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**Geographic Variation and Disparities in Total Joint Replacement Use for Medicare Beneficiaries: 2009-2017
Supplementary Appendix**

| | |
|---|----|
| Appendix Exhibit S1: Defining the denominator using the Medicare Beneficiary Summary File – Base segment (2009-2017) | 3 |
| Appendix Exhibit S2: Inclusion and exclusion criteria for Medicare beneficiaries included in the denominator from 2009 to 2017 | 4 |
| Appendix Exhibit S3: Defining the elective primary total hip and total knee replacement (THR/TKR) cohorts | 5 |
| Introduction | 5 |
| Inclusion criteria specified by CMS for both complication and readmission measures | 5 |
| Exclusion criteria specified by CMS for both complication and readmission measures | 6 |
| Exclusion criteria specified by CMS for either complication or readmission measures | 6 |
| Study criteria that differed from the CMS definition | 7 |
| Appendix Exhibit S4: Hip and knee replacement cohort determination from the 2009-2017 MedPAR files..... | 8 |
| Appendix Exhibit S5: Key methodological details..... | 10 |
| Definition of dual-eligible status..... | 10 |
| Direct standardization of Hospital Referral Region-level utilization rates | 10 |
| Time trends analysis..... | 12 |
| Between-HRR differences..... | 12 |
| Appendix Exhibit S6: Characteristics of Hospital Referral Regions in 2009..... | 14 |
| Appendix Exhibit S7: Hospital Referral Region-level characteristics of the Medicare population in 2009 and 2017..... | 15 |
| Appendix Exhibit S8: Age- and sex-standardized Hospital Referral Region-level hip and knee replacement rates in 2017 | 17 |
| Appendix Exhibit S9: Estimates from multilevel mixed-effects linear regression models for changes in hip and knee replacement utilization by race-income groups and years | 19 |
| Appendix Exhibit S10: Mean Hospital Referral Region-level age- and sex-standardized hip and knee replacement rates separately by race and dual-eligibility groups..... | 20 |

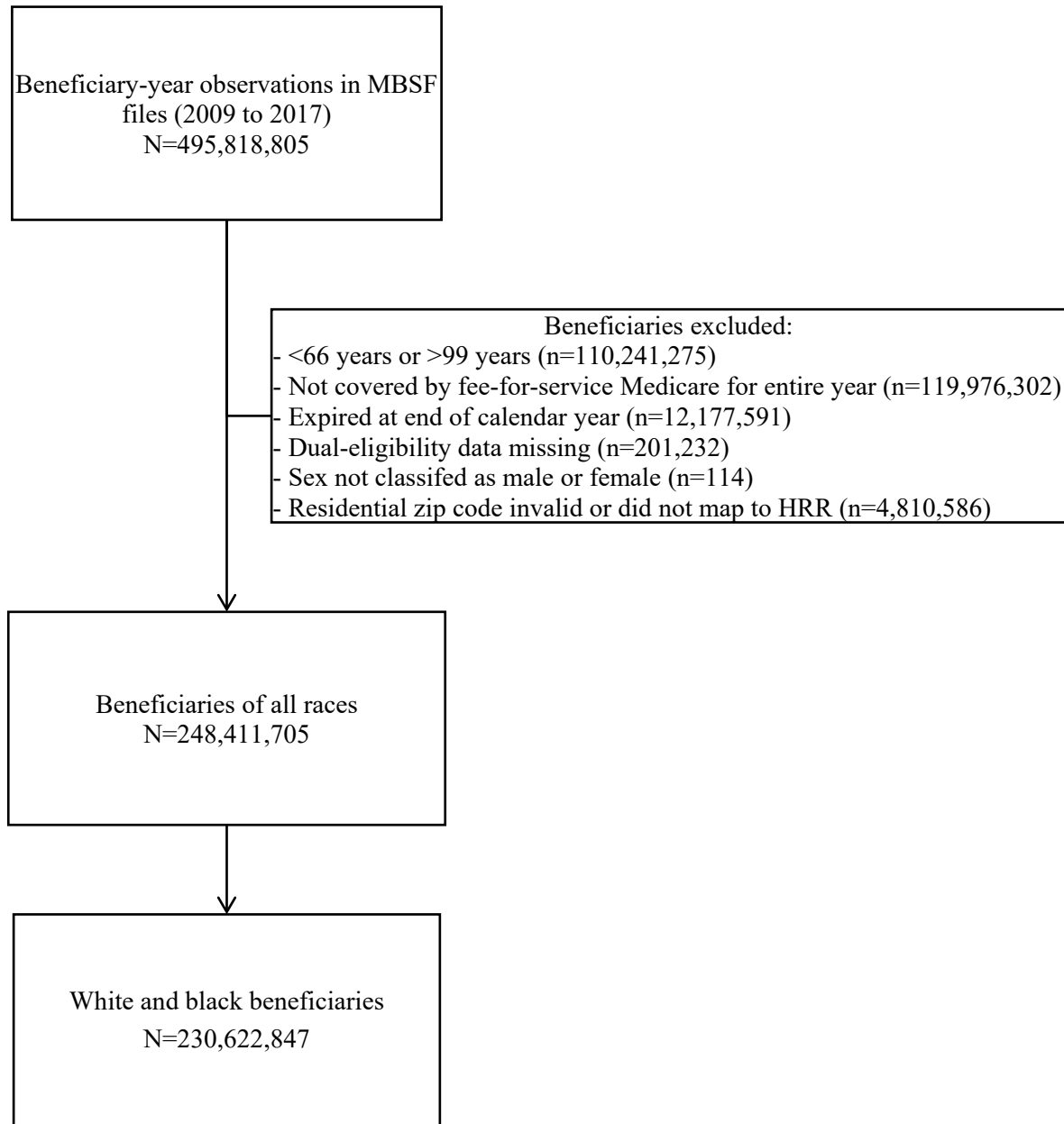
| | |
|--|----|
| Appendix Exhibit S11: Estimates from multilevel mixed-effects linear regression models for changes in hip and knee replacement utilization by HRR-quartiles and years..... | 22 |
| Appendix Exhibit S12: Mean Hospital Referral Region-level age- and sex-standardized hip and knee replacement rates by combinations of race and income (Part D definition) groups | 24 |
| References..... | 25 |

Appendix Exhibit S1: Defining the denominator using the Medicare Beneficiary Summary File –
Base segment (2009-2017)

Inclusion criteria:

- Beneficiaries between 66 and 99 years of age: Since most Medicare beneficiaries qualify for Medicare at 65 years, we limited the cohort to beneficiaries 66 years and older to account for a full year of coverage. We use the age variable included in the MBSF file which represents the age of the beneficiary at the end of the calendar year or at the time of death.
- Fee-for-service beneficiaries identified as those with fee-for-service Medicare coverage for 12 months in the year.
- Beneficiaries who were alive at the end of the calendar year.
- Beneficiaries with missing data for dual-eligibility or sex.
- Beneficiaries with zip codes that mapped to Hospital Referral Regions.
- White or Black Medicare beneficiaries.

Appendix Exhibit S2: Inclusion and exclusion criteria for Medicare beneficiaries included in the denominator from 2009 to 2017



Appendix Exhibit S3: Defining the elective primary total hip and total knee replacement

(THR/TKR) cohorts

Introduction

We used the definitions developed and validated by the Centers for Medicare and Medicaid Services (CMS) for identifying patients undergoing elective primary total hip and knee replacements using claims data.¹ These definitions use a combination of the International Classification of Diseases diagnosis and procedure codes. The definitions were developed by CMS for defining the joint replacement cohort for computing the risk-standardized complication and readmission rates for assessing hospital performance. We used the 2016 version of these definitions for stays that use ICD-9 codes (discharge date before October 1, 2015),^{2,3} and the 2019 version for stays that use ICD-10 codes (discharge date on or after October 1, 2015).^{4,5} Because the 2019 version (ICD-10 version) provides specific details about whether a particular diagnosis or surgical code should be looked up in the primary and/or secondary code fields, and whether or not present-on-admission diagnosis codes should be used, we used the logic provided in the 2019 document for stays that were coded using ICD-9 codes as well.

In this Exhibit, we summarize the criteria that were used to define the cohort from the MedPAR files. We refer the readers to the CMS documentation²⁻⁵ for the specific diagnosis and procedure codes that were used.

Inclusion criteria specified by CMS for both complication and readmission measures

From 2009-2017 MedPAR Files:

- We used ICD-9 (2 codes) and ICD-10 (48 codes) procedure codes to identify inpatient stays undergoing total hip and total knee replacement.

Exclusion criteria specified by CMS for both complication and readmission measures

From 2009-2017 MedPAR Files:

- We excluded patients with fracture of the pelvis or lower limbs; concurrent partial hip or knee arthroplasty procedures; concurrent revision/resurfacing/implanted device or prosthesis removal procedure; mechanical complications; malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow; disseminated malignant neoplasm; transfer in from another acute care facility for THR/TKR.
- Stays with discharge against medical advice.
- Stays with more than two THA/TKA procedure codes during the index admission.
- Stays that were longer than one year.
- Stays for patients that are not included in the Medicare denominator/enrollment file.

From 2009-2017 Impact Files:

- Stays at hospitals that are not short-term acute care hospitals.

Exclusion criteria specified by CMS for either complication or readmission measures

From 2009-2017 MedPAR Files:

- Stays with death or transfer to another acute care facility as the discharge disposition (specific only to the readmission measure).

- Subsequent qualifying inpatient stay within 30 days of prior qualifying stay (specific to complication measure).

Study criteria that differed from the CMS definition

- The CMS definition limits the cohort to patients enrolled in fee-for-service Medicare Parts A and B for 12 months before the date of admission and in Part A during the index admission, and to patients 65 years and over.

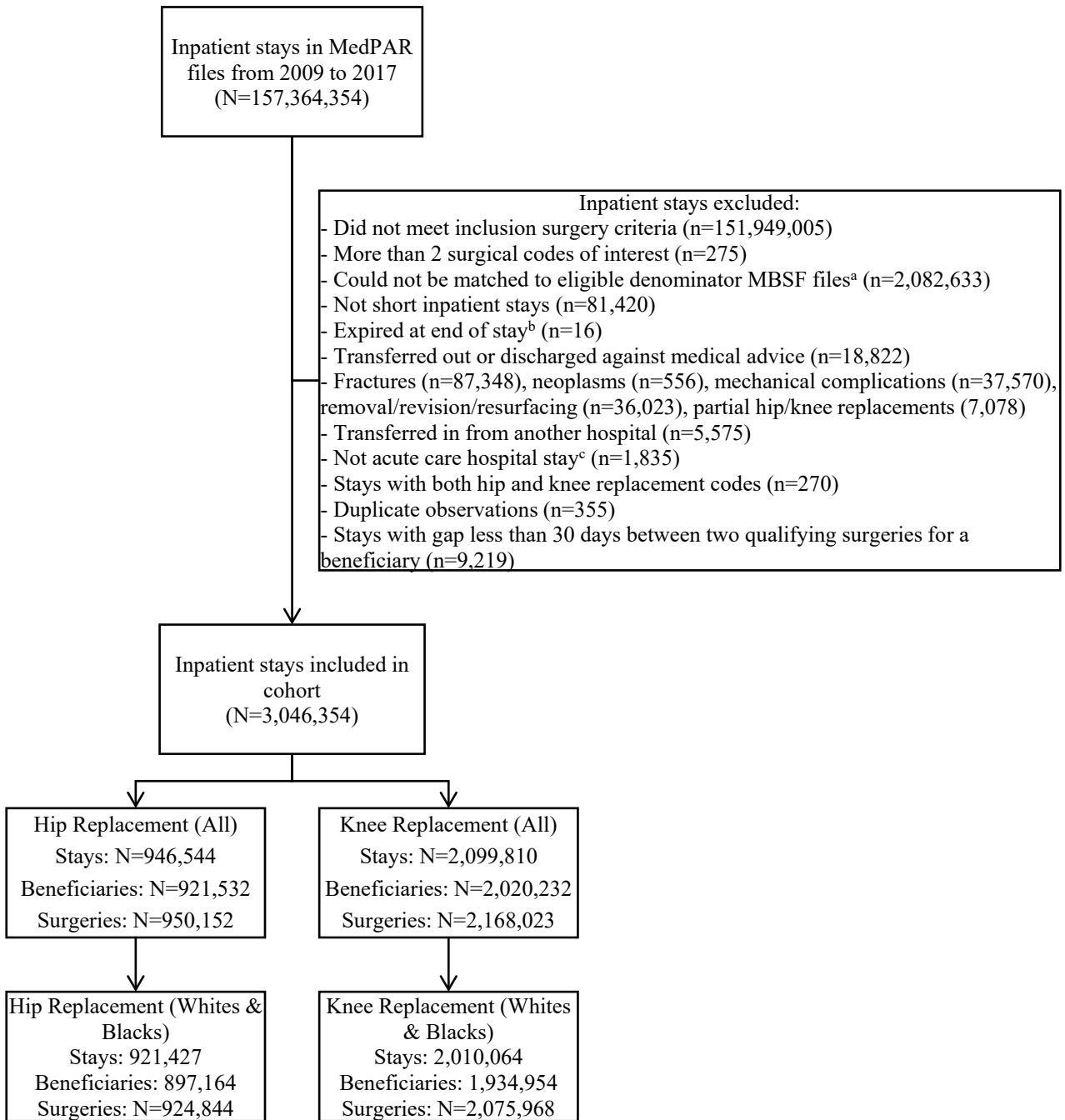
Since most Medicare beneficiaries qualify for Medicare at 65 years, we implemented this CMS criterion by limiting the cohort to beneficiaries 66 years and older to account for full coverage in the year before surgery.

We also excluded beneficiaries who had Medicare Part C coverage (identified using the Health Maintenance Organization [HMO] coverage from the Medicare Denominator Files) for any part of the year thereby ensuring that the cohort included only those Medicare beneficiaries who were covered by fee-for-service Medicare throughout the year.

- Additionally, we limited the cohort to short inpatient stays (identified from the MedPAR files).
- We excluded duplicate observations.
- We also excluded stays that included codes for both hip and knee replacements as attribution to either the THR or TKR cohort would be challenging.

Appendix Exhibit S4: Hip and knee replacement cohort determination from the 2009-2017

MedPAR files



^a Please see inclusion/exclusion criteria in Appendix Exhibits S1 and S2.

^b Most of the Medicare beneficiaries who had expired during the year were excluded when we merged the MedPAR file with the MBSF file because the patient death criterion was applied during the determination of the denominator (Appendix Exhibit S1). This step refers to those beneficiaries whose death data were included in the MedPAR file but were not included in the MBSF file for the calendar year.

^c Determined from Medicare Impact Files.⁶

Appendix Exhibit S5: Key methodological details

Definition of dual-eligible status

We used the `dual_elgbl_mons` variable included in the MBSF files to identify dual-eligible Medicare beneficiaries. This variable is derived from the state-reported dual-eligible status code that is reported for each month of the year.⁷ Beneficiaries with `dual_elgbl_mons==12` represented those who were dual-eligibles for the entire year and were classified as dual-eligibles for the study. Beneficiaries with `dual_elgbl_mons<12` were classified as Medicare-only.

In sensitivity analyses, we used varying definitions of dual-eligibility based on the MBSF data from 2013-2017. First, we used the Cost Share Group variables⁷ to identify dual-eligibles as those with full (eligibility codes 01 to 03) or partial (eligibility codes of 04 to 08) dual-eligibility in each month of the calendar year (Results presented in Appendix Exhibit S12). Second, we used the more restrictive definition of the state reported dual-eligible status code in which beneficiaries with full dual-eligible benefits (codes “02”, “04”, or “08”) in each month of the year were classified as dual-eligibles (Results not presented). The inferences from these definitions were consistent with inferences from the main analysis.

Direct standardization of Hospital Referral Region-level utilization rates

The use of hip and knee replacements has been shown to vary based on the age and sex of the Medicare beneficiary. Since Hospital Referral Regions (HRR) include varying proportions of these demographics, we standardized the hip and knee replacement utilization rates to account for the varying age- and sex-compositions of the HRRs.⁸ We used the direct standardization approach because we had access to national data (all Medicare beneficiaries) through the MBSF

and MedPAR files from which we computed the standard population. The relevant age- and sex-strata of each HRR were weighted by the weights derived from the standard population. We used Stata's⁹ `–dstdize–` command to estimate the standard population and compute the direct standardized rates. This involved the following steps:

- Step 1: We merged the beneficiary-level MBSF and MedPAR files (see the Data Sources and Study Cohort subsection in the Materials and Methods section) for each study year.
- Step 2: We then collapsed each annual file to the following strata to compute direct standardized rates using Stata's `–dstdize–` command:
 - Age (≤ 69 years, > 69 and ≤ 74 years, > 74 and ≤ 79 years, > 79 and ≤ 84 years, > 84 and ≤ 99 years)-sex-race-dual strata for each HRR ($5 \times 2 \times 4 \times 306$) to compute age- and sex-standardized rates for each HRR-race/dual combination used in Figure 2.
 - Code used for direct standardization: `dstdize hip/knee pop age_dum sex_dum, by(hrrnum race_dual)`
 - hip/knee represented the counts of hip or knee replacements, pop was the population count for each age-sex stratum, age_dum and sex_dum were the age and sex categories, hrrnum was the HRR number, and race_dual represented the race-dual combination dummy.
 - The resulting rates were multiplied by 1,000 to express the age- and sex-standardized rates as surgeries per 1,000 beneficiaries, and to create HRR-year-race-dual datasets for hip and knee replacements.

Time trends analysis

To determine whether mean rates for groups (White Medicare-only, White dual-eligibles, Black Medicare-only, and Black dual-eligibles) had changed significantly over time, we constructed separate multilevel mixed-effects linear regression models for THRs and TKRs with HRR-level random effects and exchangeable covariance structure to account for the clustering of observations within an HRR. The general specification of the models was as follows:

$$E(Y_{it}) = \beta_0 + \beta_1 \text{RaceDual}_{it} + \beta_2 \text{Year}_t + \beta_3 \text{RaceDual}_{it} \times \text{Year}_t + \varepsilon_i,$$
$$i = 1, 2, \dots, n \quad t = 1, 2, \dots, 9$$

In this equation, Y_{it} denotes age- and sex-standardized rates of surgeries for the i th HRR at year t , RaceDual_{it} is the race-dual category (White Medicare-only, White dual-eligibles, Black Medicare-only, and Black dual-eligibles), Year_t is the data year, and ε_i is the random effect to control for clustering. We also assumed outcome measures clustered within HRRs followed a normal distribution of mean 0 and a constant variance, in which exchangeable covariance structure was considered.

Between-HRR differences

To determine whether HRRs with higher percentage of Black beneficiaries and dual-eligible beneficiaries were likely to have lower utilization of surgeries for all groups, we estimated separate hierarchical linear regression models for THRs and TKRs with HRR-level random effects and exchangeable covariance structure. The general specification of the models was as follows:

$$E(Y_{it}) = \beta_0 + \beta_1 P_Black_i + \beta_2 P_Dual_i + \beta_3 Year_t + \beta_4 P_Black_i \times Year_t \\ + \beta_5 P_Dual_i \times Year_t + HRR_i + \varepsilon_i, \quad i = 1, 2, \dots, n \quad t = 1, 2, \dots, 9$$

In this equation, Y_{it} denotes age- and sex-standardized rates of surgeries for the i th HRR at year t , P_Black_i is the quartiles of percentage of Black beneficiaries in the HRR in 2009, P_Dual_i is the quartiles of percentage of dual-eligible beneficiaries in the HRR in 2009, $Year_t$ is data year, and HRR_i are the set of HRR covariates. We also assumed outcome measures clustered within HRRs followed a normal distribution of mean 0 and a constant variance, in which exchangeable covariance structure was considered.

Appendix Exhibit S6: Characteristics of Hospital Referral Regions in 2009

| Characteristic | Total |
|--|----------------------|
| HRRs: N | 306 |
| Total population in 1000s ^a : Median (IQR) | 1,001 (531 to 1,882) |
| Percentage of residents over 65 years ^a : Mean (SD) | 16.24 (3.42) |
| Percentage of high-school graduates ^a : Mean (SD) | 85.30 (5.37) |
| Income in \$1000s ^a : Mean (SD) | 66.10 (17.93) |
| Ortho surgeons per 100,000 residents ^b : Mean (SD) | 6.40 (1.36) |
| Hospital beds per 1,000 residents ^c : Mean (SD) | 2.15 (0.54) |
| Region: N (%) ^a | |
| <i>Northeast</i> | 43 (14.05) |
| <i>Midwest</i> | 84 (27.45) |
| <i>South</i> | 119 (38.89) |
| <i>West</i> | 60 (19.61) |

Abbreviations: N: Number; IQR: Interquartile range; SD: Standard deviation; %: Column percentage

Notes: ^a 2009 American Community Survey, ^b 2011 Dartmouth Atlas of Health Care Physician Workforce file, ^c 2012 Dartmouth Atlas of Health Care Hospital Resource file.

Appendix Exhibit S7: Hospital Referral Region-level characteristics of the Medicare population
in 2009 and 2017

| | 2009 | 2017 |
|---|---------------------------|---------------------------|
| HRRs | 306 | 306 |
| Medicare total population in HRR: Mean (SD) | 85,389 (81,271) | 95,469 (92,089) |
| Highest volume HRR (n) | Los Angeles, CA (557,342) | Los Angeles, CA (586,519) |
| Lowest volume HRR (n) | Johnstown, PA (14,201) | Dubuque, IA (11,681) |
| Medicare White & Black population in HRR: Mean (SD) | 80,254 (74,328) | 87,300 (81,936) |
| Highest volume HRR (n) | Boston, MA (451,071) | Boston, MA (523,057) |
| Lowest volume HRR (n) | Johnstown, PA (14,113) | Dubuque, IA (11,375) |
| % of Black beneficiaries in HRR: Median (IQR) | 3.47 (1.13, 8.83) | 3.57 (1.29, 8.86) |
| Highest % HRR | New Orleans, LA (38.20) | New Orleans, LA (39.64) |
| Lowest % HRR | Wausau, WI (0.05) | Bismarck, ND (0.11) |
| % of dual-eligible beneficiaries in HRR: Mean (SD) | 11.69 (6.27) | 9.94 (5.16) |
| Highest | McAllen, TX (43.00) | Harlingen, TX (35.54) |
| Lowest | Sun City, AZ (1.63) | Sun City, AZ (2.56) |
| % of White Medicare-only beneficiaries in HRR: Mean (SD) | 80.80 (10.45) | 79.82 (10.12) |
| Highest | Sun City, AZ (95.46) | Sun City, AZ (92.44) |
| Lowest | Honolulu, HI (27.23) | Honolulu, HI (33.02) |
| % White dual-eligible beneficiaries in HRR: Mean (SD) | 7.94 (3.88) | 6.54 (3.01) |
| Highest | Bangor, ME (29.30) | Bangor, ME (23.55) |
| Lowest | Sun City, AZ (1.25) | Newport News, VA (1.44) |
| % of Black Medicare-only beneficiaries in HRR: Median (IQR) | 2.59 (0.84, 6.37) | 2.77 (1.00, 6.89) |
| Highest | Chicago, IL (24.28) | New Orleans, LA (28.05) |
| Lowest | Wausau, WI (0.04) | Provo, UT (0.08) |
| % of Black dual-eligible beneficiaries in HRR: Median (IQR) | 0.79 (0.22, 2.26) | 0.71 (0.24, 1.81) |

| | 2009 | 2017 |
|---------|-------------------------|-------------------------|
| HRRs | 306 | 306 |
| | | |
| Highest | New Orleans, LA (14.25) | New Orleans, LA (11.59) |
| Lowest | Bismarck, ND (0.00) | Great Falls, MT (0.01) |

Abbreviations: HRR: Hospital Referral Region; SD: Standard deviation; %: Percentage; IQR:

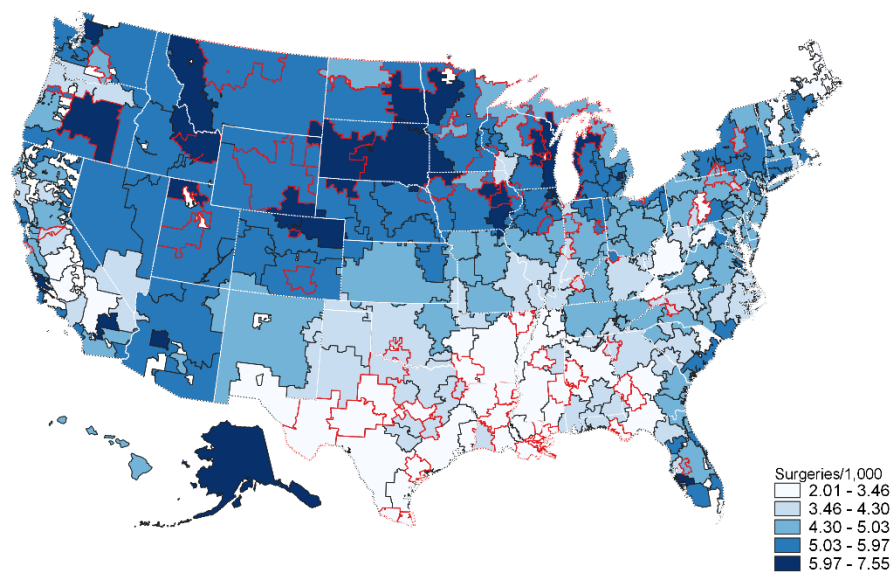
Inter-quartile range

Notes: Authors analysis of 2009 and 2017 Medicare Beneficiary Summary File (MBSF) and

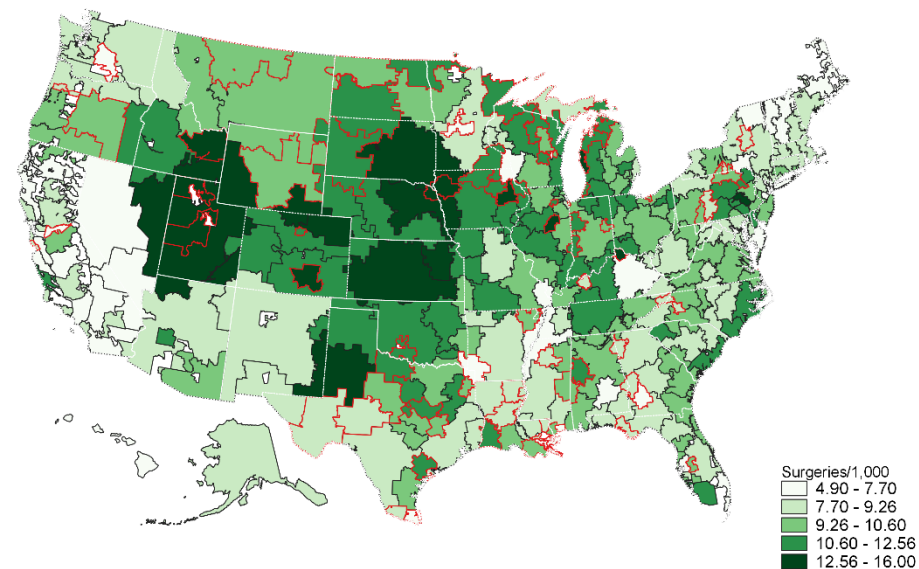
Dartmouth Atlas of Health Care zipcode-Hospital Referral Region crosswalk files.

Appendix Exhibit S8: Age- and sex-standardized Hospital Referral Region-level hip and knee replacement rates in 2017

Hip Replacements



Knee Replacements



Notes: Authors analysis of 2017 Medicare Provider Analysis and Review (MedPAR) and Medicare Beneficiary Summary File

(MBSF), and Dartmouth Atlas of Health Care zip code-Hospital Referral Region crosswalk files. The utilization rates were computed

using the direct standardization method. Hospital Referral Regions in the lowest quartile of White and Black Medicare beneficiary volume are outlined in red.

Appendix Exhibit S9: Estimates from multilevel mixed-effects linear regression models for changes in hip and knee replacement utilization by race-income groups and years

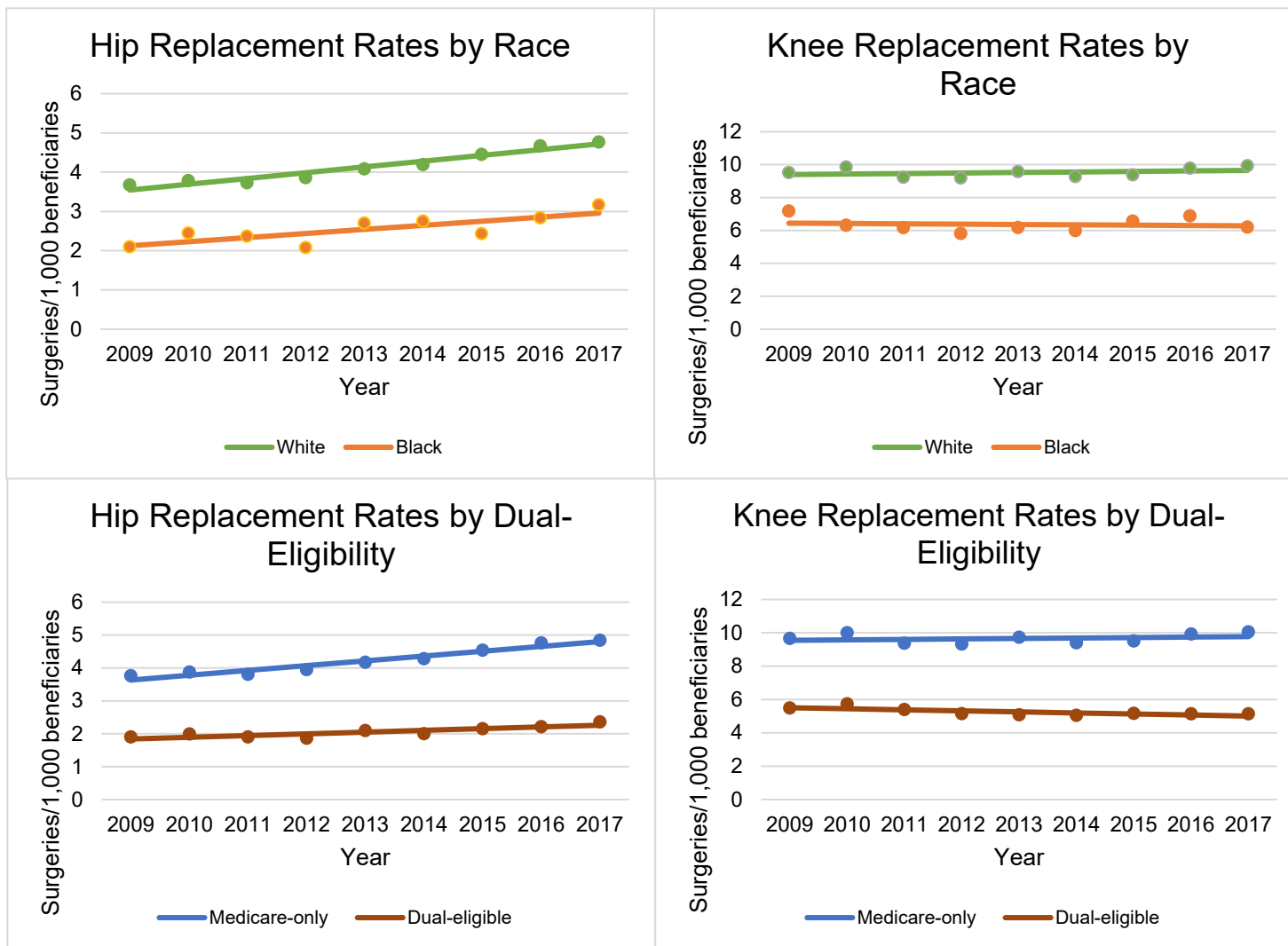
| | Hip Replacement | Knee Replacement |
|--------------------------------|------------------------|------------------------|
| | b [95% CI] | b [95% CI] |
| Observations (Strata-HRR-year) | 11,015 | 11,015 |
| HRRs | 306 | 306 |
| Race | | |
| White Medicare-only | Ref | Ref |
| White Dual | -1.83*** [-2.23,-1.43] | -4.09*** [-4.58,-3.60] |
| Black Medicare-only | -1.49*** [-1.89,-1.09] | -2.98*** [-3.48,-2.49] |
| Black Dual | -1.87*** [-2.27,-1.48] | -4.99*** [-5.48,-4.50] |
| Year | 0.15*** [0.09,0.21] | 0.03 [-0.04,0.10] |
| Race#Year interaction | | |
| White Medicare-only # year | Ref | Ref |
| White Dual # year | -0.09* [-0.18,-0.01] | -0.09 [-0.19,0.02] |
| Black Medicare-only # year | -0.02 [-0.10,0.07] | -0.03 [-0.13,0.08] |
| Black Dual # year | -0.16*** [-0.24,-0.08] | -0.08 [-0.18,0.03] |

* p<0.05, ** p<0.01, *** p<0.001

Abbreviations: HRR: Hospital Referral Region; b: Beta estimate; 95% CI: 95% Confidence Interval; Ref: Reference group

Notes: Strata refer to the four strata in each HRR i.e. White Medicare-only, White dual- eligible, Black Medicare-only, Black dual-eligible. Estimates from multilevel mixed-effects linear regression models with Hospital Referral Region-level random effects and exchangeable covariance structure. The adjusted estimates of these regressions were used to plot Figure 2.

Appendix Exhibit S10: Mean Hospital Referral Region-level age- and sex-standardized hip and knee replacement rates separately by race and dual-eligibility groups



Notes: Authors analysis of 2009-2017 Medicare Provider Analysis and Review (MedPAR) and Medicare Beneficiary Summary File (MBSF). The estimates were derived from multilevel mixed-effects linear regression models with Hospital Referral Region-level random effects and exchangeable covariance structure (separate models for race and socioeconomic groups). The dots represent the estimates from similar models with year specified as a categorical variable.

2017 HRR-level surgery rates per 1000 beneficiaries

| | Hip Replacement | Knee Replacement |
|---------------|-----------------|------------------|
| White | 4.72 | 9.65 |
| Black | 2.96 | 6.28 |
| Medicare-only | 4.80 | 9.77 |
| Dual-eligible | 2.26 | 5.01 |

Appendix Exhibit S11: Estimates from multilevel mixed-effects linear regression models for changes in hip and knee replacement utilization by HRR-quartiles and years

| | Hip Replacement | Knee Replacement |
|---|------------------------|-------------------------|
| | b [95% CI] | b [95% CI] |
| Observations (HRR-year) | 2,754 | 2,754 |
| HRRs | 306 | 306 |
| Quartile of % Black | | |
| Q1 (Black) | Ref | Ref |
| Q2 (Black) | -0.17* [-0.34,-0.00] | 0.13 [-0.29,0.56] |
| Q3 (Black) | -0.32*** [-0.51,-0.14] | -0.37 [-0.83,0.10] |
| Q4 (Black) | -0.42*** [-0.63,-0.21] | -0.90** [-1.44,-0.36] |
| Quartile of % dual | | |
| Q1 (Dual) | Ref | Ref |
| Q2 (Dual) | -0.16 [-0.32,0.00] | -0.65** [-1.06,-0.24] |
| Q3 (Dual) | -0.29*** [-0.46,-0.13] | -0.84*** [-1.25,-0.42] |
| Q4 (Dual) | -0.39*** [-0.57,-0.20] | -1.84*** [-2.31,-1.37] |
| Year | 0.14*** [0.13,0.15] | -0.01 [-0.04,0.02] |
| Quartile of % black #Year interaction | | |
| Q1(Black)#Year | Ref | Ref |
| Q2(Black)#Year | 0.02* [0.00,0.03] | -0.01 [-0.04,0.02] |
| Q3(Black)#Year | 0.02** [0.01,0.04] | 0.01 [-0.02,0.04] |
| Q4(Black)#Year | 0.02 [-0.00,0.03] | 0.04* [0.01,0.07] |
| Quartile of % dual # Year interaction | | |
| Q1(Dual)#Year | Ref | Ref |
| Q2(Dual)#Year | 0.00 [-0.02,0.01] | 0.05** [0.02,0.08] |
| Q3(Dual)#Year | -0.01 [-0.02,0.01] | 0.02 [-0.02,0.05] |
| Q4(Dual)#Year | -0.04*** [-0.05,-0.02] | 0.04* [0.00,0.07] |
| Covariates | | |
| Orthopedic Surgeons per 100,000 Residents (2011) | 0.06** [0.02,0.10] | 0.04 [-0.08,0.15] |
| Acute Care Hospital Beds per 1,000 Residents (2012) | -0.31*** [-0.43,-0.19] | 0.44** [0.12,0.75] |
| % of residents with at least high school degree | 0.04*** [0.03,0.06] | 0.05* [0.00,0.09] |
| Mean Income (in 1,000s) | 0.01*** [0.00,0.01] | -0.02*** [-0.03,-0.01] |
| % of residents over 65 years of age | 0.04*** [0.02,0.05] | -0.03 [-0.08,0.01] |

| | Hip Replacement | Knee Replacement |
|--------------|------------------------|-------------------------|
| | b [95% CI] | b [95% CI] |
| % of females | -0.01 [-0.06,0.04] | -0.12 [-0.26,0.02] |
| Region | | |
| Northeast | Ref | Ref |
| Midwest | 0.72*** [0.54,0.90] | 1.63*** [1.15,2.10] |
| South | 0.05 [-0.15,0.24] | 0.98*** [0.47,1.50] |
| West | 0.49*** [0.29,0.68] | 0.77** [0.26,1.29] |

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

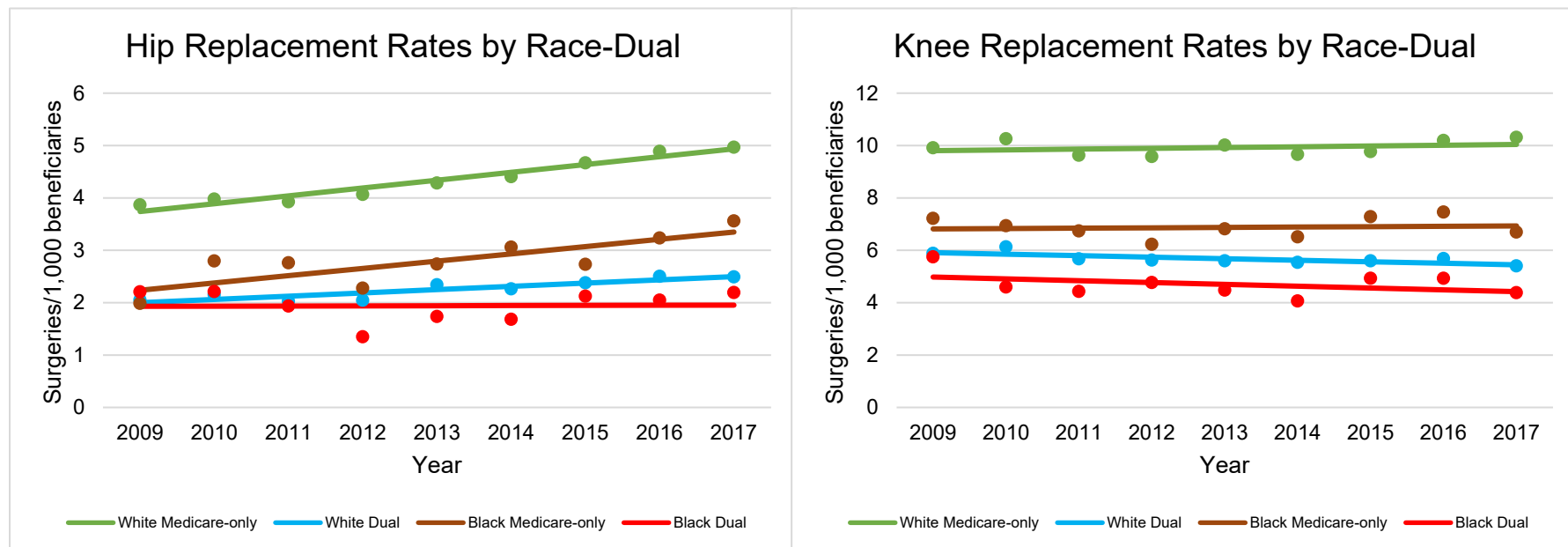
Abbreviations: HRR: Hospital Referral Region; b: Beta estimate; 95% CI: 95% Confidence

Interval; Ref: Reference group

Notes: Estimates from multilevel mixed-effects linear regression models with Hospital Referral

Region-level random effects and exchangeable covariance structure.

Appendix Exhibit S12: Mean Hospital Referral Region-level age- and sex-standardized hip and knee replacement rates by combinations of race and income (Part D definition) groups



Notes: Authors analysis of 2009-2017 Medicare Provider Analysis and Review (MedPAR) and Medicare Beneficiary Summary File (MBSF). The standardized rates were computed separately for each year. The estimates were derived from multilevel mixed-effects linear regression models with Hospital Referral Region-level random effects and exchangeable covariance structure. The dots represent the estimates from similar models with year specified as a categorical variable.

References

1. Centers for Medicare and Medicaid Services. Hip/Knee Complication Measures. <https://www.qualitynet.org/inpatient/measure/complication/methodology>. Accessed 12/01, 2019.
2. Centers for Medicare and Medicaid Services. THA/TKA Complication Measures: Archived Resources. <https://www.qualitynet.org/dcs/ContentServer?cid=1228774719413&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page>. Accessed 09/04, 2019.
3. Centers for Medicare and Medicaid Services. Readmission Measures: Archived Resources. <https://www.qualitynet.org/dcs/ContentServer?cid=1228774371008&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page>. Accessed 09/04, 2019.
4. Centers for Medicare and Medicaid Services. 2019 Procedure-Specific Complication Measure Updates and Specifications: THA/TKA. <https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1228772782693>. Accessed 09/04, 2019.
5. Centers for Medicare and Medicaid Services. 2019 Procedure-Specific Readmission Measure Updates and Specification Report: Total Hip Arthroplasty and/or Total Knee Arthroplasty and Coronary Artery Bypass Graft. <https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841>. Accessed 09/04, 2019.
6. Centers for Medicare and Medicaid Services. Acute Inpatient Prospective Payment System - Impact Files. <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Historical-Impact-Files-for-FY-1994-through-Present>. Accessed 01/02, 2020.
7. Chronic Condition Data Warehouse. Options for determining which CMS Medicare beneficiaries are dually eligible for Medicare and Medicaid benefits—A technical guidance paper. *accessed on February*. 2014;27:2016.
8. Celentano DD, Szklo M. *Gordis Epidemiology*. Sixth ed. Elsevier; 2019.
9. StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LP. 2019.