serious illness care is often fragmented or incomplete.^{3,11} Polypharmacy increases with comorbidity, increasing risk of adverse reactions and inappropriate use.¹² Consequently, improving care for individuals with serious illness has been a principal motivation for recent ACO reforms. Understanding the

ABSTRACT

OBJECTIVES: Since 2019, the Medicare Shared Savings Program (MSSP) has allowed accountable care organizations (ACOs) to choose either retrospectively or prospectively attributed ACO populations. To understand how ACOs' choice of attribution method affects incentives for care among seriously ill Medicare beneficiaries, this study compares beneficiary characteristics and Medicare per capita expenditures between prospective and retrospective ACO populations.

STUDY DESIGN: This retrospective, cross-sectional analysis describes survival, patient characteristics, and Medicare spending for Medicare fee-for-service beneficiaries identified with serious illness (n = 1,600,629) using 100% Medicare Master Beneficiary Summary and MSSP beneficiary files (2014-2016).

METHODS: We used generalized linear models with ACO and year fixed effects to estimate the average within-ACO difference between potential retrospective and prospective ACO populations.

RESULTS: Dying in the first 90 days of the performance year was associated with reduced odds of retrospective ACO attribution [odds ratio [OR], 0.24; 95% CI, 0.24-0.25] relative to beneficiaries surviving 270 days or longer. Similarly, hospice use was associated with reduced odds of retrospective assignment (OR, 0.80; 95% CI, 0.79-0.80). Among ACOs that did not achieve shared savings, average per capita Medicare expenditures (after truncation) were \$2459 (95% CI, \$2192-\$2725) higher for prospective vs retrospective ACO populations. The difference was \$834 (95% CI, \$402-\$1266) greater per capita among ACOs that achieved shared savings.

CONCLUSIONS: The difference in survival and spending for ACO populations captured by prospective vs retrospective attribution methods means that ACOs may need to employ different care management strategies to improve performance depending on their attribution method.

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factors and outcomes associated with ACO attribution, specifically for seriously ill Medicare beneficiaries, will inform the evolving MSSP program and care reforms for the seriously ill.

Evidence from the first year of the MSSP suggested that decedents are differentially excluded from retrospectively attributed ACO populations,¹³ but the relationship between choice of attribution method and patient case mix in retrospectively compared with prospectively attributed ACO populations is unclear. We compared patient characteristics and Medicare per capita expenditures between ACO populations defined using prospective and retrospective claims-based attribution methods. Additionally, we compared observed and truncated per-beneficiary per-year (PBPY) spending using the rules applied by CMS in calculating MSSP ACO financial performance, which truncates spending for patients exceeding the 99th percentile nationally by eligibility category. We hypothesized that PBPY spending will be higher in prospective rather than retrospective ACO populations, with and without truncation, because of greater inclusion of decedents.

METHODS

To evaluate the probability of attribution of decedents to ACO populations, we tested the association of beneficiary survival during the PY with (1) retrospective attribution to an MSSP ACO and (2) prospective attribution to an MSSP ACO. Outcomes for ACO attributed populations are evaluated cross-sectionally by ACO-year rather than following patients over time to reflect the way ACOs' performance is evaluated by CMS and, as a result, financial incentives for ACO decision-making.

Setting and Study Population

Using 100% Medicare beneficiary summary and MSSP beneficiary files for years 2014-2016, we included fee-for-service (FFS) Medicare beneficiaries identified as seriously ill in the year prior to the PY. We applied the inclusion algorithm to the year prior to the ACO PY to prevent introducing bias by conditioning on colliders, or effects of the outcome and exposure. We identified the serious illness population by adapting a preexisting definition using Medicare claims data with 3 eligibility criteria: (1) any inpatient claim, (2) any claim for home health or skilled nursing or durable medical equipment, and (3) either a serious chronic illness or multimorbidity.^{14,15} Comorbidities were defined using the Chronic Conditions Warehouse algorithms for 27 common conditions and other chronic and disabling conditions.¹⁶ Serious chronic illnesses included advanced liver disease or cirrhosis; lung, colorectal, or endometrial cancer; chronic obstructive pulmonary disease; congestive heart failure; Alzheimer disease or related dementias; diabetes with complications including ischemic heart disease or peripheral vascular disease; hip fracture; or renal failure as indicated by any use of dialysis.

TAKEAWAY POINTS

- ▶ Compared with retrospectively attributed Medicare accountable care organization (ACO) populations, prospectively attributed Medicare ACO populations included more decedents and had higher per-beneficiary per-year expenditures among seriously ill Medicare beneficiaries.
- ▶ In evaluating ACO financial performance, the Medicare Shared Savings Program truncates the extremely high costs of 1 in 4 decedents, substantially reducing the difference in per capita expenditures between prospectively and retrospectively attributed ACO populations.
- ▶ The difference in survival and spending for ACO populations captured by prospective vs retrospective attribution methods means that ACOs may need to employ different care management strategies to improve performance depending on their attribution method.

Outcomes

The primary outcome is ACO Medicare spending PBPY. For each ACO in each PY, we described average Medicare spending for 2 possible definitions of ACO populations, prospective and retrospective, regardless of the attribution method that CMS actually used to evaluate the ACO. Medicare spending was evaluated cross-sectionally by ACO-year rather than following patients over time to reflect the way ACOs' performance is evaluated by CMS and perceived by ACO administrators. To measure spending, we summed Medicare parts A and B PBPY spending reported in annual Medicare Beneficiary Summary files, then annualized based on eligibility months to mirror MSSP calculations, and then standardized spending at the county level using the CMS geographic variation public use file to remove variation due to inflation and geography. We applied the MSSP stop-loss rule by truncating spending at 0 and the average 99th percentile within each Medicare eligibility category over the study period.

ACO Attribution

Our key interest is ACO-level decision-making, and ACOs make strategic decisions by viewing the attributed population as a whole and comparing the potential retrospective and prospective ACO populations. For each eligible beneficiary, CMS provides an attribution status at the beginning of the PY (prospective) and at the end of the PY (retrospective) regardless of the ACO's decision to use retrospective or prospective attribution for performance evaluation. Thus, we were able to define potential prospective and potential retrospective assignment for each beneficiary and compare characteristics and outcomes for the 2 potential ACO populations within each ACO. Retrospective attribution was defined using a binary indicator for the CMS final assignment indicator in the MSSP beneficiary-level administrative data files for each ACO PY. Prospective attribution was defined using a binary indicator for CMS preliminary assignment of a beneficiary to an MSSP ACO in the first quarter of the PY. We considered using the final assignment flag from the prior year to define prospective assignment; however, this would have restricted the sample to ACOs with multiple years in the MSSP, and we would not be able to define prospective attribution in the first year of an ACO contract. Because of the growth of the MSSP during this period, more than a third of the sample would

have been excluded. The first-quarter preliminary assignment flag we used and the prior-year final assignment flags apply the same algorithm to the same period. The only difference we can discern is that fewer claims are submitted and available to inform the algorithm within 7 days (current-year preliminary assignment) than within 90 days (prior-year final assignment) of the end of the PY. As a result, we decided the improved generalizability was more valuable to the analysis than the small difference in precision that may be gained by using the prior-year flag.

Covariates

Covariates included patient demographics (gender, age, race), Medicare eligibility category (age, disabled, end-stage renal disease [ESRD], or both disabled and ESRD), comorbidities (27 chronic conditions), county factors from the CMS geographic variation file (mean Medicaid and Medicare Advantage payments, average Hierarchical Condition Category scores), and year fixed effects. In the model describing the association between beneficiary survival and retrospective attribution, 4 survival categories were defined where the date of death was in 0 to 89 days, 90 to 179 days, 180 to 269 days, or 270 or more days from the start of the PY (January 1 of each year). Beneficiaries surviving the entire year were assigned to the referent category of 270 or more days survived from the start of the PY.

Analysis

The association between patient survival and retrospective attribution to an ACO was assessed with logistic regression. The beneficiary-level model included an interaction of survival category and prospective assignment to improve model fit and was adjusted for patient demographics, comorbidities, county factors, and year fixed effects.

ACO-level observations were used to compare Medicare spending between the 2 potential ACO populations, retrospective and prospective. We aggregated truncated PBPY expenditures among prospective and retrospective populations for each ACO by year. The objective was to describe the difference in spending resulting from the difference in case mix due to selection; thus, the models are intentionally not adjusted for beneficiary characteristics. We used generalized linear models with ACO and year fixed effects to estimate the average within-ACO difference between retrospective and prospective ACO populations. The model presented included an interaction of attribution type (prospective or retrospective) with ACO shared savings success in that year. ACO shared savings success is defined by the indicator provided by CMS for achieved shared savings in the MSSP PY files. Correlations of outcomes within ACOs were modeled using exchangeable correlation structures. Analyses were conducted in SAS Studio Enterprise Edition 3.7 (SAS Institute), and this study was approved by the Duke University Institutional Review Board.

RESULTS

Despite similarity in demographics and comorbidities, spending and mortality differed substantially between prospective and retrospective

ACO populations. Of 5,564,982 Medicare FFS beneficiaries identified with serious illness, beneficiaries attributed to prospective MSSP ACO populations ($n=1,336,562$) are similar to beneficiaries attributed to retrospective ACO populations ($n=1,306,168$) in age, gender, and disability status. Of 1,600,629 observations attributed either prospectively or retrospectively, two-thirds (65%) ($n=1,042,655$) have common membership in retrospective and prospective ACO populations. The prevalence of chronic conditions was not meaningfully different between the groups, and most differences were less than 2 percentage points.

Mean unadjusted annualized Medicare expenditures PBPY are \$10,000 higher in the prospective than in retrospective ACO populations. After applying the MSSP stop-loss rule to truncate outlier spending, the difference in unadjusted PBPY spending between prospective and retrospective ACO populations is less than \$3000. A smaller proportion of beneficiaries died during the PY in retrospective vs prospective ACO populations (12.5% vs 15.6%, respectively) (Table). The differences in expenditures and survival are driven by the subgroup members who are assigned prospectively but not retrospectively, referred to as prospective only ($n=293,907$). Compared with the retrospective-only group ($n=264,067$), the PY death rate in the prospective-only subgroup is nearly double, at 27.6% and 14.0%, respectively.

Survival and ACO Attribution

Among beneficiaries prospectively assigned to an ACO, death in the first 90 days was associated with a 76% reduction in odds of retrospective ACO attribution (odds ratio [OR], 0.24; 95% CI, 0.24-0.25), and dying in the second or third quarter was associated with 41% and 31% reductions in odds (OR, 0.59; 95% CI, 0.58-0.60; and OR, 0.69; 95% CI, 0.67-0.70, respectively) compared with survival of 270 days or more. Estimates for survival effects were independent of hospice enrollment, which was also associated with reductions in the odds of retrospective attribution (OR, 0.80; 95% CI, 0.79-0.80). Full results are reported in eAppendix Table 1 (eAppendix available at ajmc.com). Among beneficiaries who were prospectively assigned to an MSSP ACO, beneficiaries dying in the first quarter of the PY had a predicted probability of retrospective assignment of 0.45 compared with 0.77 for those surviving until the fourth quarter (Figure 1).

Sensitivity Analysis

The difference in the odds of prospective attribution was less than 3% for beneficiaries dying in the first 90 days relative to those surviving 270 days or more (eAppendix Table 2).

Spending in Retrospective and Prospective ACO Populations

Using an ACO-fixed effect model, we evaluated the within-ACO difference in PBPY Medicare expenditures for prospective and retrospective ACO populations. After truncation of outlier spending, average PBPY Medicare expenditures were higher for prospective vs retrospective ACO populations with a mean difference of \$2459

TABLE. Characteristics of Seriously Ill Beneficiaries Attributed to Retrospective and Prospective ACO Populations and Subgroups With Only Prospective or Retrospective Attribution (2015-2016)^a

	Retrospective n = 1,306,168 ^b	Prospective n = 1,336,562 ^b	Retrospective only n = 264,067	Prospective only n = 293,907
	% or mean (SD)	% or mean (SD)	% or mean (SD)	% or mean (SD)
Demographics				
Age in years, mean (SD)	76.5 (11.6)	76.8 (11.6)	75.8 (12.2)	77.2 (12.3)
Male, %	41.0	41.1	40.9	41.2
Disabled, %	12.2	12.0	13.9	12.8
Outcomes				
Died in PY, %	12.5	15.6	14.0	27.6
Days alive in PY, mean (SD)	342.3 (70.1)	333.2 (85.5)	340.2 (72.6)	299.1 (121.0)
Total PBPY in \$1000s, not truncated, mean (SD)	37.4 (70.7)	47.3 (218.5)	47.2 (83.6)	91.4 (445.9)
Total PBPY in \$1000s, truncated, mean (SD)	33.0 (41.4)	35.6 (44.3)	40.5 (46.4)	51.5 (54.5)
Chronic conditions, %				
Myocardial infarction	2.3	2.3	2.8	2.6
ADRD	27.9	29.8	30.2	38.7
Atrial fibrillation	23.7	23.5	22.8	21.6
Cataracts	17.7	16.9	16.6	13.3
Diabetes	49.0	50.1	42.8	48.4
Glaucoma	8.9	8.5	8.0	6.3
Ischemic heart disease	60.5	62.1	55.4	63.2
Depression	35.0	34.6	37.8	35.9
Osteoarthritis	12.2	11.9	12.3	11.2
Rheumatoid arthritis	56.8	57.7	52.1	56.4
Transient ischemic attack	10.2	10.0	11.6	10.9
Breast cancer	4.9	4.8	4.8	4.5
Prostate cancer	4.5	4.5	4.3	4.1
Lung cancer	7.0	7.0	7.1	7.1
Anemia	50.2	49.9	53.7	51.6
Asthma	17.1	16.5	17.2	14.9
Hyperlipidemia	65.3	63.6	63.1	55.4
Hypertension	85.2	83.7	84.2	77.6
Chronic kidney disease	54.3	56.1	49.8	58.3
Congestive heart failure	46.9	48.7	44.0	52.3
COPD	33.8	33.6	32.8	32.1
Hip fracture	2.0	2.1	2.8	3.1

ACO, accountable care organization; ADRD, Alzheimer disease and related dementias; COPD, chronic obstructive pulmonary disease; PBPY, per beneficiary per year; PY, performance year.

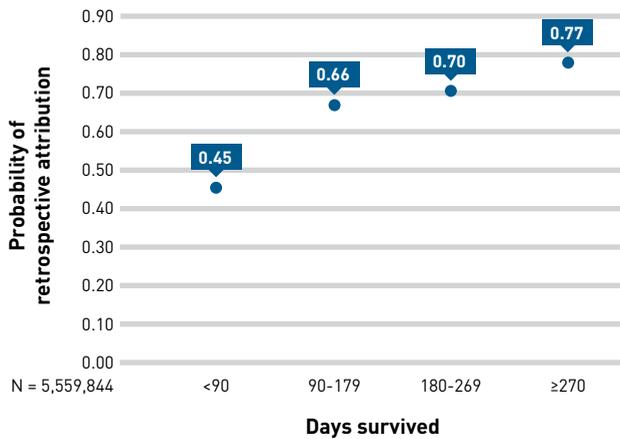
^aFrom the authors' analysis of the Medicare Beneficiary Summary File (2015-2016). Spending was adjusted for geography, inflated to 2017 dollars, and annualized, and the stop loss was applied as defined in the Medicare Shared Savings Program.

^bA total of 1,042,655 (65%) beneficiary observations have common membership in retrospective and prospective subgroups; 1,306,168 are attributed either prospectively or retrospectively.

(95% CI, \$2192-\$2725) among ACOs that did not achieve shared savings (Figure 2). The mean difference was greater among ACOs that achieved shared savings that year, with an additional \$834 (95% CI, \$402-\$1266) PBPY increase in the prospective vs retrospective ACO populations. Restricting the sample to the 1,355,777 ACO beneficiaries who survived the PY, we found that prospective ACO populations cost \$261.58 (95% CI, \$79.12-\$416.65) PBPY more than retrospective ACO populations, on average.

Observed (not truncated) spending for prospective and retrospective ACO populations is presented by inpatient, postacute, hospice, and other care settings (Figure 3). In each category, spending is greater in prospective than retrospective populations. The MSSP stop-loss rule reduces the difference in PBPY expenditures between prospective and retrospective ACO populations overall (Figure 4), and greater changes are observed among subgroups of hospice users and decedents. The stop-loss threshold truncated spending for 5.1%

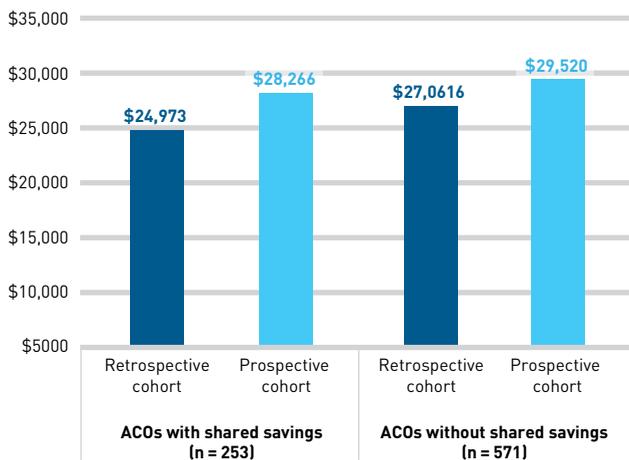
FIGURE 1. Predicted Probabilities of Retrospective ACO Attribution Among Prospectively Attributed Seriously Ill Beneficiaries (PY 2015-2016)^a



ACO, accountable care organization; PY, performance year.

^aFrom the authors' analysis of the Medicare Beneficiary Summary File (2015-2016) annual data for continuously enrolled fee-for-service beneficiaries meeting criteria for serious illness in the prior year and surviving until the start of the PY. Models control for beneficiary demographics, comorbidities, and county covariates. Using logistic regression model, predicted probabilities and 95% CIs are generated at the mean values for all covariates conditional on prospective attribution status to any Medicare Shared Savings Program ACO. Beneficiary survival categories are defined by quarter of death, if any, during the ACO PY. A total of 5138 observations were excluded because of missing data.

FIGURE 2. Comparing Retrospective and Prospective ACO Populations' Medicare Expenditures (per beneficiary per year) Among the Seriously Ill (PY 2015-2016)^a



ACO, accountable care organization; PY, performance year.

^aFrom the authors' analysis of the Medicare Beneficiary Summary File (2015-2016) annual data for continuously enrolled fee-for-service beneficiaries meeting criteria for serious illness in the year prior to the PY. Spending was adjusted for geography, inflated to 2016 dollars, and annualized, and the stop loss was applied as defined in the Medicare Shared Savings Program. ACO population averages are simulated for each ACO among prospective and retrospectively defined populations, generating 2 observations for each of 824 ACO PYs (n = 1648). Generalized linear models included ACO and year fixed effects.

of the seriously ill beneficiaries and 24.5% of decedents. Decedents' actual annualized spending surpassed \$150,000 PBPY, on average, in prospective populations vs \$119,000 PBPY in retrospective populations. After applying the stop-loss threshold to truncate spending, the difference between prospective and retrospective populations is reduced to \$3000 PBPY among decedents, hospice users, and the full sample. Furthermore, 80% of beneficiaries exceeding the stop-loss threshold died during the PY and 47% died during the first 90 days.

DISCUSSION

Compared with retrospectively attributed ACO populations, prospectively attributed MSSP ACO populations included more decedents and had higher PBPY expenditures. Beneficiaries who survived the PY contributed 10% of the difference between prospective and retrospective cohorts, suggesting that the majority of the difference is due to greater inclusion of decedents in prospective ACO populations. Although the MSSP stop-loss rule narrows the difference in spending between retrospective and prospective ACO populations by truncating outlier spending, which is often decedents' spending, a significant difference in spending remains between the 2 potential ACO populations after truncation. These findings have implications for ACO care delivery for seriously ill patients, as well as MSSP rules and regulations.

We found that decedents and hospice users had reduced odds of retrospective attribution to an MSSP ACO in recent PYs. This relationship is a consequence of the mechanics of claims-based attribution, which relies on the accumulation of claims over time to identify attributable beneficiaries. The longer that seriously ill beneficiaries survive in a given PY, the more likely they will use services necessary for retrospective attribution. A study using 2012 Medicare data found that the majority of unattributable beneficiaries had no encounter with the health care system at all; however, 6% of those unattributed were decedents with high spending.¹³ Other studies evaluating end-of-life care in MSSP ACOs have applied prospective attribution instead of retrospective attribution to retain substantial proportions of hospice users and decedents in the study sample and reduce risk of bias.^{17,18}

The difference in per capita spending between prospective and retrospective attribution methods may influence ACOs' choice of attribution method; however, low per capita spending does not necessarily result in better financial performance relative to the benchmark. ACO benchmark calculations can be complex, incorporating historical benchmarks, regional trends, truncation, and other factors. In theory, if an ACO chooses prospective (or retrospective) attribution, and they are compared against a prospective (or retrospective) benchmark, then an ACO's choice of attribution method should not affect its savings calculation. It is unclear whether ACO benchmarks adequately adjust for differences in case mix.

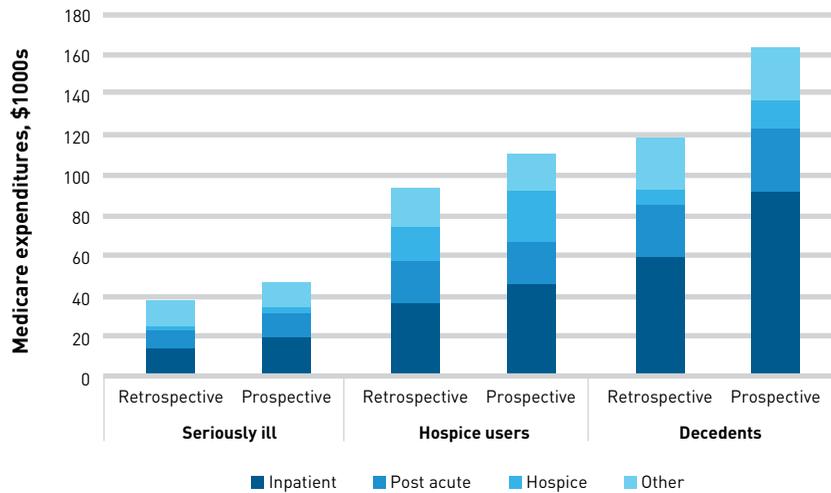
Prior studies have evaluated ACO selection of healthier patients with mixed results; our results suggest that sicker patients may

be differentially excluded as an artifact of attribution methodologies rather than ACO activities.^{19,20} In the past, CMS would not upwardly adjust beneficiaries' risk scores between PYs, which may have discouraged inclusion of high-risk beneficiaries in the ACO. The new MSSP rule allows up to 3% change, which balances accuracy against potential for upcoding.

The difference in survival and spending for ACO populations captured by prospective vs retrospective attribution methods means that ACOs may need to employ different care management strategies to improve performance depending on their attribution method. Despite evidence that early ACOs targeted preventive health in low-risk populations to achieve savings, a national survey found that 93% of ACOs self-reported partially implemented efforts to identify their serious-illness population.²¹⁻²³ Seriously ill beneficiaries may benefit from the care management strategies employed by ACOs. Building on the success of ACOs, CMS is testing the next evolution of risk-sharing arrangements through Direct Contracting, with a specific focus on beneficiaries with complex, chronic conditions. Similarly, the Primary Care First CMS demonstration model encourages a seamless continuum of care for seriously ill Medicare beneficiaries, potentially led by palliative and hospice providers.

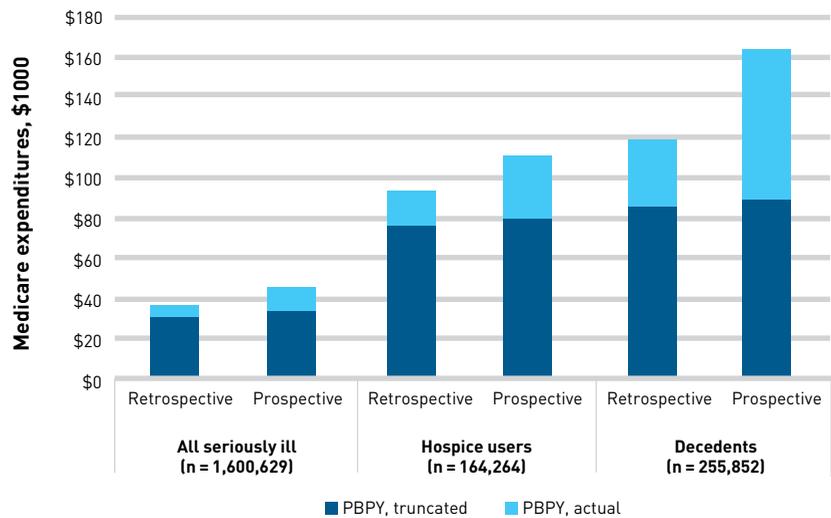
Prospective and retrospective attribution methods both have benefits that should be carefully weighed by policy makers and health system leaders. Greater inclusion of decedents and hospice users in prospectively attributed populations means that more of ACOs' financial performance will depend on moving the needle among seriously ill patients approaching the end of life. In addition, prospective attribution methods allow ACOs to know which patients are included in their defined population at the beginning of the period, allowing them to target care programs more directly. Retrospectively attributed ACO populations are more likely to include beneficiaries newly enrolled in Medicare during the period and patients with newly diagnosed serious illness, and they are more likely to have a greater number of attributed patients overall.²⁴ Unlike prospective assignment, retrospective attribution does not hold the ACO responsible for beneficiaries who have moved or changed their care and receive little or no care from ACO providers during the year.

FIGURE 3. Annualized PBPY Medicare Expenditures (in \$1000s) by Care Setting Among Prospective and Retrospective ACO Populations



ACO, accountable care organization; PBPY, per-beneficiary per-year.

FIGURE 4. Annualized PBPY Medicare Expenditures (in \$1000s) Among Prospective and Retrospective ACO Populations by Subgroup*



ACO, accountable care organization; PBPY, per-beneficiary per-year; PY, performance year.
 *From the authors' analysis of the Medicare Beneficiary Summary File (2015-2016). PY expenditures were annualized for fee-for-service beneficiaries who met criteria for serious illness in the prior year and survived to the start of the PY. Spending was adjusted for geography, inflated to 2016 dollars, and annualized, and the stop loss was applied as defined in the Medicare Shared Savings Program.

Although there is growing evidence to inform ACO attribution strategies, the implications of technical contract specifications, like the MSSP rule for truncating outlier spending, are not well understood. Truncating outlier spending is necessary to protect ACOs against catastrophic claims; however, the current MSSP truncation rule

affects spending calculations for 1 in 4 decedents, reducing ACO accountability for escalating end-of-life spending. By truncating the extremely high spending on decedents, the MSSP stop-loss rule substantially reduces the differences in PBPY expenditures between prospective and retrospective ACO populations. The current method of annualizing spending results in highly inflated values by applying end-of-life spending to the full year, and alternative models may better capture spending for decedents. As CMS indicated in the 2018 rules, new methodologies specifically targeting “the most complex patients, such as high-risk patients or those receiving care for chronic conditions,” are needed for both attribution and stop-loss rules.¹

Limitations

Our conclusions are limited to the subgroup of the MSSP-attributed population that meets criteria for serious illness in the prior year and has continuous FFS eligibility during the study period. The population with serious illness changes with time, as individuals who are seriously ill in a given year often die or do not meet the serious illness criteria in the following year, resulting in substantial churn in the serious illness sample from year to year. This study benefits from a comprehensive national data source and MSSP beneficiary data that reflect CMS algorithms for attribution to ACOs. A further limitation is that we were unable to assess the sensitivity of our findings to the definition of prospective assignment using prior-year retrospective assignment rather than current-year preliminary assignment.

CONCLUSIONS

As MSSP saturates the health care landscape, the impact of ACO contractual incentives on care for seriously ill patients will intensify. ACOs using prospective attribution may have greater motivation to target high-risk groups with care management programs because of greater inclusion of decedents and hospice users in the ACO population. CMS should consider performance algorithms and benchmarks that increase accountability and reward health systems that are able to bend the spending curve near the end of life. Future research should evaluate potential models, including specialized ACOs, disease-specific medical homes, and other serious illness payment models. ■

Author Affiliations: Margolis Center for Health Policy, Duke University (BGK, WKB, RS, DA, CHV, JC, MBM), Durham, NC, and Washington, DC; Department of Population Health Sciences, Duke University School of Medicine (BGK, CHV), Durham, NC; Center of Innovation to Accelerate Discovery and Practice Transformation (ADAPT) (BGK, CHV), Durham VA Medical Center, Durham, NC; Leavitt Partners (DBM), Salt Lake City, UT; Duke Clinical Research Institute (JC), Durham, NC.

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Johnson & Johnson, and PrognomIQ; cochairs the Guiding Committee for the Health Care Payment Learning and Action Network; and receives fees for serving as an adviser for Arsenal Capital Partners, Blackstone Life Sciences, and MITRE.

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Address Correspondence to: Brystana G. Kaufman, PhD, MSPH, Margolis Center for Health Policy, Duke University, 230 Science Dr, Durham, NC 27705. Email: Brystana.kaufman@duke.edu.

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eAppendix Table 1. Odds ratios for the model predicting retrospective attribution to an MSSP ACO among seriously ill Medicare beneficiaries

ODDS RATIO ESTIMATES			
EFFECT	POINT ESTIMATE	95% WALD CONFIDENCE LIMITS	
PROSPECTIVELY ATTRIBUTED=0			
<90 DAYS VERSUS 270+	0.684	0.668	0.7
90-179 DAYS VERSUS 270+	1.016	0.994	1.038
180-269 DAYS VERSUS 270+	1.161	1.135	1.187
PROSPECTIVELY ATTRIBUTED =1			
<90 DAYS VERSUS 270+	0.241	0.237	0.245
90-179 DAYS VERSUS 270+	0.587	0.575	0.599
180-269 DAYS VERSUS 270+	0.688	0.673	0.703
ANY HOSPICE USE 1 VS 0	0.795	0.786	0.804
ANY EVALUATION AND MANAGEMENT 1 VS 0	1.339	1.326	1.352
MALE 1 VS 0	0.991	0.984	0.998
70 TO 64 VS 65 TO 69	0.984	0.973	0.995
75 TO 79 VS 65 TO 69	0.985	0.974	0.996
80 TO 84 VS 65 TO 69	0.993	0.982	1.005
85 TO 89 VS 65 TO 69	0.999	0.987	1.011
90+ VS 65 TO 69	0.975	0.962	0.987
UNDER 65 VS 65 TO 69	0.892	0.882	0.903
ASIAN VS WHITE	1.108	1.080	1.138
BLACK VS WHITE	0.968	0.959	0.978
HISPANIC VS WHITE	0.994	0.972	1.016
NORTH AMERICAN NATIVE VS WHITE	0.522	0.497	0.549
OTHER VS WHITE	0.991	0.962	1.020
UNKNOWN VS WHITE	1.078	1.034	1.124
MYOCARDIAL INFARCTION 1 VS 0	1.063	1.043	1.083
ALZHEIMERS AND RELATED DEMENTIAS 1 VS 0	0.821	0.815	0.826
ATRIAL FIBRILLATION 1 VS 0	1.080	1.072	1.088
CATARACTS 1 VS 0	1.026	1.018	1.034
DIABETES 1 VS 0	0.906	0.900	0.912

GLAUCOMA	1 VS 0		1.063	1.052	1.075
ISCHEMIA	1 VS 0		0.898	0.892	0.904
DEPRESSION	1 VS 0		1.021	1.014	1.027
OSTEOARTHRITIS	1 VS 0		1.046	1.037	1.056
RHEUMATOID ARTHRITIS	1 VS 0		0.907	0.902	0.913
TRANSIENT ISCHEMIC ATTACK VS 0		1	0.988	0.978	0.997
BREAST CANCER	1 VS 0		1.018	1.004	1.033
PROSTATE CANCER	1 VS 0		1.046	1.031	1.061
OTHER CANCER	1 VS 0		1.033	1.021	1.045
ANEMIA	1 VS 0		1.020	1.013	1.026
ASTHMA	1 VS 0		0.998	0.990	1.007
HYPERLIPIDEMIA	1 VS 0		1.170	1.163	1.178
HYPERPLASIA	1 VS 0		1.049	1.038	1.060
HYPERTHYROIDISM	1 VS 0		1.213	1.202	1.223
HYPOTHYROIDISM	1 VS 0		1.003	0.996	1.010
CHRONIC KIDNEY DISEASE 0		1 VS	0.941	0.935	0.947
CONGESTIVE HEART FAILURE VS 0		1	0.908	0.902	0.914
CHRONIC OBSTRUCTIVE PULMONARY	1 VS 0		0.990	0.983	0.997
HIP FRACTURE	1 VS 0		0.849	0.832	0.866
YEAR	2016 VS 2015		0.992	0.987	0.998
COUNTY VARIABLES					
MEAN HCC SCORE			1.246	1.230	1.262
PROPORTION ON MEDICAID			0.988	0.988	0.988
PROPORTION MEDICARE ADVANTAGE			1.001	1.001	1.002

eAppendix Table 2. Odds ratios for the model predicting prospective attribution to an MSSP ACO among seriously ill Medicare beneficiaries

Odds Ratio Estimates: Pr (Prospective Attribution)				
Effect	Point Estimate	95% Wald		
		Confidence Limits		
180-269 Days vs 270+ Days	0.974	0.962	0.985	
90-179 Days vs 270+ Days	0.984	0.974	0.995	
<90 Days vs 270+ Days	1.006	0.996	1.015	
ANY HOSPICE USE 1 VS 0	0.963	0.956	0.97	
ANY EVALUATION AND MANAGEMENT 1 VS 0	1.122	1.115	1.13	
MALE 1 VS 0	0.975	0.971	0.98	
70 TO 64 VS 65 TO 69	1.13	1.123	1.138	
75 TO 79 VS 65 TO 69	1.138	1.13	1.145	
80 TO 84 VS 65 TO 69	1.154	1.146	1.161	
85 TO 89 VS 65 TO 69	1.169	1.161	1.177	
90+ VS 65 TO 69	1.165	1.156	1.174	
UNDER 65 VS 65 TO 69	0.998	0.979	1.017	
ASIAN VS WHITE	0.908	0.902	0.915	
BLACK VS WHITE	0.893	0.878	0.907	
HISPANIC VS WHITE	0.393	0.379	0.408	
NORTH AMERICAN NATIVE VS WHITE	0.935	0.916	0.954	
OTHER VS WHITE	1.015	0.984	1.048	
UNKNOWN VS WHITE	0.964	0.951	0.977	
MYOCARDIAL INFARCTION 1 VS 0	0.875	0.871	0.879	
ALZHEIMERS AND RELATED DEMENTIAS 1 VS 0	1.068	1.063	1.074	
ATRIAL FIBRILLATION 1 VS 0	1.043	1.037	1.049	
CATARACTS 1 VS 0	1.005	1.001	1.009	
DIABETES 1 VS 0	1.095	1.087	1.103	
ISCHEMIA 1 VS 0	1.015	1.01	1.02	
DEPRESSION 1 VS 0	1.037	1.033	1.042	
OSTEOARTHRITIS 1 VS 0	1.052	1.045	1.059	
RHEUMATOID ARTHRITIS 1 VS 0	1.011	1.006	1.015	
TRANSIENT ISCHEMIC ATTACK 1 VS 0	0.967	0.96	0.973	
BREAST CANCER 1 VS 0	1.049	1.039	1.059	
PROSTATE CANCER 1 VS 0	1.057	1.046	1.068	
OTHER CANCER 1 VS 0	1.069	1.061	1.078	
ANEMIA 1 VS 0	0.964	0.96	0.968	
ASTHMA 1 VS 0	1.028	1.022	1.034	
HYPERLIPIDEMIA 1 VS 0	1.15	1.145	1.156	
HYPERPLASIA 1 VS 0	1.042	1.034	1.049	
HYPERTHYROIDISM 1 VS 0	1.048	1.042	1.055	

HYPOTHYROIDISM	1 VS 0	0.972	0.967	0.976
CHRONIC KIDNEY DISEASE	1 VS 0	1.05	1.045	1.055
CONGESTIVE HEART FAILURE	1 VS 0	0.955	0.951	0.96
CHRONIC OBSTRUCTIVE PULMONARY	1 VS 0	0.969	0.964	0.973
HIP FRACTURE	1 VS 0	0.91	0.897	0.922
YEAR	2016 VS 2015	1.136	1.131	1.14
COUNTY VARIABLES		1.367	1.354	1.38
MEAN HCC SCORE		0.982	0.982	0.983
PROPORTION ON MEDICAID		1.002	1.001	1.002