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Appendix I International Classification of Diseases, 9th Revision (ICD-9) and 10th Revision (ICD-10) codes

Procedure or Comorbidity	ICD-9	ICD-10
Total hip arthroplasty	81.51	0SR90J9, 0SR90JA, 0SR90JZ, 0SRB0J9, 0SRB0JA, 0SRB0JZ
Total knee arthroplasty	81.54	0SRC06Z, 0SRD06Z, 0SRC07Z, 0SRD07Z, 0SRC0JZ, 0SRD0JZ, 0SRC0KZ, 0SRD0KZ, 0SRC0LZ, 0SRD0LZ, 0SRT07Z, 0SRU07Z, 0SRT0JZ, 0SRU0JZ, 0SRT0KZ, 0SRU0KZ, 0SRV07Z, 0SRW07Z, 0SRV0JZ, 0SRW0JZ, 0SRV0KZ, 0SRW0KZ
Hip hemiarthroplasty	81.52	0SRA009, 0SRE009, 0SRA00A, 0SRE00A, 0SRA00Z, 0SRE00Z, 0SRA019, 0SRE019, 0SRA01A, 0SRE01A, 0SRA01Z, 0SRE01Z, 0SRA039, 0SRE039, 0SRA03A, 0SRE03A, 0SRA03Z, 0SRE03Z, 0SRA07Z, 0SRE07Z, 0SRA0J9, 0SRE0J9, 0SRA0JA, 0SRE0JA, 0SRA0JZ, 0SRE0JZ, 0SRA0KZ, 0SRE0KZ, 0SRR*, 0SRS*
Tobacco use	3051, V1582	F17, Z87891
Obesity	27800, 27801, 27802, 27803	E66, Z683, Z684
DM without complications	250.0–250.3, 250.7	E10.0, E10.1, E10.6, E10.8, E10.9, E11.0, E11.1, E11.6, E11.8, E11.9, E12.0, E12.1, E12.6, E12.8, E12.9, E13.0, E13.1, E13.6, E13.8, E13.9, E14.0, E14.1, E14.6, E14.8, E14.9
DM with complications	250.4–250.6	E10.2–E10.5, E10.7, E11.2–E11.5, E11.7, E12.2–E12.5, E12.7, E13.2–E13.5, E13.7, E14.2–E14.5, E14.7

DM = diabetes mellitus.

*Indicates “wildcard.”

Appendix II Characteristics of patients who underwent HHA or HKR in bMSAs before (April–December 2015) and after (April–December 2016) implementation of the Comprehensive Care for Joint Replacement bundled payment model*

Characteristics	Pre-Policy, %			Post-Policy, %		
	HHA (n = 786)	HKR (n = 6039)	P Value	HHA (n = 763)	HKR (n = 6349)	P Value
<i>Patient characteristics</i>						
Age, yr	82.5 (9.4) [†]	71.8 (8.3) [†]	<0.01	82.8 (9.0) [†]	71.7 (8.2) [†]	<0.01
Female sex	69	63	<0.01	70	62	<0.01
Race						
White	92	88	<0.01	92	87	<0.01
Black	4.2	7.0		3.9	7.3	
Hispanic	2.8	2.8		2.8	3.2	
Asian	0.6	0.6		0.8	0.7	
Dual-eligibility	21	10	<0.01	19	9.5	<0.01
<i>Clinical characteristics</i>						
CCI value	1.66 (1.9) [†]	0.83 (1.2) [†]	<0.01	2.08 (2.05) [†]	0.83 (1.2) [†]	<0.01
Current tobacco use	8.8	6.5	0.02	8.1	5.6	<0.01
History of tobacco use	20	23	0.09	20	25	<0.01
Obesity	4.1	22	<0.01	3.7	23	<0.01
DM without complications	18	19	0.70	14	16	<0.01
DM with complications	2.4	2.2	0.37	6.8	4.0	0.08

bMSA = bundled metropolitan statistical area; CCI = Charlson Comorbidity Index; DM = diabetes mellitus; HHA = hip hemiarthroplasty; HKR = hip and knee replacement.

*Sample is within 40 matched bMSAs.

[†]Data presented as mean (standard deviation).

Appendix III Differential changes in patient case mix from the pre-policy period (2015) to post-policy period (2016), comparing 33,676 Medicare beneficiaries receiving hip or knee replacement in bMSAs vs. nbMSAs[§]

Parameter	β (Robust Standard Error)							
	Dual-Eligibility	Black Race	CCI Value	Current Tobacco Use	History of Tobacco Use	Obesity	DM With Complications	DM Without Complications
Mandate × policy [†]	0.0007 (0.007)	0.0022 (0.0068)	-0.0123 (0.0319)	-0.0010 (0.0052)	-0.0209* (0.0110)	-0.0046 (0.0108)	0.0006 (0.0039)	-0.0063 (0.0090)
Mandate	-0.0668*** (0.0039)	0.0375*** (0.0038)	-0.0669*** (0.0181)	-0.0336*** (0.0030)	0.0769*** (0.0063)	-0.140*** (0.0061)	0.0161*** (0.0022)	0.0014 (0.0051)
Policy	-0.0571*** (0.0054)	-0.0173*** (0.0046)	0.1600*** (0.0239)	0.0089* (0.0046)	0.1320*** (0.0084)	-0.0232** (0.0089)	0.0286*** (0.0037)	0.0079 (0.0072)
Age	-0.0124*** (0.0004)	-0.0038*** (0.0003)	0.0070*** (0.0011)	-0.0058*** (0.0003)	0.0014*** (0.0003)	-0.0090*** (0.0003)	-2.20e-05 (0.0001)	-0.0013*** (0.0003)
Female sex	0.0489*** (0.0042)	0.0173*** (0.0038)	-0.1450*** (0.0158)	-0.0179*** (0.0029)	-0.0910*** (0.0061)	0.0409*** (0.0063)	-0.0116*** (0.0026)	-0.0340*** (0.0044)
Constant	1.001*** (0.0281)	0.2700*** (0.0210)	0.6340*** (0.0759)	0.5730*** (0.0193)	0.2290*** (0.0209)	0.8780*** (0.0241)	0.02420** (0.0109)	0.3530*** (0.0191)
R ²	0.134	0.075	0.019	0.051	0.036	0.057	0.011	0.017

bMSAs = bundled metropolitan statistical areas; CCI = Charlson Comorbidity Index; DM = diabetes mellitus; HKR = hip and knee replacement; nbMSAs = non-bundled metropolitan statistical areas

* p < 0.1

** p < 0.05

*** p < 0.01

[†] Variable of interest.

[§] Outcomes are coded as 0 or 1 (except CCI value). Coefficients indicate the probability (except CCI value, which indicates the change in index value) of experiencing outcome in bMSAs post-policy.

Appendix IV Differential changes in patient case mix from the pre-policy period (April–December 2015) to post-policy period (April–December 2016), comparing 13,937 Medicare Beneficiaries in bMSAs receiving HKR versus HHA[§]

Parameter	β (Robust Standard Error)							
	Dual-Eligibility	Black Race	CCI Value	Current Tobacco Use	History of Tobacco Use	Obesity	DM With Complications	DM Without Complications
HHA × policy [†]	−0.0104 (0.0142)	−0.0001 (0.0081)	0.3630*** (0.0697)	0.0160* (0.0089)	−0.0138 (0.0149)	−0.0154* (0.0093)	0.0237*** (0.0068)	−0.0158 (0.0127)
HHA	0.2400*** (0.0118)	0.0096 (0.0055)	0.7890*** (0.0444)	0.0860*** (0.0082)	−0.0244** (0.0102)	−0.1010*** (0.0084)	0.0010* (0.0041)	−0.0001 (0.0098)
Policy	−0.0559*** (0.0055)	−0.0123** (0.0048)	0.1910*** (0.0211)	0.0102*** (0.0037)	0.1270*** (0.0084)	−0.0217*** (0.0071)	0.0312*** (0.0032)	0.0053 (0.0061)
Age	−0.0117*** (0.0004)	−0.0034*** (0.0003)	0.00478*** (0.0011)	−0.0062*** (0.00025)	0.0010*** (0.0003)	−0.0082*** (0.0003)	−0.0002 (0.0001)	−0.0014*** (0.0003)
Female sex	0.0482*** (0.0040)	0.0132*** (0.0034)	−0.1810*** (0.0150)	−0.0197*** (0.0026)	−0.0940*** (0.0061)	0.0377*** (0.0058)	−0.0140*** (0.0023)	−0.0337*** (0.0041)
Constant	0.8820*** (0.0264)	0.2850*** (0.0192)	0.7640*** (0.0772)	0.5630*** (0.0185)	0.3220*** (0.0187)	0.6910*** (0.0221)	0.0573*** (0.0099)	0.3670*** (0.0188)
R ²	0.127	0.069	0.075	0.055	0.035	0.073	0.014	0.017

bMSAs = bundled metropolitan statistical areas; CCI = Charlson Comorbidity Index; DM = diabetes mellitus; HHA = hip hemiarthroplasty; HKR = hip and knee replacement.

* p < 0.1

** p < 0.05

*** p < 0.01

[†]Variable of interest.

[§]Outcomes are coded as 0 or 1 (except CCI value). Coefficients indicate the probability (except CCI value, which indicates the change in index value) of experiencing outcome in bMSAs post-policy