

## Medicare Reimbursements Following Confirmatory MRI-Guided Biopsy versus Systematic Biopsy-Only in Low-Risk and Favorable Intermediate-Risk Prostate Cancer: A Real-World Cost Analysis Among Elderly Medicare Beneficiaries

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### Background

- The annual Medicare spending on localized prostate cancer was \$400 million in 2004 to 2007 and increasing over time.<sup>1</sup>
- Prostate biopsy-related costs are a major contributor to this expenditure.<sup>2</sup>
- Despite this, the economic implications of incorporating magnetic resonance imaging-guided biopsy (MRI-Bx) into confirmatory diagnosis algorithms of low-risk and favorable intermediate-risk prostate cancer (LIPCa) remains understudied.<sup>3</sup>

### Objectives

- The study objective is to quantify the reimbursed Medicare costs (RMC) associated with MRI-Bx in the elderly Medicare population in the United States.

### Methods

#### Study Design and Data Source

- We conducted a retrospective cohort study using the Surveillance, Epidemiology, and End Results (SEER)-Medicare 100% Prostate Cancer file (2006–2020) linked to PolicyMap Census tract-level social determinants of health (SDOH) measures.<sup>4,5</sup>
- SEER program is a nationally representative cancer surveillance program that collects demographic, clinical, and tumor characteristics and linked with Medicare Parts A, B, and D claims to provide information on prostate biopsy testing, diagnoses, treatments, utilization, and costs.<sup>4</sup>

#### Study Population

- This study identified patients 66 to 75 years newly diagnosed LIPCa (2007 to 2019), and who received confirmatory MRI-Bx or systematic biopsy-only (SBx) during the 18 months post-initial diagnosis.
- Utilized the American Joint Committee on Cancer's (AJCC) clinical tumor-node-metastasis (TNM) staging variables, and the American Urological Association (AUA) risk stratification algorithm<sup>6</sup> to identify and categorize patients as LIPCa (cT1-cT2c, cN0, cMO with Gleason scores 3+4).
- The MRI-Bx cohort included patients with LIPCa who underwent prostate or pelvic MRI on or before the SBx date, identified using CPT/ICD-9/10-PCS codes for in-bore MRI-guided biopsy (i.e., 55706) and MRI (i.e., 72195, 72196, 72197, 76398, 77021, 76999).<sup>7</sup>
- The SBx cohort were identified using CPT codes 55700, 55705, 76842, 76872, 76942, 76972, 88305, G0416, and ICD-9/10-PCS 60.11, 60.12, 0VB03Z codes.<sup>7</sup>
- The study required continuous enrollment for Medicare Part A, B, and D coverage during the 12-month pre-index date (baseline period) and at least a 12-month post-index date (follow-up period) to enable us to estimate the RMC during the 12-month follow-up period.

#### Study Outcome

- We estimated the 12-month RMC (U.S. \$) from a Medicare perspective.
- The 12-month RMC was inflated to 2024 U.S. dollars purchasing power using the 2024 average Consumer Price Index for the medical care component for inflation.
- All costs were adjusted to 2024 US dollars to reflect current Medicare reimbursements and improve comparability with present-day reimbursement analysis to inform contemporary decision-making.

#### Pre-Index Date Multilevel Factors

- Patient-level: Risk group, and age group in years, sociodemographic information; tumor-level (i.e., Clinical T stage, Gleason grade group [GG], prebiopsy PSA level); clinical (i.e., Charlson Comorbidity Index [CCI], hyperlipidemia, alcohol use disorder, year of receiving confirmatory biopsy).
- Census tract-level SDOH measures: Education, household income, poverty, Yost index, homeowners cost burden, food insecurity, internet access, and public transportation access.
- Physician/Practice-level: Physician specialty and Medicare LIPCa case volume (average cumulative Medicare volume, ACMV).

#### Statistical Analysis

- Implemented Propensity Score Inverse Probability of Treatment Weighting (PS-IPTW), using generalized linear mixed model (GLMM) with a physician random intercept model, to account for differences between groups in the measured pre-index date covariates.<sup>8</sup>
- We estimated the cost ratio and the average marginal effect (AME) using a PS-TPTW weighted generalized estimating equation (GEE) method, specifying a gamma distribution, a log link and an exchangeable working correlation structure at the physician level.<sup>8</sup>
- Delta method was used to estimate the 95% confidence interval.
- We used a p-value of 0.05 or less to establish a statistically significant difference.
- Sensitivity analyses examined 18-month RMC and estimated the E-value to quantify the strength of a potential unmeasured confounder required to fully explain away the observed AME on a cost ratio scale.<sup>8</sup>
- All statistical analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC).

### Results

- Among 8,620 patients in the IPTW weighted sample 15.3% received MRI-Bx as presented in Table 1 below.
- The mean 12-month RMC was 11.4% higher in the MRI-Bx group (adjusted cost ratio = 1.114; 95% CI = 1.051 to 1.181; p-value < 0.01) and the associated AME was \$3,588 (95% CI = \$1,556 to \$5,619; p-value < 0.01) as highlighted in Figure 2 below.
- Among the MRI-Bx versus SBx group, physician and supplier (42.0% vs. 46.1%), hospital outpatient (37.0% vs 29.6%), and inpatient hospital (13.6% vs. 16.1%) services contributed the most to the RMC as shown in Figure 1.
- The adjusted mean 18-month RMC difference, and E-value were \$4,317 (95% CI = \$1,533 to \$7,100), and 1,470 (95% CI = 1,280 to 1,643), respectively.
- There were no major differences in the AME estimates across the base case and the sensitivity analysis.

**Table 1. Characteristics of patients undergoing confirmatory biopsy, after Propensity Score Inverse Probability of Treatment Weighting, 2007–2020**

Characteristics	Overall		Confirmatory biopsy received		Characteristics	Overall		Confirmatory biopsy received		P-value <sup>a</sup>
	N (%)	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	N (%)	
All LIPCa patients, N=8,620	8,620 (100)	1,315 (15.3)	7,305 (64.7)	2,310 (26.7)	All LIPCa patients, N=8,620	8,620 (100)	1,315 (15.3)	7,305 (84.7)	2,310 (26.7)	<0.01
Sociodemographic characteristics					Age: 65–69 (reference)	704 (4.7)	701 (4.2)	705 (4.8)	NA	
Median age at index date (Q1–Q3), years	70 (69–71)	70 (69–71)	70 (69–71)	70 (69–71)	≥ 70 (reference)	749 (85.3)	748 (85.8)	747 (85.2)	747 (85.2)	
Age: 65–69 (reference)	7,618 (42.0)	6,916 (48.4)	2,982 (40.8)	2,982 (40.8)	≥ 70 (reference)	7,478 (57.7)	7,410 (59.2)	7,311 (59.0)	7,311 (59.0)	
Sex	729 (8.3)	729 (8.3)	729 (8.3)	729 (8.3)	Female (reference)	679 (7.9)	679 (7.9)	679 (7.9)	679 (7.9)	
Marital status	5,089 (59.1)	5,015 (59.0)	5,038 (59.0)	5,038 (59.0)	Married (reference)	4,948 (22.8)	4,945 (24.9)	4,945 (24.9)	4,945 (24.9)	<0.01
Married (reference)	5,151 (59.6)	5,123 (59.5)	5,091 (59.5)	5,091 (59.5)	Divorced (reference)	2,113 (9.2)	2,110 (9.2)	2,110 (9.2)	2,110 (9.2)	
Married	3,118 (13.0)	3,118 (13.0)	3,066 (13.2)	3,066 (13.2)	Widowed (reference)	5,103 (22.5)	5,074 (22.5)	5,074 (22.5)	5,074 (22.5)	
Married	5,062 (58.0)	5,034 (57.9)	5,014 (57.9)	5,014 (57.9)	Widowed	5,123 (22.5)	5,094 (22.5)	5,094 (22.5)	5,094 (22.5)	
Race/Ethnicity	7,687 (83.2)	1,077 (81.9)	6,610 (82.3)	1,077 (81.9)	White (reference)	5,125 (57.6)	5,094 (59.5)	5,094 (59.5)	5,094 (59.5)	
Black/African American	942 (11.0)	115 (9.6)	942 (11.0)	115 (9.6)	Black/African American	5,103 (52.4)	5,074 (50.5)	5,074 (50.5)	5,074 (50.5)	
Hispanic	432 (5.2)	55 (4.2)	397 (5.4)	55 (4.2)	Hispanic (reference)	5,123 (11.1)	5,094 (12.2)	5,094 (12.2)	5,094 (12.2)	<0.01
Asian	519 (6.0)	66 (5.4)	423 (6.0)	66 (5.4)	Asian (reference)	5,123 (11.1)	5,094 (12.2)	5,094 (12.2)	5,094 (12.2)	
Primary place of diagnosis	7,044 (81.1)	1,355 (87.5)	6,606 (82.3)	1,355 (87.5)	Group 1 (reference)	5,123 (22.5)	5,094 (22.5)	5,094 (22.5)	5,094 (22.5)	
Medicare private (reference)	485 (5.6)	55 (4.2)	490 (5.9)	55 (4.2)	Group 2	1,120 (4.8)	108 (4.7)	108 (4.7)	108 (4.7)	
Medicare private and insurance	974 (11.3)	105 (8.0)	869 (11.9)	105 (8.0)	Group 3	1,720 (7.3)	280 (13.3)	280 (13.3)	280 (13.3)	
Unknown	7,748 (89.8)	1,231 (93.6)	6,317 (89.2)	1,231 (93.6)	Group 4	1,720 (7.3)	1,473 (20.2)	1,473 (20.2)	1,473 (20.2)	
Dual eligibility status <sup>b</sup>	7,748 (89.8)	1,231 (93.6)	6,317 (89.2)	1,231 (93.6)	Unknown (reference)	239 (0.8)	51 (0.9)	51 (0.9)	51 (0.9)	<0.01
US region of residence	2,159 (25.0)	393 (29.9)	1,765 (24.2)	393 (29.9)	Northeast (reference)	2,399 (24.0)	275 (20.0)	275 (20.0)	275 (20.0)	
Midwest (reference)	876 (10.2)	128 (9.7)	148 (10.2)	128 (9.7)	Midwest	2,120 (21.7)	223 (17.0)	223 (17.0)	223 (17.0)	
Midwest	2,112 (24.5)	256 (19.5)	1,856 (23.4)	256 (19.5)	South	869 (91.9)	142 (10.0)	142 (10.0)	142 (10.0)	
West	3,674 (40.5)	530 (40.5)	3,674 (40.5)	530 (40.5)	West	4,507 (32.2)	1,216 (8.6)	1,216 (8.6)	1,216 (8.6)	
Charlson Comorbidity Index <sup>c</sup>	4,828 (56.0)	816 (62.1)	4,912 (54.9)	816 (62.1)	Charlson Comorbidity Index <sup>c</sup> (reference)	8,620 (100)	1,315 (15.3)	7,305 (84.7)	2,310 (26.7)	
0 (reference)	2,113 (24.5)	290 (22.1)	1,823 (21.0)	290 (22.1)	1 (reference)	7,305 (84.7)	1,315 (15.3)	7,305 (84.7)	2,310 (26.7)	
1	1,679 (19.5)	209 (15.9)	1,470 (20.1)	209 (15.9)	≥ 2 (reference)	7,305 (84.7)	1,315 (15.3)	7,305 (84.7)	2,310 (26.7)	
Hypopituitarism	5,260 (6.0)	846 (64.3)	4,414 (60.4)	846 (64.3)	Physician specialty <sup>d</sup>	4,843 (25.6)	741 (54.6)	741 (54.6)	741 (54.6)	<0.01
Yes	3,360 (39.0)	469 (35.7)	2,891 (39.6)	469 (35.7)	Diagnostic radiologist	2,696 (14.2)	472 (31.4)	472 (31.4)	472 (31.4)	
No (reference)	5,686 (66.0)	873 (66.4)	4,813 (65.9)	873 (66.4)	Radiation oncologist	2,696 (14.2)	576 (37.0)	576 (37.0)	576 (37.0)	
Bioplastic hypopituitarism	2,934 (34.0)	442 (33.8)	2,492 (34.1)	442 (33.8)	Endocrinologist	2,696 (14.2)	3,380 (44.8)	3,380 (44.8)	3,380 (44.8)	
No (reference)	5,686 (66.0)	873 (66.4)	4,813 (65.9)	873 (66.4)	ACLV <sup>e</sup> (reference)	7,623 (88.1)	1,315 (97.4)	1,315 (97.4)	1,315 (97.4)	<0.01
Yes	2,934 (34.0)	442 (33.8)	2,492 (34.1)	442 (33.8)	ACLV <sup>e</sup> (reference)	7,623 (88.1)	1,315 (97.4)	1,315 (97.4)	1,315 (97.4)	
					High volume <sup>f</sup> (reference)	1,008 (11.7)	100 (0.8)	908 (91.2)	908 (91.2)	

**Figure 1. Mean reimbursed Medicare costs among the MRI-Bx and SBx cohorts in a population of Propensity Score Inverse Probability of Treatment Weighted patients, 2007–2020**