Original Article

Variation in Prostate Cancer Treatment and Spending Among Medicare Shared Savings Program Accountable Care Organizations

Parth K. Modi, MD (iD)[1,2]; Samuel R. Kaufman, MS[2]; Tudor Borza, MD, MS (iD)[1,2]; Phyllis Yan, MS[2]; David C. Miller, MD, MPH[1,2]; Ted A. Skolarus, MD, MPH[1,2,3]; John M. Hollingsworth, MD, MS[1,2]; Edward C. Norton, PhD[4,5,6]; Vahakn B. Shahinian, MD, MS[7]; and Brent K. Hollenbeck, MD, MS[1,2]

BACKGROUND: Accountable care organizations (ACOs) have been shown to reduce prostate cancer treatment among men unlikely to benefit because of competing risks (ie, potential overtreatment). This study assessed whether the level of engagement in ACOs by urologists affected rates of treatment, overtreatment, and spending. **METHODS:** A 20% sample of national Medicare data was used to identify men diagnosed with prostate cancer between 2012 and 2014. The extent of urologist engagement in an ACO, as measured by the proportion of patients in an ACO managed by an ACO-participating urologist, served as the exposure. The use of treatment, potential overtreatment (ie, treatment in men with a ≥75% risk of 10-year noncancer mortality), and average payments in the year after diagnosis for each ACO were modeled. **RESULTS:** Among 2822 men with newly diagnosed prostate cancer, the median rates of treatment and potential overtreatment by an ACO were 71.3% (range, 23.6%-79.5%) and 53.6% (range, 12.4%-76.9%), respectively. Average Medicare payments among ACOs in the year after diagnosis ranged from $16,523.52 to $34,766.33. Stronger urologist-ACO engagement was not associated with treatment (odds ratio, 0.87; 95% confidence interval, 0.6-1.2; $P = .4$) or spending (9.7% decrease in spending; $P = .08$). However, urologist engagement was associated with a lower likelihood of potential overtreatment (odds ratio, 0.29; 95% confidence interval, 0.1-0.86; $P = .03$). **CONCLUSIONS:** ACOs vary widely in treatment, potential overtreatment, and spending for prostate cancer. ACOs with stronger urologist engagement are less likely to treat men with a high risk of noncancer mortality, and this suggests that organizations that better engage specialists may be able to improve the value of specialty care. *Cancer* **2018;124:3364-71.** © 2018 American Cancer Society.

KEYWORDS: accountable care organizations, overtreatment, prostate cancer, spending, treatment.

INTRODUCTION

Prostate cancer is a common and expensive disease, with an anticipated 164,690 new cases in 2018 and spending approaching $12 billion.[1-4] Recently, the understanding that many prostate cancers are slow growing and do not require treatment[5] has led to changes in the screening and diagnosis of prostate cancer.[6,7] However, despite decreased screening and fewer diagnoses, treatment and potential overtreatment of men diagnosed with prostate cancer have remained common.[8] Financial incentives embedded in the fee-for-service payment system that favor treatment have the potential to influence this trend.

Policies that align financial incentives with evidenced-based management (ie, those that improve value) have the potential to affect the treatment of prostate cancer. Accountable care organizations (ACOs) are emblematic of such a policy. These integrated health systems aim to improve value by enhancing quality and reducing spending.[9,10] For example, it is well established that a man with a significant competing risk of death from noncancer causes is unlikely to benefit from treatment for prostate cancer (ie, potential overtreatment).[11] By limiting the use of treatment in these men (ie, reducing potential overtreatment), ACOs could provide higher quality care and reduce overall spending. In fact, prior work has demonstrated that ACOs are associated with lower rates of potential overtreatment.[12] However, ACOs are organized around the primary care physician, and it is unclear whether the mission-critical philosophy of improving value trickles down to associated specialists. Indeed, a minority of surgeons[13] and urologists[14] participate in ACOs, and this may limit

the ability of these organizations to influence care delivery in certain specialist-oriented clinical contexts such as prostate cancer.

We hypothesized that variation among ACOs in the care of men with prostate cancer may be due to differing levels of engagement with urologists, who most commonly make a new diagnosis. We proposed that ACOs that better integrated with participating urologists would be able to constrain the use of lower value prostate cancer treatment and, therefore, have lower rates of potential overtreatment and reduced spending. To address this question, we examined Medicare Shared Savings Program ACOs with national Medicare claims. In particular, we aimed to characterize the variation among ACOs in initial treatment, potential overtreatment, and average spending patterns for newly diagnosed men with prostate cancer.

MATERIALS AND METHODS
Data and Study Population
Using a 20% sample of national Medicare claims, we performed a retrospective cohort study of men diagnosed with prostate cancer between 2012 and 2014. All men were followed through December 31, 2015. Incident prostate cancer was identified with a previously validated algorithm, which has a specificity of 99.8% and a positive predictive value of 88.7%.[15] We limited the cohort to men 66 years old or older to allow for a health status assessment in the year preceding the cancer diagnosis.[16] Only men with continuous enrollment in Medicare Parts A and B for 1 year before and after the new diagnosis were included. Men participating in Medicare managed care plans were excluded because they were not eligible to participate in ACOs per Centers for Medicare and Medicaid regulations.

All men with prostate cancer were assigned to a primary care physician implementing the methodology used by the Medicare Shared Savings Program.[17] Physicians were then aligned with Medicare Shared Savings Program ACOs with the provider-level research identifiable file provided by the Centers for Medicare and Medicaid Services. This study included only men who were attributed to an ACO at the time of their prostate cancer diagnosis.

Exposure
The primary exposure was the extent of urologist engagement by the beneficiary's ACO. Previous studies have found that only 10% of urologists participate in Medicare Shared Savings Program ACOs, and only 50% of ACOs include a urologist.[14] We postulated that in order for an ACO to affect prostate cancer care, it would have to both

include participating urologists and preferentially direct referrals to those urologists. Therefore, we constructed a variable to characterize the strength of each ACO's engagement with participating urologists. Urologist engagement was defined as the proportion of prostate cancer patients in each ACO managed by an ACO-participating urologist. For the purposes of this measure, the urologist could participate in any Shared Savings Program ACO to be counted as an ACO participant and need not participate in the same ACO as the primary care provider. Each beneficiary's primary urologist was defined with previously described methods.[18] If the urologist participated in any Medicare Shared Savings Program ACO from 2012 to 2014, he or she was considered an ACO-participating urologist for the purposes of creating the urologist engagement variable.

Outcomes
The primary outcome of this study was the use of curative treatment for prostate cancer within 12 months of diagnosis, and it was measured at the beneficiary level. Treatment was ascertained from the Medicare Provider Analysis and Review, Carrier, and Outpatient files with Healthcare Common Procedure Coding System codes for external-beam radiation therapy, surgery, cryotherapy, and brachytherapy. Patients managed without treatment within 12 months of their diagnosis or with primary androgen deprivation therapy (ie, without contemporaneous surgery or radiation therapy) were classified as undergoing observation.

We also measured 2 secondary outcomes likely to be affected by ACOs. First, we assessed the use of potential overtreatment (ie, treatment in men with a $\geq75\%$ chance of 10-year mortality). Treatment is generally not recommended for men expected to live less than 10 years after diagnosis because of the slow-growing nature of most prostate cancers.[19] Therefore, ACOs that aim to reduce low-value prostate cancer care would be expected to constrain potential overtreatment. Using established methods,[8,12,20] we identified beneficiaries with the highest predicted risk ($\geq75\%$) of noncancer death within 10 years and modeled the use of treatment in this subset of patients.[8] Second, we determined total price-standardized payments for the 12-month period after diagnosis. A primary goal of ACOs is to reduce spending, in part by improving care coordination and reducing waste. We used this comprehensive measure of spending to capture all claims (eg, visits, complications, and readmissions) related to prostate cancer management. Price standardization was used to control for differences in payments

related to geography and facility characteristics (see the supporting information).

Analysis

We compared patient characteristics between those who underwent treatment and those who did not with Pearson's chi-square test. We fit multivariate mixed-effects models with a logit link to estimate patient-level treatment and potential overtreatment. A similar approach was implemented for a model to estimate spending differences, although a log link was used. All models were adjusted with patient age, race, comorbidity,[16] and socioeconomic class at the zip code level[21] and with the degree of urbanization of the beneficiary place of residence (ie, urban vs rural). We used these models to generate plots of treatment and spending at the ACO level by averaging individual-level best linear unbiased predictions for beneficiaries in each ACO. Because we identified different numbers of prostate cancer patients among ACOs, all models were reliability-adjusted with empirical Bayes techniques to reduce statistical noise.[22,23] This technique adjusted the point estimate for an outcome in each ACO toward the overall mean, with the degree of adjustment proportional to the precision of the point estimate.

All analyses were performed with SAS 9.4 (SAS, Cary, North Carolina) and Stata 14 (StataCorp, College Station, Texas). All tests were 2-sided with the probability of type 1 error (α) set at .05. This study protocol was deemed exempt from review by the University of Michigan institutional review board.

RESULTS

Treatment and Overtreatment

We identified 2822 beneficiaries with newly diagnosed prostate cancer who were assigned to 1 of 296 ACOs (Table 1). The median rate of treatment among all ACOs was 71.3%, and the rate ranged from 23.6% to 79.5% (Fig. 1). Among men newly diagnosed with prostate cancer in an ACO, age was significantly associated with the use of treatment ($P < .001$). No significant associations were noted between the use of treatment and race, comorbidity, socioeconomic status, or urban place of residence (Table 2). Of the 2822 men with newly diagnosed prostate cancer in an ACO, 255 had a $\geq 75\%$ chance of non-cancer mortality within 10 years (ie, those subject to potential overtreatment), and they were attributed to 137 ACOs. In these ACOs, the median rate of potential overtreatment was 53.6%, and the rate ranged from 12.4% to 76.9%. Younger age was associated with potential overtreatment ($P = .003$). No significant associations were

TABLE 1. Patient Characteristics by Receipt of Treatment[a]

Characteristic	No Curative Treatment, No. (%)	Curative Treatment, No. (%)	P
No. of patients	849	1973	—
Age			<.001
66-69 y	214 (25.2)	692 (35.1)	
70-74 y	262 (30.9)	708 (35.9)	
75-79 y	164 (19.3)	430 (21.8)	
80-84 y	137 (16.1)	119 (6.0)	
$\geq$85 y	72 (8.5)	24 (1.2)	
Race/ethnicity			.62
White	749 (88.2)	1743 (88.3)	
Black	72 (8.5)	175 (8.9)	
Other/unknown	28 (3.4)	55 (2.8)	
Comorbidity			.093
0	449 (52.9)	1132 (57.4)	
1	206 (24.3)	450 (22.8)	
2	100 (11.8)	219 (11.1)	
$\geq$3	94 (11.1)	172 (8.7)	
Socioeconomic status			.24
Low	221 (26.0)	466 (23.6)	
Medium	306 (36.0)	699 (35.4)	
High	322 (37.9)	808 (41.0)	
Residential area			.38
$\geq$1 million metropolitan county	464 (54.7)	1119 (56.7)	
<1 million metropolitan county	281 (33.1)	616 (31.2)	
Nonmetropolitan rural or urban population[b]	104 (12.2)	228 (11.6%)	

[a] Totals may exceed 100% due to rounding.
[b] Categories have been combined because of the small cell size.

noted between the use of potential overtreatment and race, comorbidity, socioeconomic status, or urban place of residence (Table 2).

Spending

We then evaluated total Medicare spending in the first year after diagnosis among men in ACOs. Average price-adjusted spending among ACOs (Fig. 2) was $21,152.35 (standard deviation, $2589.40) per beneficiary, and spending ranged from $16,523.52 to $34,766.33. Younger age and fewer comorbidities were associated with lower average spending. Residence in a large county ($\geq$1 million population) was associated with higher spending than residence in smaller counties. No significant associations between spending and race or socioeconomic status were noted (Table 2).

ACO-Urologist Engagement

The strength of ACO-urologist engagement ranged among ACOs from 0% (no patients with prostate cancer managed by ACO-participating urologists) to 100% (all patients with prostate cancer managed by ACO-participating urologists). Among the 2282 patients, the median strength of ACO-urologist engagement was 0.14
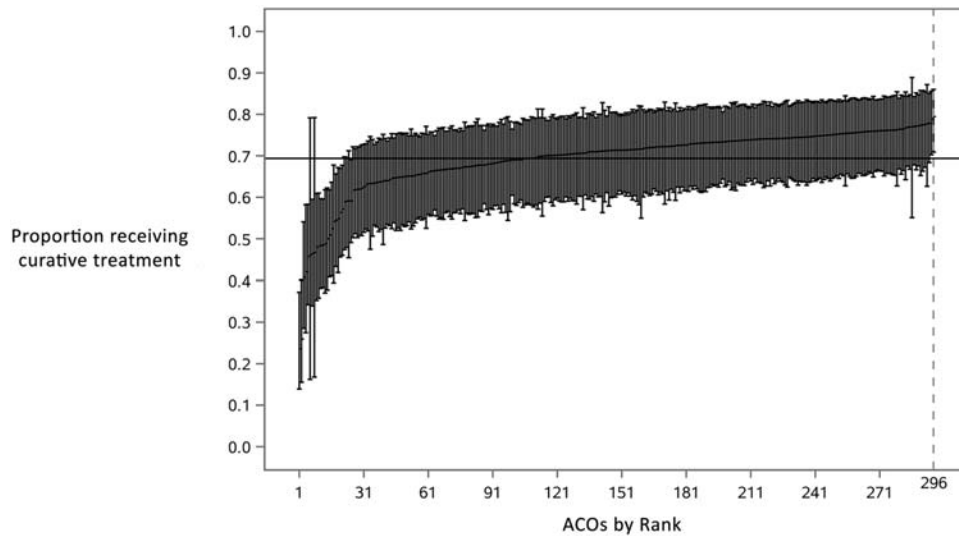
Figure 1. ACOs ranked by the proportion of men with prostate cancer receiving treatment. ACO-level estimates were generated by the averaging of the best linear unbiased predictions from our mixed-effects model. This model estimated treatment after adjusting for age, race, comorbidity score, socioeconomic status, and place of residence. These ACO-level averages were then reliability-adjusted with empirical Bayes techniques and ordered from the lowest to highest proportions of men treated. ACO indicates accountable care organization.

TABLE 2. Models Estimating Treatment, Overtreatment, and Spending Among Men With Prostate Cancer in a Medicare Shared Savings Program ACO

	Treatment (n = 2822)			Potential Overtreatment (n = 255)			Spending (n = 2822)		
	aOR	95% CI	P	aOR	95% CI	P	IRR	SE	P
Age			<.001			.003			.001
66-69 y	Reference			—[a]			Reference		
70-74 y	0.84	0.68-1.04		Reference			1.07	1.04	
75-79 y	0.81	0.64-1.03		1.00	0.37-2.70		1.18	1.04	
80-84 y	0.27	0.20-0.36		0.68	0.24-1.93		1.08	1.06	
≥85 y	0.10	0.06-0.16		0.13	0.03-0.50		0.97	1.09	
Race/ethnicity			.27			.89			.64
White	Reference			Reference			Reference		
Black	1.04	0.76-1.41		0.81	0.34-1.92		0.96	1.06	
Comorbidity			.49			.85			<.001
0	Reference			Reference			Reference		
1	0.91	0.74-1.12		0.66	0.19-2.26		1.07	1.04	
2	0.95	0.72-1.26		0.62	0.18-2.15		1.19	1.05	
≥3	0.81	0.60-1.08		0.56	0.15-2.05		1.59	1.05	
Socioeconomic status			.39			.23			.83
Low	Reference			Reference			Reference		
Medium	1.11	0.88-1.39		1.33	0.65-2.71		1.00	1.04	
High	1.18	0.93-1.50		2.02	0.89-4.56		1.02	1.04	
Residential area			.28			.47			.04
≥1 million metropolitan county	Reference			Reference			Reference		
<1 million metropolitan county	0.88	0.72-1.08		1.08	0.55-2.13		0.94	1.04	
Urban population	0.97	0.72-1.31		0.67	0.27-1.67		0.92	1.05	
Rural population	1.96	0.76-5.08		4.95	0.35-69.27		1.29	1.15	
ACO urologist engagement (0-1)	0.87	0.63-1.21	.4	0.29	0.10-0.86	.03	0.90	1.06	.08

Abbreviations: ACO, accountable care organization; aOR, adjusted odds ratio; CI, confidence interval; IRR, incident rate ratio; SE, standard error.
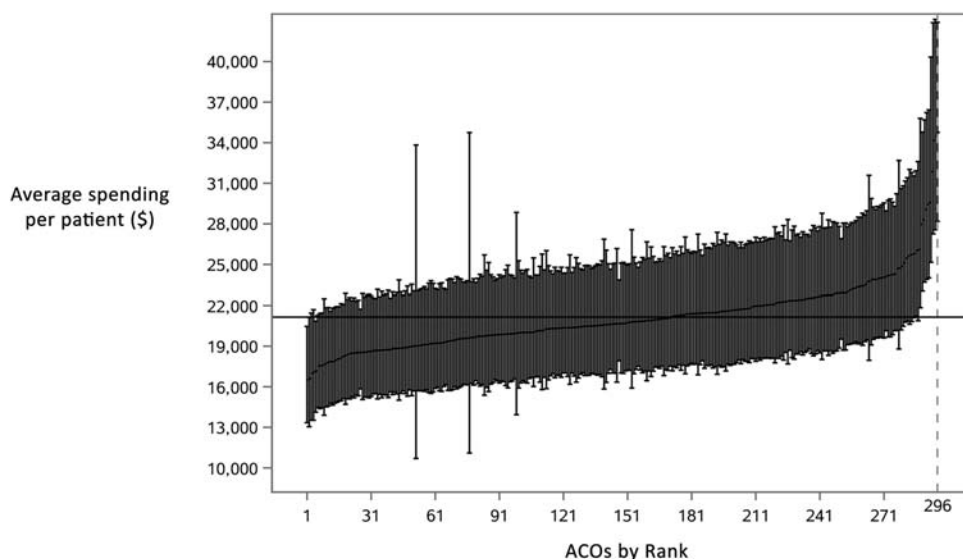[a] There were no patients in this category.

Figure 2. ACOs ranked according to average spending for men with prostate cancer. ACO-level estimates were generated by the averaging of the best linear unbiased predictions from our mixed-effects model. This model estimated spending after adjusting for age, race, comorbidity score, socioeconomic status, and place of residence. These ACO-level averages were then reliability-adjusted with empirical Bayes techniques and ordered from lowest to highest average spending among men with prostate cancer. ACO indicates accountable care organization.

(interquartile range, 0.43). We noted small, statistically significant differences in patient characteristics across quartiles of ACO-urologist engagement (Supporting Table 1). Across quartiles of urologist engagement, we noted small differences in treatment among all men with prostate cancer but larger differences in treatment among men with a high risk of death (Supporting Fig. 1). ACO-urologist engagement was not associated with use of treatment (odds ratio, 0.87; 95% confidence interval, 0.6-1.2; $P = .4$) or Medicare spending (9.7% decrease in spending; $P = .08$) after adjustments for covariates. However, in the subset of patients with a high risk of 10-year mortality, stronger ACO-urologist engagement was independently associated with lower odds of potential overtreatment (odds ratio, 0.29; 95% confidence interval, 0.1-0.9; $P = .03$).

DISCUSSION

We found that Medicare Shared Savings Program ACOs varied widely in treatment, potential overtreatment, and spending for men with newly diagnosed prostate cancer. The use of treatment in these men varied more than 3-fold among Medicare Shared Savings Program ACOs during the study period, with rates ranging from 23.6% to 79.5%. Average spending varied by more than $18,000 between the highest and lowest spending ACOs. ACO-urologist engagement was not significantly associated with the treatment rate or overall spending. However,

among men with a high risk of noncancer mortality, greater ACO-urologist engagement was associated with reduced use of potential overtreatment.

It is well accepted that men with significant medical conditions that limit their life expectancy are particularly unlikely to benefit from prostate cancer treatment.[24,25] Although ACOs as a whole have been shown to reduce the overtreatment of these men,[12] we found that not all ACOs constrain overtreatment to the same extent. The considerable variation in overtreatment among ACOs is surprising because there is a consensus about the value of treatment in men likely to succumb to competing risks within 10 years of a prostate cancer diagnosis.[5,24] That such variation exists among ACOs, whose conceptual underpinnings aim to improve both population health and the value of health care delivered, suggests a significant opportunity for improvement.[9,10]

How ACOs can improve value by enhancing population health and reduce spending in the context of conditions traditionally handled by specialists, such as prostate cancer, is unclear. ACOs are defined around the delivery of primary care. To be eligible to share in savings, ACOs must meet both quality and spending benchmarks.[26] Reducing low-value health care is one mechanism by which ACOs can improve quality and lower spending. In the context of prostate cancer, we posited that ACOs with stronger ties to urologists, as measured by our engagement variable, would lead to lower potential overtreatment and

per-beneficiary spending. Indeed, we found that ACOs with the highest levels of engagement with urologists were less likely to treat men unlikely to benefit (ie, those with a high risk of noncancer mortality within 10 years of their diagnosis). However, urologist engagement was not associated with overall rates of treatment or Medicare spending in the first year after diagnosis.

Our finding that the strength of urologist engagement is associated with decreased overtreatment of prostate cancer has significant implications for primary care providers and urologists. One potential explanation for these findings is that ACOs with the strongest urologist engagement (ie, those with the highest proportion of patients managed by a urologist participating in an ACO) might influence specialty care by directing referrals toward urologists whose practice patterns align with the goals of the ACO.[27] Although a urologist's ACO participation does not necessarily suggest a focus on minimizing low-value care, our results suggest that, on average, these urologists may be less likely to treat men unlikely to benefit. Though speculative, potential reasons for this might be that urologists participating in ACOs may be more conscious of population health, may be more likely to participate in value-based quality improvement efforts, or may have different financial incentives than those not participating in ACOs. Most patients who were treated by ACO-participating urologists were treated by urologists in their ACO (72%). However, more than a quarter of these patients were managed by a urologist in a different ACO. In a sensitivity analysis, the association between ACO-urologist engagement and overtreatment persisted with various definitions of ACO-urologist engagement that considered urologists in the same or different ACO as the patient and primary care physician. This finding is not surprising because patients are attributed to ACOs retrospectively and treating physicians cannot know any given patient's ACO attribution at the time of treatment.

Despite an association with less overtreatment, stronger urologist engagement had no impact on overall treatment or spending in our study. A possible explanation for this is that men with a high risk of noncancer mortality are a small proportion of all ACO patients with newly diagnosed prostate cancer. As a result, overall average spending may be a product of treatment decisions in general and not necessarily decisions in cases of potential overtreatment. Alternatively, physicians in an ACO that provides less treatment to men with a high chance of 10-year noncancer mortality may increase the use of treatment and thus average spending for the remainder of their patients.

Despite the increasing acceptance of observation and active surveillance for prostate cancer,[28] recent evidence suggests that the rate of treatment among men diagnosed with prostate cancer has decreased only modestly.[8] Differences in the use of treatment among ACOs suggests persistent uncertainty or disagreement about the role of therapy for some men with newly diagnosed prostate cancer. A comparison of the use of prostate cancer treatment in patients managed within and outside ACOs demonstrated that ACOs, though not affecting the rate of prostate cancer treatment overall, did constrain the use of potential overtreatment.[12] Our results in the current study build on this finding. An ACO's ability to constrain overtreatment is associated with the strength of its engagement with ACO-participating urologists. However, despite this impact on potential overtreatment, participation in an ACO with strong urologist engagement had no significant effect on prostate cancer treatment or overall spending.

These results must be interpreted with several limitations in mind. First, ACO-urologist engagement is an imperfect measure. We characterized ACO-urologist engagement on the basis of the treatment of ACO patients by urologists who formally participated in any Medicare Shared Savings Program ACO from 2012 to 2014. However, our analysis did not capture urologists who may have been engaged in improving value without formal ACO participation or by participating in commercial or other Medicare ACO programs. We did not distinguish between urologists who participated in the same ACO as a patient or a different ACO. In addition, our classification of ACO-urologist engagement is limited by the relatively small number of patients with prostate cancer per unique ACO, which could reduce the reliability of this measure. All of these limitations would result in random error in the classification of ACO-urologist engagement. This noise in the definition of ACO-urologist engagement would be expected to attenuate the measured association and lead to a conservative estimate of the relation between ACO-urologist engagement and prostate cancer treatment, potential overtreatment, and spending. Second, Medicare data lack information about cancer severity, which is a major factor in determining the value of therapy for the individual diagnosed with prostate cancer. Although we would not expect population-level differences in cancer severity among ACO-enrolled patients, ACOs may vary with respect to their screening and diagnostic intensity. Although such differences have not been empirically demonstrated, such differences could lead to variations in the prostate cancer stage and grade as well as comorbidity diagnoses among ACOs and potentially

confound the results of this analysis. An ideal analysis would incorporate the prostate cancer stage and grade, and such data would be available in data sets with clinical registry information linked with Medicare data (eg, Surveillance, Epidemiology, and End Results–Medicare). However, because of the geographic locations of Surveillance, Epidemiology, and End Results regions, a large proportion of ACOs and attributed patients would be excluded, and this would render a meaningful analysis of ACOs impossible. To evaluate Medicare ACOs, this limitation cannot be overcome with available data. Third, although we demonstrated an association between urologist engagement and overtreatment of men with prostate cancer, we cannot infer a causal relation from this observation. It is possible that ACOs in which patients are less likely to be overtreated more often refer patients to ACO-participating urologists. However, because patients usually make decisions about prostate cancer treatment after consultation with their urologists, it is likely that the choice of urologist plays a significant role in this effect. Finally, our analysis is restricted to men diagnosed with prostate cancer in Medicare Shared Savings Program ACOs from 2012 to 2014. Our findings may not apply to Medicare Pioneer ACOs and commercial ACO programs.

In conclusion, Medicare Shared Savings Program ACOs vary considerably in how they treat men with newly diagnosed prostate cancer and in average spending in the year after diagnosis. This variation is representative of the difficulties that ACOs may have in effecting changes in specialty care. The ability of an ACO to engage urologists is associated with how often it provides prostate cancer treatment to men who are unlikely to benefit. Further research is needed to understand how ACOs can better engage urologists, whether by improved care coordination, directed referral patterns, or modification of financial incentives.

CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

AUTHOR CONTRIBUTIONS

Parth K. Modi: Conceptualization, formal analysis, and writing–original draft. **Samuel R. Kaufman:** Formal analysis and data curation. **Tudor Borza:** Conceptualization, supervision, and writing–review and editing. **Phyllis Yan:** Formal analysis and data curation. **David C. Miller:** Funding acquisition, supervision, and writing–review and editing. **Ted A. Skolarus:** Supervision and writing–review and editing. **John M. Hollingsworth:** Funding acquisition, supervision, and writing–review and editing. **Edward C. Norton:** Formal analysis, supervision, and data curation. **Vahakn B. Shahinian:** Funding acquisition, conceptualization, supervision, and formal analysis. **Brent K. Hollenbeck:** Conceptualization, formal analysis, writing–review and editing, funding acquisition, and supervision.

REFERENCES

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. *CA Cancer J Clin.* 2018;68:7-30.
2. Stokes ME, Ishak J, Proskorovsky I, Black LK, Huang Y. Lifetime economic burden of prostate cancer. *BMC Health Serv Res.* 2011;11:349.
3. Mariotto AB, Yabroff KR, Shao Y, Feuer EJ, Brown ML. Projections of the cost of cancer care in the United States: 2010-2020. *J Natl Cancer Inst.* 2011;103:117-128.
4. Roehrig C, Miller G, Lake C, Bryant J. National health spending by medical condition, 1996-2005. *Health Aff (Millwood).* 2009;28:w358-367.
5. Bill-Axelson A, Holmberg L, Garmo H, et al. Radical prostatectomy or watchful waiting in early prostate cancer. *N Engl J Med.* 2014;370:932-942.
6. Zavaski ME, Meyer CP, Sammon JD, et al. Differences in prostate-specific antigen testing among urologists and primary care physicians following the 2012 USPSTF recommendations. *JAMA Intern Med.* 2016;176:546-547.
7. Barocas DA, Mallin K, Graves AJ, et al. Effect of the USPSTF grade D recommendation against screening for prostate cancer on incident prostate cancer diagnoses in the United States. *J Urol.* 2015;194:1587-1593.
8. Borza T, Kaufman SR, Shahinian VB, et al. Sharp decline in prostate cancer treatment among men in the general population, but not among diagnosed men. *Health Aff (Millwood).* 2017;36:108-115.
9. Fisher ES, Shortell SM. Accountable care organizations: accountable for what, to whom, and how. *JAMA.* 2010;304:1715-1716.
10. Fisher ES, McClellan MB, Bertko J, et al. Fostering accountable health care: moving forward in Medicare. *Health Aff (Millwood).* 2009;28:w219-w231.
11. Hamdy FC, Donovan JL, Lane JA, et al. 10-year outcomes after monitoring, surgery, or radiotherapy for localized prostate cancer. *N Engl J Med.* 2016;375:1415-1424.
12. Borza T, Kaufman SR, Yan P, et al. Early effect of Medicare Shared Savings Program accountable care organization participation on prostate cancer care. *Cancer.* 2018;124:563-570.
13. Resnick MJ, Graves AJ, Buntin MB, Richards MR, Penson DF. Surgeon participation in early accountable care organizations. *Ann Surg.* 2018;267:401-407.
14. Hawken SR, Herrel LA, Ellimoottil C, Ye Z, Hollenbeck BK, Miller DC. Urologist participation in Medicare Shared Savings Program accountable care organizations (ACOs). *Urology.* 2016;90:76-80.
15. Hollenbeck BK, Bierlein MJ, Kaufman SR, et al. Implications of evolving delivery system reforms for prostate cancer care. *Am J Manag Care.* 2016;22:569-575.
16. Klabunde CN, Potosky AL, Legler JM, Warren JL. Development of a comorbidity index using physician claims data. *J Clin Epidemiol.* 2000;53:1258-1267.
17. Centers for Medicare and Medicaid Services. Medicare Shared Savings Program shared savings and losses and assignment methodology, version 3. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/Downloads/Shared-Savings-Losses-Assignment-Spec-V5.pdf. Accessed January 28, 2018.

18. Shahinian VB, Kuo YF, Freeman JL, Goodwin JS. Determinants of androgen deprivation therapy use for prostate cancer: role of the urologist. *J Natl Cancer Inst.* 2006;98:839-845.

19. National Comprehensive Cancer Network. NCCN guidelines for patients: prostate cancer. https://www.nccn.org/patients/guidelines/prostate/index.html. Accessed January 28, 2018.

20. Jacobs BL, Zhang Y, Schroeck FR, et al. Use of advanced treatment technologies among men at low risk of dying from prostate cancer. *JAMA.* 2013;309:2587-2595.

21. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and incidence of coronary heart disease. *N Engl J Med.* 2001;345:99-106.

22. Dimick JB, Ghaferi AA, Osborne NH, Ko CY, Hall BL. Reliability adjustment for reporting hospital outcomes with surgery. *Ann Surg.* 2012;255:703-707.

23. Dimick JB, Staiger DO, Birkmeyer JD. Ranking hospitals on surgical mortality: the importance of reliability adjustment. *Health Serv Res.* 2010;45(6 pt 1):1614-1629.

24. Albertsen PC, Moore DF, Shih W, Lin Y, Li H, Lu-Yao GL. Impact of comorbidity on survival among men with localized prostate cancer. *J Clin Oncol.* 2011;29:1335-1341.

25. Daskivich TJ, Fan KH, Koyama T, et al. Effect of age, tumor risk, and comorbidity on competing risks for survival in a U.S. population-based cohort of men with prostate cancer. *Ann Intern Med.* 2013;158:709-717.

26. Office of Inspector General. Medicare Shared Savings Program accountable care organizations have shown potential for reducing spending and improving quality (OEI-02-15-00450). https://oig.hhs.gov/oei/reports/oei-02-15-00450.asp.

27. Dupree JM, Patel K, Singer SJ, et al. Attention to surgeons and surgical care is largely missing from early Medicare accountable care organizations. *Health Aff (Millwood).* 2014;33:972-979.

28. Ritch CR, Graves AJ, Keegan KA, et al. Increasing use of observation among men at low risk for prostate cancer mortality. *J Urol.* 2015;193:801-806.