Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

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Section 1. International Classification of Diseases-9-Clinical Modification (ICD-9-CM) Diagnosis Codes, ICD-9-CM Procedure Codes and Diagnosis-Related Group Codes used in the present study

A. ICD-9-CM diagnosis codes for hip fracture: 820.00-09, 820.01-19, 820.21-2, 820.31-2, 820.8-9

B. ICD-9-CM procedure codes for open reduction, internal fixation, total arthroplasty or hemiarthroplasty: 00.70-7, 79.15, 79.25, 79.35, 81.40, 81.51-3

C. ICD-9-CM procedure codes for abdominal, cardiac, thoracic, vascular, and neurosurgical procedures, grouped by Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project Clinical Classification Software (CCS) category[1]

CCS 1   Incision and excision of central nervous system
0101 0109 0121 0122 0123 0124 0125 0126 0127 0128 0131 0132 0139 0141 0142 0151 0152 0153 0159

CCS2   Insertion; replacement; or removal of extracranial ventricular shunt
0231 0232 0233 0234 0235 0239 0242 0243

CCS 3   Laminectomy; excision intervertebral disc
0302 0309 805 8050 8051 8059 8459 8460 8461 8462 8463 8464 8465 8466 8467 8468 8469 8480 8481 8482 8483 8484 8485

CCS 9   Other operating room therapeutic nervous system procedures
016 0201 0202 0203 0204 0205 0206 0207 0211 0212 0213 0214 022 0291 0292 0293 0294 0296 0299 0301 031 0329 034 0351 0352 0353 0359 036 0371 0372 0379 0397 0398 0399 0401 0402 0403 0404 0405 0406 0407 042 043 0441 0442 045 046 0471 0472 0473 0474 0475 0476 0479 0491 0492 0493 0499 050 0521 0522 0523 0524 0525 0529 0581 0589 059 1761 8053 8054 8458 8694 8695 8696 8697 8698

CCS 36   Lobectomy or pneumonectomy
3220 3221 3222 3223 3224 3225 3226 3229 323 3230 3239 324 3241 3249 325 3250 3259

CCS 42   Other operating room therapeutic procedures on respiratory system and mediastinum
3001 3009 301 3021 3022 3029 303 304 313 315 3161 3162 3163 3164 3169 3171 3172 3173 3174 3175 3179 3191 3192 3198 3199 320 3209 321 326 329 330 331 3334 3339 3341 3342 3343 3348 3349 3392 3393 3398 3399 3401 3403 3405 341 343 344 3451 3452 3459 346 3473 3474 3479 3481 3482 3483 3484 3485 3489 3493 3499

CCS 43   Heart valve procedures
3500 3501 3502 3503 3504 3510 3511 3512 3513 3514 3520 3521 3522 3523 3524 3525 3526 3527 3528 3596 3599

CCS 44   Coronary artery bypass graft
3610 3611 3612 3613 3614 3615 3616 3617 3619 362 363 3631 3632 3633 3634 3639

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[1] HCUP CCS-Services and Procedures. Agency for Healthcare Research and Quality, 2013. (Accessed June 26, 2013, at http://www.hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccssvcproc.jsp.)

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CCS 49   Other operating room heart procedures
3531 3532 3533 3534 3535 3539 3541 3542 3550 3551 3552 3553 3554 3555 3560 3561 3562 3563 3570
3571 3572 3573 3581 3582 3583 3584 3591 3592 3593 3594 3595 3598 3600 3603 3609 3691 3699 3710
3711 3712 3731 3732 3733 3734 3735 3736 374 3741 3749 3752 3753 3754 3755 3760 3761 3762 3763
3764 3765 3766 3767 3768 3790 3791 3799

CCS 50   Extracorporeal circulation auxiliary to open heart procedures
3961 3962 3963 3964 3965 3966

CCS 51   Endarterectomy; vessel of head and neck
3811 3812

CCS 52   Aortic resection; replacement or anastomosis
3834 3844 3864 3971 3973

CCS 55   Peripheral vascular bypass
3925 3929

CCS 56   Other vascular bypass and shunt; not heart
390 391 3921 3922 3923 3924 3926 3928

CCS 59   Other operating room procedures on vessels of head and neck
0061 0062 0063 0064 0065 3801 3802 3831 3832 3841 3842 3851 3852 3861 3862 3881 3882 3972 3974
3975 3976

CCS 61   Other operating room procedures on vessels other than head and neck
0040 0041 0042 0043 0044 0045 0046 0047 0048 0055 3800 3803 3804 3805 3806 3807 3809 3810 3813
3814 3815 3816 3830 3833 3835 3836 3837 3838 3839 3840 3843 3845 3846 3847 3848 3849 3850 3853
3855 3857 3860 3863 3865 3866 3867 3868 3869 387 3880 3883 3884 3885 3886 3887 3888 3889 3930
3931 3932 3941 3949 3950 3951 3952 3953 3954 3955 3956 3957 3958 3959 397 3979 398 3990 3991
3992 3994 3998 3999

CCS 74   Gastrectomy; partial and total
435 436 437 4381 4389 4391 4399

CCS 75   Small bowel resection
 4561 4562 4563

CCS 78   Colorectal resection
1731 1732 1733 1734 1735 1736 1739 4571 4572 4573 4574 4575 4576 4579 458 4581 4582 4583 4840
4841 4842 4843 4849 485 4850 4851 4852 4859 4861 4862 4863 4864 4865 4866 4869

CCS 79   Local excision of large intestine lesion (not endoscopic)
4541

CCS 80   Appendectomy
470 4701 4709 471 4711 4719

CCS 84   Cholecystectomy and common duct exploration
5121 5122 5123 5124 5141 5142 5143 5149 5151 5159

CCS 85   Inguinal and femoral hernia repair
1711 1712 1713 1721 1722 1723 1724 5300 5301 5302 5303 5304 5305 5310 5311 5312 5313 5314 5315
5316 5317 5321 5329 5331 5339

CCS 86   Other hernia repair

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5341 5342 5343 5349 5351 5359 5361 5362 5363 5369 537 5371 5372 5375 5380 5381 5382 5383 5384 539

CCS 87   Laparoscopy (gastrointestinal only)
5421

CCS 89   Exploratory laparotomy
5411

CCS 90   Excision; lysis peritoneal adhesions
545 5451 5459

CCS 94   Other operating room upper gastrointestinal therapeutic procedures
4201 4209 4210 4211 4212 4219 4231 4232 4239 4240 4241 4242 4251 4252 4253 4254 4255 4256 4258 4259 4261 4262 4263 4264 4265 4266 4268 4269 427 4282 4283 4284 4285 4286 4287 4289 4299 430 433 4342 4349 4400 4401 4402 4403 442 4421 4429 4431 4438 4439 4440 4441 4442 445 4461 4463 4464 4465 4466 4467 4468 4469 4491 4492 4495 4496 4497 4498 4499

CCS 96   Other operating room lower gastrointestinal therapeutic procedures
4500 4501 4502 4503 4531 4532 4533 4534 4549 4550 4551 4552 4590 4591 4592 4593 4594 4595 4601 4602 4603 4604 4640 4641 4642 4643 4650 4651 4652 4660 4661 4662 4663 4664 4671 4672 4673 4674 4675 4676 4679 4680 4681 4682 4691 4692 4693 4694 4699 472 4791 4792 4799 480 481 4835 4871 4872 4873 4874 4875 4876 4879 4881 4882 4891 4892 4893 4899 4901 4902 4904 4911 4912 493 4939 4951 4952 4959 496 4971 4972 4973 4974 4975 4976 4979 4991 4992 4993 4994 4995 4999

CCS 99   Other operating room gastrointestinal therapeutic procedures
1763 500 5021 5022 5023 5024 5025 5026 5029 503 504 5061 5069 5102 5103 5104 5131 5132 5133 5134 5135 5136 5137 5139 5161 5162 5163 5169 5171 5172 5179 5181 5182 5183 5189 5191 5192 5193 5194 5195 5199 5201 5209 522 5222 523 524 5251 5252 5253 5259 526 527 5292 5295 5296 5299 540 5412 5419 543 544 5461 5462 5463 5464 5471 5472 5473 5474 5475 5492 5493 5494 5495

D. Diagnosis-related group codes indicating major trauma

For patients with admission dates occurring between January 1, 2004 and December 31, 2007: 280, 418, 444, 445, 484, 485, 486, 487, 506, 508, 510

For patients with admission dates occurring between January 1, 2008 and December 31, 2011: 604, 862, 863, 913, 914, 955, 956, 957, 958, 959, 963, 964, 965, 928, 934, 935

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Section 2. Characteristics of regional anesthesia-specialized, general anesthesia-specialized, and non-reporting hospitals

eTable 1: Characteristics of regional anesthesia-specialized, general anesthesia-specialized, and non-reporting hospitals included in this study			
	Regional anesthesia-specialized[a] (N=63)	General anesthesia-specialized[a] (N=96)	No anesthesia data reported (N=36)
Mean percentage of hip fracture cases receiving regional anesthesia (SD)	61.94 (17.77)	11.56 (9.65)	Not reported
Median bed count (Interquartile Range))	177 (143,267)	340 (209.5, 622)	306 (190, 455)
Teaching hospital (%)	10 (15.87)	30 (31.25)	12 (33.33)
Level 1 trauma center (%)	5 (7.94)	16 (16.67)	5 (13.89)
Mean nurse skill mix (SD)[b]	0.88 (0.09)	0.89 (0.10)	0.90 (0.08)
Mean nurse-to-bed ratio (SD)[c]	1.36 (0.55)	1.44 (0.57)	1.40 (0.53)
Notes: a. Regional anesthesia-specialized hospitals included all facilities that used regional anesthesia in at least 33% of all hip fracture cases performed over the study period; general anesthesia-specialized hospitals included all facilities that used regional anesthesia in less than 33% of all hip fracture cases performed over the period. b. Nurse skill mix calculated as total number of full-time-employee registered nurses and licensed practical nurses divided by total number of full-time employee nurses. c. Nurse to bed ratio calculated as total number of full-time employee nurses divided by total number of hospital beds.			

Section 3. Glossary of matching terms

1. *Exact matching:* Matching cases to controls requiring the same value of a nominal covariate.[1]

2. *Optimal matching:* Matching cases and controls such that the total distance of all covariates between matched pairs is minimized.[1]

3. *Optimal Subset matching:* A matching technique that solves an optimization problem to pick the most similar individuals from treated and control groups, omitting treated subjects without similar control and controls without similar treated subjects.[2]

4. *Fine balance:* Fine balance is a constraint on an optimal matching that forces a nominal variable to have the same distribution in matched treated and control groups. In other words, it constrains a match to be balanced on a given nominal variable, without restricting matching on the variable within pairs.[1, 3]

5. *Near-fine balance:* Near-fine balance follows the same logic as fine balance, but is employed when fine balance is not feasible. If fine balance is not possible, near fine balance comes as close as possible to fine balance.[1, 4]

6. *Mahalanobis distance:* A multivariate measure of covariate distance between individuals in a sample;[5, 6] the Mahalanobis distance is the difference in covariate values for treated patients and matched controls, divided by the covariate's standard deviation, this quantity squared, summed over the various covariates, with an allowance for correlation among the covariates. The distance is zero if two people have the same value for all covariates, and it increases as they become more dissimilar.

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Section 4. Definition of standardized differences used to evaluate matching quality

When evaluating the quality of matching, for each matching variable, we report the "Standardized Difference" for group comparisons before and after matching, which represents the difference in means as a fraction of the pooled standard deviation before matching. Example: if the treated-minus-control difference in mean ages was 1 year and the standard deviation of age was 10 years, the standardized difference would be $1/10$.[7-9] In detail, the Standardized Difference for age would be calculated as follows, where $\mu_{age, nearRA}$ and $\mu_{age, nearGA}$ are the mean ages of the patients residing near to a regional anesthesia-specialized hospital and matched patients residing near to a general anesthesia-specialized hospital; $s^2_{age, near RA}$ and $s^2_{age, all near GA}$ are the variances of the near-regional anesthesia patients and all near-general patients available for matching. The Standardized Difference is then $(\mu_{age, near RA} - \mu_{age, near GA})$ divided by the square root of $[(s^2_{age, near RA} + s^2_{age, all near GA})/2]$. The Normal distribution deposits approximately 95% of its probability on an interval whose length is 4 standard deviations, and a standardized difference of 0.2 is $1/20$ of the length of that interval. A usual rule of thumb is to try to achieve Standardized Differences below 0.2, or a fifth of a standard deviation.[1, 7-9] In our analyses, we used a benchmark of 0.10 as a maximum acceptable Standardized Difference.

Section 5. Description of matching procedures for "near-far," "within-hospital" and "across-hospital" matches

A. "Near-far" (instrumental variable) match. For the near-far match, we used the R *mipmatch* package[10] to form matched pairs, pairing each patient who lived relatively closer to a regional anesthesia-specialized hospital to a similar patient who lived relatively closer to a general-anesthesia specialized hospital. We matched pairs exactly for gender, fracture type, procedure type, procedure year, and chronic obstructive pulmonary disease. We used fine balance[3] (a method of constraining two groups to be balanced on a particular variable without restricting matching on the variable within individual pairs) for all comorbidities, race, Medicaid eligibility, nursing home residence, and hospital trauma center and teaching status. The match minimized a Mahalanobis distance[6] (a standard multivariate measure of differences between individuals) that incorporated all study variables and a propensity score that we estimated with logit regression using all patient-, hospital-, and are-level variables to predict the likelihood of living closer to a regional anesthesia-specialized hospital than to a general anesthesia-specialized hospital. We used optimal subset matching[2] to avoid individually poor matches. To ensure that paired individuals differed meaningfully in terms of their relative proximity to one or another type of hospital,[11, 12] we set the minimum within-pair difference in the instrumental variable at 15 miles and excluded all patients who resided in densely populated urban ZIP codes where the absolute value of the instrumental variable was under two miles.

B. "Within-hospital" match: For the within-hospital match, we used the R *mipmatch* package.[10] This software package matched each patient who received regional anesthesia to a similar patient who received general anesthesia via an optimal matching algorithm anesthesia with exact matching for hospital. In other words, each patient who received regional anesthesia was paired to a patient who received general anesthesia within the same hospital. This match minimized the total Mahalanobis distance within pairs on patient covariates subject to calipers on a propensity score that we estimated with logit regression using all patient-level covariates to predict the likelihood of receiving regional anesthesia. Within individual hospitals, we used near-fine balance to improve matching on covariates. Due to differences in the available sample sizes within specific hospital, the degree of fine balance achieved varied across hospitals.

C. "Across-hospital" match: For the across-hospital match, we used the SAS PROC ASSIGN function. This software package matched each patient who received regional anesthesia to a similar patient who received general anesthesia via an optimal matching algorithm. This match minimized the total Mahalanobis distance within pairs on patient, hospital-, and area-level covariates subject to calipers on a propensity score that we estimated with logit regression using all patient-, hospital- and area-level covariates to predict the likelihood of receiving regional anesthesia; patients were matched exactly for gender.

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Section 6: Comparison of patients with and without missing data on anesthesia type

Table 2: Characteristics of patients with and without missing data on anesthesia type				
	Patients with available data on anesthesia type (N=56,729)	Patients with missing data on anesthesia type (N=28,275)	Absolute standardized difference[a]	P
Patient characteristics				
Age in years, mean (SD)	81.4 (9.9)	81.6 (9.8)	0.02	0.143
Male sex (%)	14,745 (26.0)	7,478 (26.5)	0.01	0.157
Race: white (%)	50,180 (88.5)	23,430 (82.9)	0.16	<0.001
Race: black (%)	1,832 (3.2)	1,846 (6.5)	0.15	<0.001
Race: other (%)	4,717 (8.3)	2,999 (10.6)	0.08	<0.001
Dementia (%)	14,471 (25.5)	6,893 (24.4)	0.03	<0.001
Prior stroke (%)	4,105 (7.2)	2,033 (7.2)	<0.01	0.811
Congestive heart failure (%)	9,316 (16.4)	4,360 (15.4)	0.03	<0.001
Myocardial infarction (%)	3,267 (5.8)	1,545 (5.5)	0.01	0.080
Past cardiac arrhythmia (%)	12,629 (22.3)	5,757 (20.4)	0.05	<0.001
Unstable angina (%)	229 (0.4)	120 (0.4)	<0.01	0.649
Cardiac valvular disease (%)	7,197 (12.7)	2,839 (10.04)	0.08	<0.001
Hypertension (%)	38,021 (67.0)	17,926 (63.4)	0.08	<0.001
Chronic lung disease (%)	9,649 (17.0)	4,083 (14.4)	0.07	<0.001
Renal failure (%)	4,442 (7.8)	2,066 (7.3)	0.02	0.007
Renal parenchymal disease (%)	612 (1.1)	214 (0.8)	0.03	<0.001
Liver failure	849 (1.5)	428 (1.5)	<0.01	0.858
Diabetes mellitus (%)	12,028 (21.2)	5,927 (21.0)	0.06	0.422
Electrolyte abnormality (%)	10,069 (17.8)	4,381 (15.5)	0.06	<0.001
Paraplegia (%)	1,252 (2.2)	642 (2.3)	<0.01	0.554
Thrombocytopenia (%)	1,779 (3.1)	711 (2.5)	0.04	<0.001
Cancer (%)	7,149 (12.6)	3,238 (11.5)	0.04	<0.001
Abdominal malignancy (%)	130 (0.2)	50 (0.2)	0.01	0.132
Medicaid eligible (%)	9,436 (16.6)	6,346 (22.4)	0.15	<0.001
Nursing home resident (%)	2,134 (3.8)	711 (2.5)	0.07	<0.001

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Fracture type: femoral neck (%)	26,804 (47.3)	13,142 (46.5)	0.02	0.034
Fracture type: intertrochanteric (%)	26,231 (46.2)	13,474 (47.7)	0.03	<0.001
Fracture type: subtrochanteric (%)	2,528 (4.5)	1,182 (4.2)	0.01	0.064
Fracture type: two or more (%)	1,166 (2.1)	477 (1.7)	0.03	<0.001
Procedure: total hip arthroplasty (%)	2,294 (4.0)	767 (2.7)	0.07	<0.001
Procedure: hemiarthroplasty (%)	18,578 (32.8)	9,018 (31.9)	0.02	0.012
Procedure: internal fixation (%)	35,857 (63.2)	18,490 (65.4)	0.05	<0.001
Residential ZIP code area characteristics				
Median income in dollars, mean (SD)	51,602.61 (20,620.96)	51,559.07 (21,583.23)	<0.01	0.268

Table 2 (continued): Characteristics of patients with and without missing data on anesthesia type

	Patients with available data on anesthesia type (N=56,729)	Patients with missing data on anesthesia type (N=28,275)	Absolute standardized difference[a]	P
Percent below poverty, mean (SD)	11.1 (8.4)	13.0 (9.6)	0.20	<0.001
Percent completing college, mean (SD)	28.8 (15.5)	30.1 (15.7)	0.10	<0.001
Percent completing high school, mean (SD)	82.6 (9.4)	80.3 (10.7)	0.23	<0.001
Hospital characteristics				
Number of beds, mean (SD)	483.6 (415.1)	452.5 (331.3)	0.08	<0.001
Nurse skill mix, mean (SD)[a]	0.91 (0.07)	0.92 (0.07)	0.04	<0.001
Nurse to bed ratio, mean (SD)[b]	1.55 (0.48)	1.48 (0.52)	0.15	<0.001
Teaching hospital (%)	17,659 (0.31)	9,738 (0.34)	0.07	<0.001
Trauma center (%)	9,503 (0.17)	6,847 (0.24)	0.19	<0.001
Notes: a. The standardized difference for each variable is the mean difference between patients in each matched group as a fraction of the pooled standard deviation before matching; b. Nurse skill mix calculated as total number of full-time-employee registered nurses and licensed practical nurses divided by total number of full-time employee nurses; c. Nurse to bed ratio calculated as total number of full-time employee nurses divided by total number of hospital beds.				

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Section 7. Full matching results: "near-far," "within-hospital," and "across-hospital" matches

eTable 3: Detailed results for the "near-far" match. This table compares patient-, hospital-, and area-level characteristics before and after matching for patients residing closer to a hospital specializing in regional anesthesia (RA) than to a hospital specializing in general anesthesia (GA) versus those residing closer to a hospital specializing in GA than to one specializing in RA. In the table, patients residing relatively closer to an RA-specialized hospital are denoted as "Near RA;" patients residing relatively closer to a GA-specialized hospital are denoted as "Near GA." For details of the matching approach, see Section 5 of this appendix. For definitions of standardized differences, see Section 4 of this appendix. P-values are two-sample tests for balance, using the Wilcoxon rank sum test for continuous variables, and Fisher's exact test for categorical variables.

	Near RA, all available patients (N=13,842)	Near RA, matched patients (N=10,757)	Near GA, matched patients (N=10,757)	Near GA, all available patients (N=27,082)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Differential distance: miles to nearest GA-specialized hospital minus miles to nearest RA-specialized hospital, mean	-12.3122	-12.3168	15.5443	14.1899	-2.4390	0.0000	-2.5641	0.0000
Propensity to be closer to an RA-specialized hospital, mean	0.4967	0.4511	0.4422	0.2572	1.3113	0.0000	0.0487	0.0000
Patient characteristics								
Race: white, percent	94.45	93.96	93.96	91.52	0.1149	0.0000	0.0000	1.0000
Race: black, percent	1.64	1.61	1.61	2.09	-0.0333	0.0016	0.0000	1.0000
Race: other, percent	3.91	4.43	4.43	6.39	-0.1124	0.0000	0.0000	1.0000
Age, mean	81.15	81.35	81.19	81.48	-0.0329	0.0053	0.0158	0.0978
Male sex, percent	26.87	26.62	26.62	25.95	0.0210	0.0448	0.0000	1.0000

eTable 3 (continued): Detailed results for the "near-far" match.

	Near RA, all available patients (N=13,842)	Near RA, matched patients (N=10,757)	Near GA, matched patients (N=10,757)	Near GA, all available patients (N=27,082)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Medicaid insurance, percent	15.39	13.54	13.54	14.75	0.0178	0.0894	0.0000	1.0000
Pre-fracture nursing home residence, percent	5.32	4.17	4.17	3.64	0.0813	0.0000	0.0000	1.0000
Fracture type: subtrochanteric, percent	4.50	4.11	4.11	4.54	-0.0020	0.8604	0.0000	1.0000
Fracture type: intertrochanteric, percent	44.06	44.72	44.72	45.86	-0.0361	0.0006	0.0000	1.0000
Fracture type: femoral neck, percent	48.93	49.34	49.34	47.49	0.0289	0.0058	0.0000	1.0000
Fracture type: two or more, percent	2.51	1.84	1.84	2.12	0.0260	0.0123	0.0000	1.0000
Procedure: total hip arthroplasty, percent	3.25	3.66	3.66	4.33	-0.0564	0.0000	0.0000	1.0000
Procedure: hemiarthroplasty, percent	35.52	34.59	34.59	33.13	0.0503	0.0000	0.0000	1.0000
Procedure: internal fixation, percent	61.23	61.75	61.75	62.54	-0.0270	0.0101	0.0000	1.0000
Congestive heart failure, percent	16.66	15.62	15.62	16.97	-0.0083	0.4346	0.0000	1.0000
Stroke, percent	7.52	6.88	6.88	7.53	-0.0005	0.9842	0.0000	1.0000
Electrolyte abnormality, percent	18.55	17.75	17.75	18.44	0.0026	0.8086	0.0000	1.0000
Myocardial infarction, percent	6.18	5.72	5.72	6.02	0.0068	0.5260	0.0000	1.0000

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	Near RA, all available patients (N=13,842)	Near RA, matched patients (N=10,757)	Near GA, matched patients (N=10,757)	Near GA, all available patients (N=27,082)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
eTable 3 (continued): Detailed results for the "near-far" match.								
Past cardiac arrhythmia, percent	22.82	21.93	21.93	23.17	-0.0084	0.4273	0.0000	1.0000
Unstable angina, percent	0.36	0.33	0.33	0.44	-0.0124	0.2550	0.0000	1.0000
Hypertension, percent	67.22	67.56	67.56	68.07	-0.0180	0.0851	0.0000	1.0000
Cardiac valvular disease, percent	13.20	12.93	12.93	13.23	-0.0009	0.9385	0.0000	1.0000
Chronic lung disease, percent	20.34	18.63	18.63	17.48	0.0731	0.0000	0.0000	1.0000
Liver disease, percent	1.52	1.27	1.27	1.44	0.0064	0.5430	0.0000	1.0000
Renal dysfunction, percent	1.13	1.13	1.13	1.19	-0.0061	0.5932	0.0000	1.0000
Renal failure, percent	7.12	6.86	6.86	8.20	-0.0404	0.0001	0.0000	1.0000
Diabetes mellitus, percent	21.93	21.08	21.08	21.15	0.0189	0.0706	0.0000	1.0000
Paraplegia, percent	2.41	2.13	2.13	2.09	0.0216	0.0386	0.0000	1.0000
Thrombocytopenia, percent	2.95	2.80	2.80	3.25	-0.0172	0.1060	0.0000	1.0000
Any cancer, percent	12.77	12.80	12.80	12.55	0.0068	0.5190	0.0000	1.0000
Abdominal malignancy, percent	0.19	0.19	0.19	0.22	-0.0075	0.5685	0.0000	1.0000
Dementia, percent	25.72	24.93	24.93	25.98	-0.0060	0.5751	0.0000	1.0000
Residential ZIP code area characteristics								
Percent below poverty, mean	10.50	10.59	10.71	10.44	0.0092	0.0000	-0.0184	0.0000

	Near RA, all available patients (N=13,842)	Near RA, matched patients (N=10,757)	Near GA, matched patients (N=10,757)	Near GA, all available patients (N=27,082)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
eTable 3 (continued): Detailed results for the "near-far" match.								
Percent completing some college, mean	25.19	25.55	25.74	27.98	-0.2139	0.0000	-0.0146	0.0060
Percent completing high school, mean	83.19	83.55	83.55	83.89	-0.0931	0.0000	0.0000	0.0000
Median income (US$), mean	51,245.10	49,522.81	50,263.13	50,318.91	0.0461	0.6956	-0.0368	0.7809
Hospital characteristics								
Nurse to bed ratio, mean	1.4465	1.4940	1.4903	1.5527	-0.2188	0.0000	0.0076	0.0889
Nurse skill mix, mean	0.8871	0.8896	0.8918	0.9141	-0.3592	0.0000	-0.0293	0.0000
Hospital beds, mean	246.67	269.65	269.08	505.05	-0.8769	0.0000	0.0020	0.0000
Level I trauma center, percent	3.45	4.38	4.38	17.26	-0.4655	0.0000	0.0000	1.0000
Teaching hospital, percent	6.78	8.60	8.60	33.27	-0.7013	0.0000	0.0000	1.0000

eTable 4: Detailed results for the "within hospital" match. This table compares patient-, hospital-, and area-level characteristics before and after matching for patients receiving regional anesthesia (RA) and general anesthesia (GA). Within the matched sample, each patient receiving RA is matched to a similar patient within the same hospital who received GA. For details of matching approach, see Section 5 of this appendix. For definitions of standardized differences, see Section 4 of this appendix. P-values are two-sample tests for balance, using the Wilcoxon rank sum test for continuous variables, and Fisher's exact test for categorical variables.

	Received RA, all available patients (N=15,904)	Received RA, matched patients (N=11,741)	Received GA, matched patients (N=11,741)	Received GA, all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Propensity to receive general anesthesia, mean	0.3005	0.2979	0.2909	0.2725	0.3735	<0.0001	0.0932	<0.0001
Patient characteristics								
Race: white, percent	89.51	88.55	88.00	88.05	0.0462	<0.0001	0.0174	0.1942
Race: black, percent	2.51	2.86	3.02	3.51	-0.0586	<0.0001	-0.0094	0.4870
Race: other, percent	7.99	8.59	8.98	8.44	-0.0167	0.0783	-0.0142	0.2995
Age, mean	82.17	81.95	81.55	81.12	0.1067	<0.0001	0.0408	0.0532
Male sex, percent	25.52	25.36	25.33	26.18	-0.0149	0.1123	0.0007	0.9761
Medicaid insurance, percent	15.95	15.89	16.81	16.90	-0.0258	0.0060	-0.0248	0.0590
Pre-fracture nursing home residence, percent	3.88	3.69	4.13	3.72	0.0086	0.3634	-0.0230	0.0859
Fracture type: subtrochanteric, percent	3.88	3.97	4.29	4.68	-0.0396	<0.0001	-0.0158	0.2250
Fracture type: intertrochanteric, percent	45.98	46.55	46.31	46.34	-0.0073	0.4366	0.0048	0.7141
Fracture type: femoral neck, percent	48.08	47.65	47.30	46.92	0.0232	0.0135	0.0070	0.5921
Fracture type: two or more, percent	2.06	1.82	2.10	2.05	0.0007	0.9475	-0.0197	0.1322
Procedure: total hip arthroplasty, percent	3.75	3.46	3.38	4.16	-0.0211	0.0257	0.0041	0.7739

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eTable 4 (continued): Detailed results for the "within hospital" match.

	Received RA, all available patients (N=15,904)	Received RA, matched patients (N=11,741)	Received GA, matched patients (N=11,741)	Received GA, all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Procedure: hemiarthroplasty, percent	33.92	33.27	32.86	32.29	0.0345	0.0002	0.0087	0.5144
Procedure: internal fixation, percent	62.34	63.27	63.76	63.55	-0.0251	0.0075	-0.0101	0.4478
Congestive heart failure, percent	16.01	16.28	16.57	16.58	-0.0156	0.0984	-0.0079	0.5611
Stroke, percent	7.02	6.98	7.11	7.32	-0.0118	0.2133	-0.0050	0.7211
Electrolyte abnormality, percent	17.42	17.27	17.43	17.88	-0.0119	0.2077	-0.0042	0.7696
Myocardial infarction, percent	6.02	5.89	5.90	5.66	0.0153	0.1000	-0.0004	1.0000
Past cardiac arrhythmia, percent	21.33	21.69	22.61	22.63	-0.0313	0.0008	-0.0222	0.0927
Unstable angina, percent	0.31	0.33	0.29	0.44	-0.0203	0.0388	0.0065	0.6394
Hypertension, percent	66.02	65.97	65.78	67.41	-0.0295	0.0016	0.0040	0.7726
Cardiac valvular disease, percent	11.70	12.49	13.31	13.07	-0.0416	<0.0001	-0.0249	0.0644
Chronic lung disease, percent	20.16	19.42	18.58	15.78	0.1142	<0.0001	0.0219	0.1066
Liver disease, percent	1.31	1.31	1.55	1.57	-0.0213	0.0255	-0.0201	0.1378
Renal dysfunction, percent	0.80	0.80	1.00	1.19	-0.0393	<0.0001	-0.0202	0.1280
Renal failure, percent	6.97	7.35	7.55	8.16	-0.0450	<0.0001	-0.0076	0.5677
Diabetes mellitus, percent	20.23	20.07	20.50	21.58	-0.0331	0.0004	-0.0106	0.4265
Paraplegia, percent	1.77	1.82	2.08	2.38	-0.0423	<0.0001	-0.0182	0.1711
Thrombocytopenia, percent	2.49	2.79	3.18	3.39	-0.0532	<0.0001	-0.0231	0.0841
Any cancer, percent	13.31	13.20	12.89	12.33	0.0295	0.0016	0.0093	0.4855

eTable 4 (continued): Detailed results for the "within hospital" match.								
	Received RA, all available patients (N=15,904)	Received RA, matched patients (N=11,741)	Received GA, matched patients (N=11,741)	Received GA, all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Abdominal malignancy, percent	0.14	0.14	0.17	0.26	-0.0261	0.0081	-0.0067	0.6174
Dementia, percent	25.53	24.78	24.04	25.50	0.0006	0.9487	0.0170	0.1913
Residential ZIP code area characteristics								
Percent below poverty, mean	10.99	11.21	11.21	11.21	-0.0269	0.0558	0.0000	0.9227
Percent completing some college, mean	29.62	30.68	30.47	28.40	0.0770	0.0096	0.0132	0.2743
Percent completing high school, mean	82.70	82.44	82.31	82.56	0.0151	0.7194	0.0138	0.3104
Median income (US$), mean	53,802.39	54,182.37	54,312.78	50,745.66	0.1443	<0.0001	-0.0062	0.8796
Hospital characteristics								
Nurse to bed ratio, mean	1.5638	1.5541	1.5541	1.548	0.0339	0.0002	0.0000	1.0000
Nurse skill mix, mean	0.9071	0.9190	0.9190	0.9168	-0.1340	<0.0001	0.0000	1.0000
Hospital beds, mean	380.74	441.50	441.50	523.66	-0.3573	<0.0001	0.0000	1.0000
Level I trauma center, percent	14.24	15.98	15.98	17.73	-0.0955	<0.0001	0.0000	1.0000
Teaching hospital, percent	23.39	27.80	27.80	34.14	-0.2392	<0.0001	0.0000	1.0000

eTable 5: Detailed results for the "across hospital" match. This table compares patient-, hospital-, and area-level characteristics before and after matching for patients receiving regional anesthesia (RA) and general anesthesia (GA). This match used all 15,904 available RA patients, matched to an equal number of GA patients. For details of matching approach, see Section 5 of this appendix. For definitions of standardized differences, see Section 4 of this appendix. P-values are two-sample tests for balance, using the Wilcoxon rank sum test for continuous variables, and Fisher's exact test for categorical variables.

	RA patients (N=15,904)	GA: matched patients (N=15,904)	GA: all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Propensity to receive general anesthesia, mean	0.3248	0.3181	0.2630	0.5762	0.0000	0.0621	0.0000
Patient characteristics							
Race: white, percent	89.51	89.79	88.05	0.0462	0.0000	-0.0090	0.4180
Race: black, percent	2.51	2.45	3.51	-0.0586	0.0000	0.0037	0.7455
Race: other, percent	7.99	7.77	8.44	-0.0167	0.0000	0.0080	0.4791
Age, mean	82.17	81.99	81.12	0.1067	0.0000	0.0178	0.2586
Male sex, percent	25.52	25.52	26.18	-0.0149	0.1123	0.0000	1.0000
Medicaid insurance, percent	15.95	16.19	16.90	-0.0258	0.0060	-0.0066	0.5618
Pre-fracture nursing home residence, percent	3.88	4.07	3.72	0.0086	0.3634	-0.0099	0.4052
Fracture type: subtrochanteric, percent	3.88	4.01	4.68	-0.0396	0.0000	-0.0062	0.5841
Fracture type: intertrochanteric, percent	45.98	45.92	46.34	-0.0073	0.4366	0.0011	0.9283
Fracture type: femoral neck, percent	2.06	1.88	2.05	0.0007	0.9475	0.0128	0.2587
Fracture type: two or more, percent	48.08	48.20	46.92	0.0232	0.0135	-0.0023	0.8487
Procedure: total hip arthroplasty, percent	3.75	3.45	4.16	-0.0211	0.0257	0.0155	0.1570

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eTable 5: Detailed results for the "across hospital" match.

	RA patients (N=15,904)	GA: matched patients (N=15,904)	GA: all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Procedure: hemiarthroplasty, percent	33.92	33.37	32.29	0.0345	0.0002	0.0116	0.3075
Procedure: internal fixation, percent	62.34	63.19	63.55	-0.0251	0.0075	-0.0176	0.1201
Congestive heart failure, percent	16.01	16.08	16.58	-0.0156	0.0984	-0.0019	0.8786
Stroke, percent	7.02	7.15	7.32	-0.0118	0.2133	-0.0051	0.6620
Electrolyte abnormality, percent	17.42	17.30	17.88	-0.0119	0.2077	0.0033	0.7785
Myocardial infarction, percent	6.02	5.82	5.66	0.0153	0.1000	0.0083	0.4760
Past cardiac arrhythmia, percent	21.33	21.16	22.63	-0.0313	0.0008	0.0039	0.7318
Unstable angina, percent	0.31	0.23	0.44	-0.0203	0.0388	0.0133	0.1974
Hypertension, percent	66.02	66.17	67.41	-0.0295	0.0016	-0.0032	0.7853
Cardiac valvular disease, percent	11.70	11.95	13.07	-0.0416	0.0000	-0.0074	0.5093
Chronic lung disease, percent	20.16	19.56	15.78	0.1142	0.0000	0.0156	0.1865
Liver disease, percent	1.31	1.14	1.57	-0.0213	0.0255	0.0142	0.1858
Renal dysfunction, percent	0.80	0.96	1.19	-0.0393	0.0000	-0.0165	0.1333
Renal failure, percent	6.97	6.86	8.16	-0.0450	0.0000	0.0043	0.7072
Diabetes mellitus, percent	20.23	20.42	21.58	-0.0331	0.0004	-0.0045	0.6964
Paraplegia, percent	1.77	1.94	2.38	-0.0423	0.0000	-0.0119	0.2803
Thrombocytopenia, percent	2.49	2.58	3.39	-0.0532	0.0000	-0.0056	0.6177

eTable 5: Detailed results for the "across hospital" match.

	RA patients (N=15,904)	GA: matched patients (N=15,904)	GA: all available patients (N=40,825)	Standardized difference before matching	P-value before matching	Standardized difference after matching	P-value after matching
Any cancer, percent	13.31	13.19	12.33	0.0295	0.0016	0.0038	0.7533
Abdominal malignancy, percent	0.14	0.12	0.26	-0.0261	0.0081	0.0056	0.6437
Dementia, percent	25.53	25.54	25.50	0.0006	0.9487	-0.0003	0.9897
Residential ZIP code area characteristics							
Percent below poverty, mean	10.99	10.85	11.21	-0.0269	0.0558	0.0162	0.0997
Percent completing some college, mean	29.62	29.21	28.40	0.0770	0.0096	0.0258	0.9714
Percent completing high school, mean	82.70	82.69	82.56	0.0151	0.7194	0.0010	0.9038
Median income (US$), mean	53,802.39	53,115.47	50,745.66	0.1443	0.0000	0.0324	0.0998
Hospital characteristics							
Nurse to bed ratio, mean	1.5638	1.5697	1.5480	0.0339	0.0000	-0.0128	0.3563
Nurse skill mix, mean	0.9071	0.9060	0.9168	-0.1340	0.0000	0.0145	0.3878
Hospital beds, mean	380.74	381.12	523.66	-0.3573	0.0000	-0.0010	0.4491
Level I trauma center, percent	14.24	14.54	17.73	-0.0955	0.0000	-0.0084	0.4432
Teaching hospital, percent	23.39	23.52	34.14	-0.2392	0.0000	-0.0028	0.8015

Section 8. Description of sensitivity analyses

The following tables present an analysis of the sensitivity of our statistically significant study results to hypothetical unmeasured confounders of varying magnitude.[1, 13, 14] The horizontal axis of each table lists a range of potential odds ratios that could characterize the impact of a hypothetical unmeasured factor on the odds of receiving general anesthesia. For example, a value of 1.2 along the horizontal axis would correspond to a factor that increased the odds of receiving general anesthesia by 20%. The vertical axis of each table lists a range of potential odds ratio values that could characterize the impact of a hypothetical unmeasured factor on an adverse outcome of interest. For example, a value of 1.2 on the vertical axis would correspond to a factor that increased the odds of an adverse outcome by 20%. The cells of each table list the maximum possible one-sided p-values that one would obtain for the relevant comparison after accounting for a hypothetical unmeasured confounder whose associations with treatment and outcome correspond to the values listed on the vertical and horizontal axes of the table. The shaded cells indicate the levels of confounding for which the p-value would remain below the nominal threshold for statistical significance of 0.05.

eTables 6, 7, and 8 present the sensitivity analysis for the length of stay comparison results from our near-far match, our within-hospital match, and our across-hospital match, respectively. For each match, the table indicates that our findings regarding differences in length of stay are insensitive to an unmeasured confounder that increases the odds of receiving general anesthesia by 50% and also increases the odds of a longer length of stay by 50%. However, it also indicates that our results could be explained by an unobserved confounder that shows stronger associations with general anesthesia and increased length of stay. In brief, the results are insensitive to very small biases but sensitive to moderate biases.

eTable 9 presents the sensitivity analysis for the mortality comparison for our across-hospital match. This table suggests that our findings regarding mortality from this match could be explained by an unmeasured confounder that increased the odds of receiving general anesthesia by less than 25% while also increasing the odds of mortality by less than 25%. This finding indicates that our finding of a significant difference in mortality in our across-hospital match is far more sensitive to bias than are our findings regarding length of stay, and is consistent with our finding of no significant difference in mortality in the near-far or within-hospital matches, which account for greater degrees of confounding than the across-hospital match.

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Section 9: Sensitivity analysis results for all outcomes with P ≤ 0.05

eTable 6: Sensitivity analysis for length of stay comparison, near-far match									
	Odds ratio for association of a hypothetical unmeasured factor with receipt of general anesthesia								
		1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Odds ratio for association of a hypothetical unmeasured factor with increased length of stay	**1.00**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	1.25	<0.0001	<0.0001	0.0001	0.0006	0.0086	0.0251	0.0618	0.1302	0.2376
	1.50	<0.0001	0.0001	0.0086	0.2376	0.5387	0.9011	0.9805	0.9977	0.9993
	1.75	<0.0001	0.0006	0.2376	0.8144	0.9928	0.9998	1.0000	1.0000	1.0000
	2.00	<0.0001	0.0086	0.5387	0.9928	0.9999	1.0000	1.0000	1.0000	1.0000
	2.25	<0.0001	0.0251	0.9011	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
	2.50	<0.0001	0.0618	0.9805	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.75	<0.0001	0.1302	0.9977	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	3.00	<0.0001	0.2376	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

eTable 7: Sensitivity analysis for length of stay comparison, within-hospital match										
		Odds ratio for association of a hypothetical unmeasured factor with receipt of general anesthesia									
		1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Odds ratio for association of a hypothetical unmeasured factor with increased length of stay	1.00	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	1.25	<0.0001	<0.0001	<0.0001	0.0001	0.0029	0.0106	0.0318	0.0794	0.1667
	1.50	<0.0001	<0.0001	0.0029	0.1667	0.4619	0.8817	0.9782	0.9977	0.9994
	1.75	<0.0001	0.0001	0.1667	0.7766	0.9925	0.9999	1.0000	1.0000	1.0000
	2.00	<0.0001	0.0029	0.4619	0.9925	1.0000	1.0000	1.0000	1.0000	1.0000
	2.25	<0.0001	0.0106	0.8817	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
	2.50	<0.0001	0.0318	0.9782	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.75	<0.0001	0.0794	0.9977	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	3.00	<0.0001	0.1667	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

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eTable 8: Sensitivity analysis for length of stay comparison, across-hospital match

		Odds ratio for association of a hypothetical unmeasured factor with receipt of general anesthesia								
		1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Odds ratio for association of a hypothetical unmeasured factor with increased length of stay	1.00	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	1.25	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0015	0.0068	0.0247	0.0714
	1.50	<0.0001	<0.0001	0.0002	0.0714	0.3157	0.8333	0.9720	0.9977	0.9995
	1.75	<0.0001	<0.0001	0.0714	0.6876	0.9913	0.9999	1.0000	1.0000	1.0000
	2.00	<0.0001	0.0002	0.3157	0.9913	1.0000	1.0000	1.0000	1.0000	1.0000
	2.25	<0.0001	0.0015	0.8333	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
	2.50	<0.0001	0.0068	0.9720	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.75	<0.0001	0.0247	0.9977	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	3.00	<0.0001	0.0714	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

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eTable 9: Sensitivity analysis for mortality comparison, across-hospital match

		Odds ratio for association of a hypothetical unmeasured factor with receipt of general anesthesia								
		1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Odds ratio for association of a hypothetical unmeasured factor with death at 30 days after admission	**1.00**	0.0187	0.0187	0.0187	0.0187	0.0187	0.0187	0.0187	0.0187	0.0187
	1.25	0.0187	0.0688	0.1363	0.1825	0.2984	0.3657	0.4368	0.5093	0.5809
	1.50	0.0187	0.1363	0.2984	0.5809	0.7125	0.8608	0.9229	0.9608	0.9729
	1.75	0.0187	0.1825	0.5809	0.8189	0.9445	0.9817	0.9950	0.9988	0.9998
	2.00	0.0187	0.2984	0.7125	0.9445	0.9921	0.9988	0.9999	1.0000	1.0000
	2.25	0.0187	0.3657	0.8608	0.9817	0.9988	1.0000	1.0000	1.0000	1.0000
	2.50	0.0187	0.4368	0.9229	0.9950	0.9999	1.0000	1.0000	1.0000	1.0000
	2.75	0.0187	0.5093	0.9608	0.9988	1.0000	1.0000	1.0000	1.0000	1.0000
	3.00	0.0187	0.5809	0.9729	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000

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