Total Hip Arthroplasty in the Bundled Payments for Care Improvement Advanced Model: Who Will Bust the Bundle?

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INTRODUCTION: In the Bundled Payment for Care Improvement Advanced Model (BPCI-A), Centers for Medicare & Medicaid Services (CMS) engaged physician group practices (PGPs), acute care hospitals, and convener participants. These 90-day bundles hold participants accountable for cost, quality, and outcomes, promoting efficiency and value. Accurately predicting high-cost total hip arthroplasty (THA) episodes enables early identification of at-risk patients for preoperative optimization, guides targeted investments in care pathways, and informs refinements to CMS's target pricing methodology. This study aimed to identify preoperative patient and facility factors associated with exceeding target episode costs ("bundle busters") among Medicare beneficiaries undergoing primary inpatient THA with PGPs partnered with a value-based convener. We then sought to develop a predictive model to anticipate whether a THA episode would exceed the target price.

METHODS:

A retrospective review of 4,178 THAs was performed across 29 PGPs participating in BPCI-A Model Years 3 - 5 (2020-2022). For all but two clients, the convener assumed all downside risk while PGPs retained a significant portion of shared savings. Episodes paid under MS-DRG 469 and 470 were included (2.9% classified as MS-DRG 469). Costs exceeded the target price for 901 patients (22%). Using claims data, a predictive multivariable logistic regression model was built from demographics, prior long-term institutional or post-acute care utilization, CMS-Hierarchical Condition Categories (HCC), HCC Total, major teaching hospital status, urban/rural designation, safety net status, census division and bed size. Model performance was assessed using the C-statistic, and the relative contribution of variables were assessed by Akaike Information Criterion (AIC). Data management and analysis were performed using R (Version 4.3.1; Vienna, Austria).

RESULTS: Bundle busters had a median loss of $4,862.87 (IQR $1,428.66 - $13,617.45) and the median gain of a non-bundle buster was $3,069 (IQR $417 - $4,051). Significant predictors included model year (P = 0.001), MS-DRG (P < 0.001), prior post-acute care (P = 0.004), myasthenia gravis/myoneural disorders/inflammatory and toxic neuropathies (P = 0.049), coagulation defects and other hematologic disease (P = 0.011), metastatic cancer or acute leukemia (P = 0.029), and HCC Total (P = 0.034). Compared to New England, six census regions had lower odds of exceeding target prices (P ≤ 0.003). When compared to small bed size, large and extra-large bed size had higher odds of exceeding target price (P = 0.014). (Table 1) The C-statistic for this model was 0.678. The most influential variables are presented in Figure 1.

DISCUSSION AND CONCLUSION: Among 4,178 Medicare patients undergoing primary elective inpatient THA in BPCI-A bundles led by PGPs partnered with a single convener, we identified nine predictors of exceeding CMS target prices, but our model had moderate discriminative power. PGPs, especially with variable surgical volume, are disproportionately affected by bundle busters. As CMS introduces new models and considers the introduction of PGP-specific opportunities, more refined predictive models are needed to empower PGPs and conveners to strategically redesign care to ensure high-quality THA for all patients.

Table 1. Multivariable Logistic Regression Model Results for Busting THA BPCI-A Bundle

Variable	OR	(95% CI)	*P* Value
MS-DRG 470 (vs 469)	0.47	(0.32 – 0.70)	**<0.001**
Model Year			
M4 (vs MY3)	1.32	(1.12 – 1.56)	**0.001**
MY5 (vs MY3)	2.35	(1.50 – 3.70)	**<0.001**
Prior Post Acute Care, yes (vs no)	1.71	(1.19 – 2.46)	**0.004**
HCC Total	1.44	(1.03 – 2.00)	**0.034**
Myasthenia Gravis/ Myoneural Disorders / Inflammatory and Toxic Neuropathy	0.19	(0.04 – 0.99)	**0.049**
Coagulation Defects and Other Specified Hematological Disorders	0.49	(0.29 – 0.85)	**0.011**
Metastatic Cancer and Acute Leukemia	2.49	(1.10 – 5.64)	**0.029**
Bed Size			
Medium (vs Small)	0.87	(0.66 – 1.15)	0.332
Large or Extra Large (vs Small)	1.57	(1.09 – 2.24)	**0.014**
Census Division			
Middle Atlantic (vs New England)	0.88	(0.36 – 2.17)	0.778
East North Central (vs New England)	0.40	(0.22 – 0.71)	**0.002**
West North Central (vs New England)	0.82	(0.42 – 1.58)	0.556
South Atlantic (vs New England)	0.39	(0.21 – 0.73)	**0.003**
East South Central (vs New England)	0.37	(0.22 – 0.64)	**<0.001**
West South Central (vs New England)	0.27	(0.16 – 0.45)	**<0.001**
Mountain (vs New England)	0.42	(0.26 – 0.69)	**0.001**
Pacific (vs New England)	0.28	(0.17 – 0.46)	**<0.001**