

## Supplementary Online Content

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**eFigure 1.** Flow diagram describing selection of cases in the analytic cohort

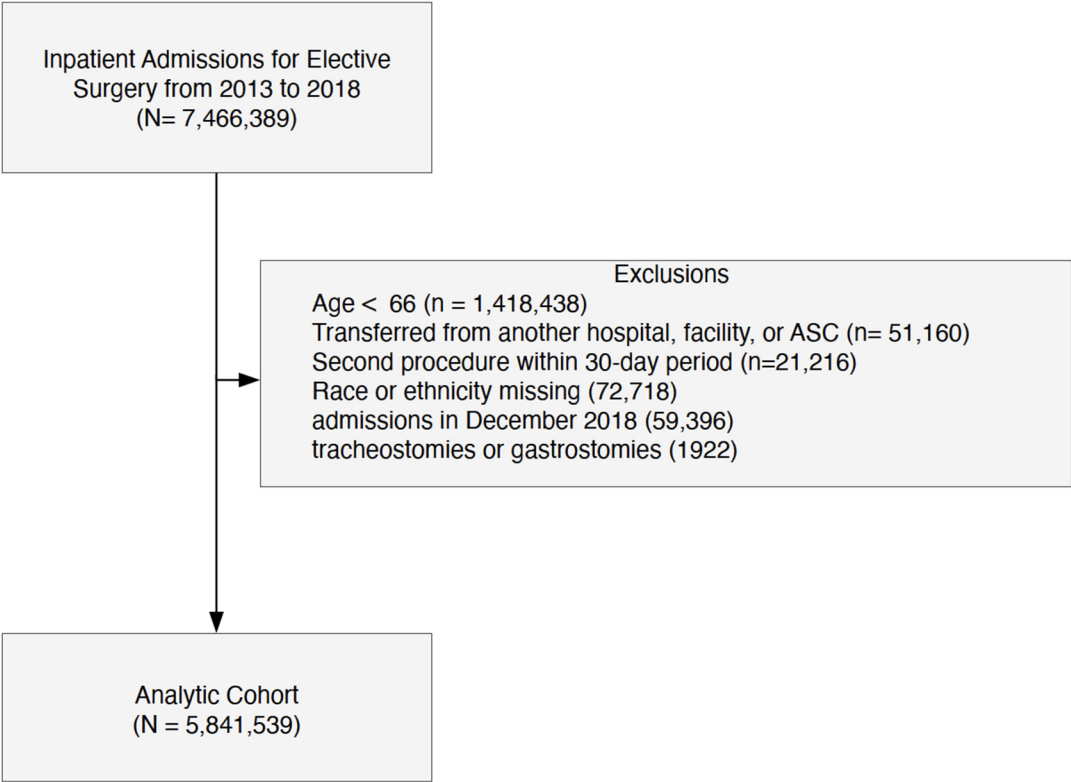
**eFigure 2.** Temporal distribution of strokes after surgery

**eFigure 3.** Risk of major adverse events and discharge to skilled nursing facility stratified by time to previous stroke in patients undergoing total hip arthroplasties or total knee arthroplasties

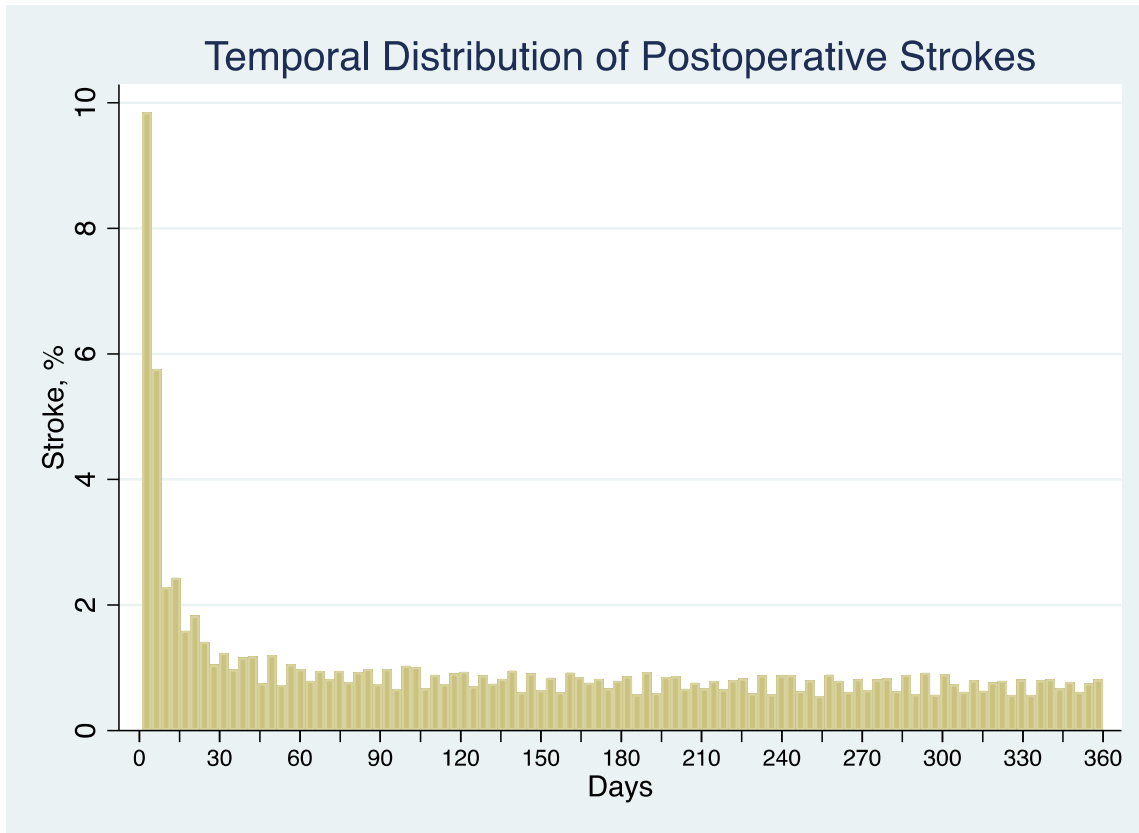
**eTable 1.** Surgery mortality risk categories

**eTable 2.** Model coefficients for baseline analysis

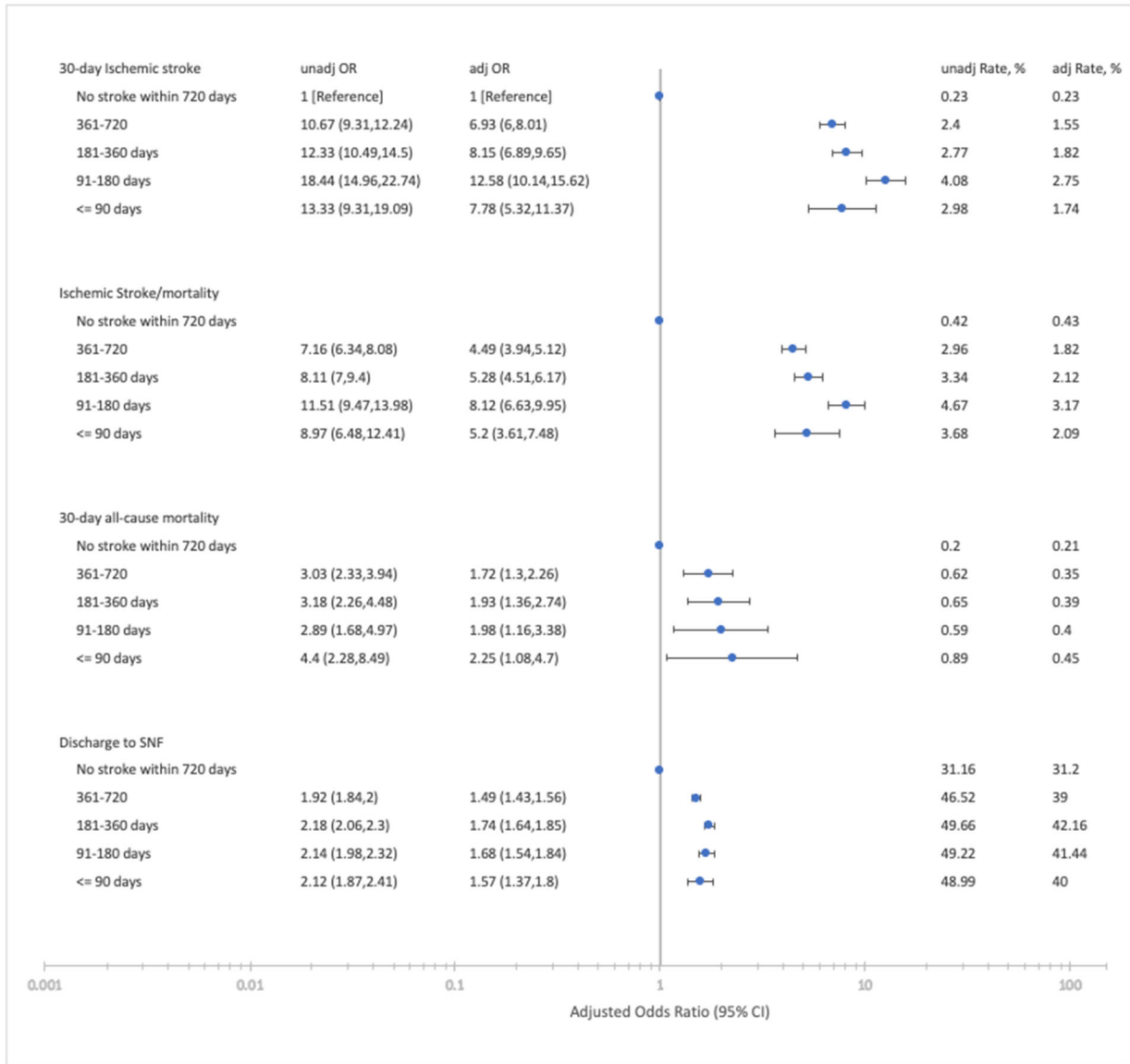
This supplementary material has been provided by the authors to give readers additional information about their work.



**eFigure 1.** Flow diagram describing selection of cases in the analytic cohort



**eFigure 2.** Temporal distribution of strokes after surgery



**eFigure 3.** Risk of major adverse events and discharge to skilled nursing facility stratified by time to previous stroke in patients undergoing total hip arthroplasties or total knee arthroplasties

Odds ratios adjusted for age, sex, race and ethnicity, dual eligibility, transfer from NH or SNF, comorbidities, surgical procedure, and year of admission.

<b>eTable 1. Surgery mortality risk categories</b>	
Surgical Procedure Classes	Risk
laminectomy	2
Thyroidectomy	2
Tonsillectomy	2
Lobectomy or pneumonectomy	3
Peripheral vascular bypass	3
Embolectomy/endarterectomy lower limbs	3
Procedures on spleen	3
Colostomy	3
Ileostomy	3
Gastrectomy	3
Small bowel resection	2
Colorectal resection	3
Appendectomy	2
Cholecystectomy	3
Inguinal/femoral hernia repair	3
Hernia repair, other	3
Exploratory laparotomy	3
Lysis of adhesions	3
Resection or removal of urinary obstruction	3
Nephrectomy	2
Kidney transplant	3
TURP	2
Open prostatectomy	2
Oophorectomy	2
Other operation on ovaries	2
Hysterectomy	2
Repair of cystocele and rectocele	1
Arthroplasty, knee	1
Hip replacement	1
Arthroplasty, other than hip or knee	1
Amputation of lower extremity	3
Spinal fusion	2

\* Surgery risk categories: 1 – mortality risk <0.5%; 2 - >0.5-1.0%; 3 - > 1.0%

**eTable 2.** Model coefficients for baseline analysis

Patient Characteristics	30-day Stroke			30-day Stroke or Mortality			30-day Mortality			Discharge to SNF		
	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value
Time to prior CVA												
No stroke within 720 days	reference			reference			reference			reference		
361-720 days	4.02	(3.66,4.42)	<0.001	2.28	(2.12,2.46)	<0.001	1.48	(1.35,1.62)	<0.001	1.48	(1.43,1.53)	<0.001
>180 days	4.76	(4.26,5.32)	<0.001	2.49	(2.28,2.72)	<0.001	1.49	(1.32,1.68)	<0.001	1.65	(1.58,1.72)	<0.001
91-180 days	5.83	(5.09,6.69)	<0.001	2.77	(2.47,3.11)	<0.001	1.47	(1.25,1.73)	<0.001	1.64	(1.55,1.74)	<0.001
61-90 days	5.01	(4,6.29)	<0.001	2.49	(2.07,3.01)	<0.001	1.49	(1.15,1.92)	0.002	1.64	(1.48,1.81)	<0.001
31-60 days	6.25	(5.07,7.71)	<0.001	2.97	(2.5,3.54)	<0.001	1.65	(1.29,2.1)	<0.001	1.75	(1.57,1.95)	<0.001
<= 30 days	8.02	(6.37,10.1)	<0.001	4.05	(3.36,4.88)	<0.001	2.51	(1.99,3.16)	<0.001	3.09	(2.71,3.53)	<0.001
Age												
66-69	reference			reference			reference			reference		
70-74	1.29	(1.24,1.35)	<0.001	1.27	(1.23,1.3)	<0.001	1.25	(1.22,1.29)	<0.001	1.42	(1.4,1.43)	<0.001
75-79	1.73	(1.66,1.81)	<0.001	1.64	(1.59,1.68)	<0.001	1.59	(1.54,1.64)	<0.001	2.19	(2.17,2.22)	<0.001
80-84	2.25	(2.14,2.35)	<0.001	2.20	(2.14,2.26)	<0.001	2.17	(2.1,2.25)	<0.001	3.70	(3.64,3.76)	<0.001
85 -	2.73	(2.59,2.88)	<0.001	3.32	(3.22,3.42)	<0.001	3.53	(3.41,3.66)	<0.001	6.98	(6.83,7.12)	<0.001
Sex												
female	reference			reference			reference			reference		
male	0.93	(0.9,0.95)	<0.001	1.10	(1.08,1.12)	<0.001	1.18	(1.15,1.21)	<0.001	0.59	(0.59,0.6)	<0.001
Race and ethnicity												
non-Hispanic White	reference			reference			reference					
Black	1.19	(1.13,1.26)	0	1.28	(1.23,1.33)	<0.001	1.32	(1.26,1.38)	<0.001	0.98	(0.91,1.06)	0.664
Hispanic	0.83	(0.77,0.9)	<0.001	1.14	(1.09,1.2)	<0.001	1.32	(1.24,1.39)	<0.001	1.11	(1,1.22)	0.057
Asian	0.90	(0.8,1.01)	0.076	0.94	(0.86,1.02)	0.154	0.98	(0.88,1.09)	0.693	0.69	(0.62,0.78)	<0.001

Native American/Alaska	1.05	(0.86,1.3)	0.626	1.56	(1.41,1.74)	<0.001	1.84	(1.64,2.08)	<0.001	1.09	(1.02,1.16)	0.009
Other	1.08	(0.91,1.28)	0.393	1.01	(0.91,1.13)	0.812	0.97	(0.85,1.11)	0.705	0.00	(0,0)	<0.001
Dual eligibility	1.18	(1.12,1.24)	<0.001	0.37	(0.36,0.39)	<0.001	0.10	(0.09,0.11)	<0.001	0.02	(2,0)	1.909
Transfer from NH/SNF	1.18	(0.98,1.42)	<0.001	2.02	(1.84,2.22)	<0.001	2.44	(2.19,2.72)	<0.001	15.69	(9.62,25.6)	<0.001
Comorbidities												
CHF	1.33	(1.27,1.39)	<0.001	1.66	(1.62,1.71)	<0.001	1.78	(1.73,1.83)	<0.001	1.49	(1.47,1.51)	<0.001
Cardiac arrhythmias	1.63	(1.58,1.69)	<0.001	1.67	(1.64,1.71)	<0.001	1.70	(1.66,1.74)	<0.001	1.32	(1.31,1.33)	<0.001
Valvular disease	1.33	(1.27,1.39)	<0.001	1.08	(1.05,1.11)	<0.001	0.99	(0.96,1.02)	0.598	1.01	(0.99,1.02)	0.283
Pulmonary circulation disorders	1.34	(1.25,1.44)	<0.001	1.62	(1.56,1.69)	<0.001	1.70	(1.63,1.78)	<0.001	1.28	(1.25,1.31)	<0.001
Peripheral vascular disease	1.52	(1.45,1.59)	<0.001	1.50	(1.45,1.54)	<0.001	1.47	(1.42,1.52)	<0.001	1.01	(0.97,1.06)	0.544
Hypertension, uncomplicated	1.25	(1.2,1.29)	<0.001	0.95	(0.93,0.97)	<0.001	0.84	(0.82,0.86)	<0.001	1.08	(1.07,1.09)	<0.001
Chronic pulmonary disease	1.06	(1.02,1.1)	0.001	1.26	(1.24,1.29)	<0.001	1.35	(1.32,1.38)	<0.001	1.23	(1.22,1.24)	<0.001
Diabetes, uncomplicated	1.25	(1.2,1.29)	<0.001	1.18	(1.16,1.21)	<0.001	1.15	(1.12,1.18)	<0.001	1.32	(1.3,1.33)	<0.001
Diabetes, complicated	1.40	(1.33,1.48)	<0.001	1.19	(1.15,1.22)	<0.001	1.11	(1.07,1.14)	<0.001	1.56	(1.52,1.59)	<0.001
Hypothyroidism	0.91	(0.88,0.95)	<0.001	0.92	(0.9,0.94)	<0.001	0.92	(0.89,0.94)	<0.001	1.05	(1.05,1.06)	<0.001
Renal failure	1.19	(1.12,1.27)	<0.001	1.35	(1.3,1.39)	<0.001	1.38	(1.33,1.43)	<0.001	1.17	(1.15,1.2)	<0.001
Liver disease	1.17	(1.08,1.26)	<0.001	2.32	(2.24,2.4)	<0.001	2.68	(2.57,2.79)	<0.001	1.04	(1.01,1.06)	0.001
Peptic ulcer disease	1.16	(1,1.34)	0.043	1.06	(0.98,1.15)	0.144	1.03	(0.94,1.12)	0.585	1.16	(1.12,1.2)	<0.001
AIDS/HIV	3.90	(3.54,4.29)	<0.001	2.64	(2.49,2.8)	<0.001	2.12	(1.98,2.28)	<0.001	1.79	(1.71,1.87)	<0.001
Lymphoma	0.94	(0.79,1.12)	0.499	1.12	(1.03,1.22)	0.008	1.15	(1.05,1.27)	0.003	1.12	(1.08,1.15)	<0.001
Metastatic cancer	1.10	(1.02,1.18)	0.014	1.62	(1.54,1.69)	<0.001	1.75	(1.66,1.84)	<0.001	1.22	(1.18,1.27)	<0.001
Solid tumor without metastasis	1.06	(1,1.12)	0.038	1.18	(1.15,1.21)	<0.001	1.21	(1.17,1.24)	<0.001	1.01	(0.99,1.03)	0.189
Rheumatoid arthritis	0.99	(0.93,1.06)	0.765	1.07	(1.03,1.11)	<0.001	1.12	(1.07,1.18)	<0.001	1.17	(1.16,1.19)	<0.001
Coagulopathy	1.53	(1.44,1.61)	<0.001	2.06	(1.99,2.13)	<0.001	2.21	(2.13,2.3)	<0.001	1.51	(1.47,1.55)	<0.001
Obesity	0.94	(0.9,0.98)	0.005	0.88	(0.85,0.91)	<0.001	0.84	(0.81,0.87)	<0.001	1.31	(1.28,1.34)	<0.001
Weight loss	1.70	(1.59,1.81)	<0.001	2.16	(2.09,2.23)	<0.001	2.18	(2.1,2.26)	<0.001	2.76	(2.67,2.84)	<0.001
Fluid and electrolyte disorder	1.85	(1.78,1.92)	<0.001	2.85	(2.79,2.92)	<0.001	3.38	(3.29,3.47)	<0.001	1.85	(1.81,1.89)	<0.001
Blood loss anemia	1.07	(0.95,1.2)	0.287	1.01	(0.95,1.07)	0.796	0.99	(0.92,1.07)	0.840	1.45	(1.39,1.51)	<0.001
Deficiency anemia	1.00	(0.92,1.09)	0.979	0.89	(0.85,0.94)	<0.001	0.86	(0.81,0.91)	<0.001	1.21	(1.19,1.24)	<0.001
Alcohol abuse	1.50	(1.36,1.66)	<0.001	1.20	(1.13,1.27)	<0.001	1.11	(1.04,1.19)	0.002	1.52	(1.47,1.56)	<0.001

Drug abuse	1.13	(0.99,1.3)	0.070	0.98	(0.9,1.06)	0.564	0.90	(0.81,1)	0.050	1.73	(1.66,1.8)	<0.001
Psychoses	1.45	(1.25,1.7)	<0.001	1.43	(1.29,1.57)	<0.001	1.40	(1.25,1.57)	<0.001	3.05	(2.94,3.17)	<0.001
Depression	1.18	(1.14,1.23)	<0.001	1.09	(1.06,1.11)	<0.001	1.03	(0.99,1.06)	0.105	1.46	(1.44,1.47)	<0.001
Hypertension, complicated	1.22	(1.15,1.3)	<0.001	0.95	(0.92,0.98)	0.003	0.88	(0.85,0.92)	<0.001	1.06	(1.04,1.09)	<0.001
Surgical Procedure Classes												
laminectomy	reference			reference			reference					
Thyroidectomy	1.12	(0.91,1.38)	0.295	0.87	(0.77,0.98)	0.018	0.79	(0.68,0.9)	0.001	0.34	(0.32,0.38)	<0.001
Tonsillectomy	1.72	(1.11,2.66)	0.015	1.13	(0.85,1.48)	0.399	0.99	(0.71,1.38)	0.934	0.65	(0.55,0.76)	<0.001
Lobectomy or pneumonectomy	1.47	(1.34,1.61)	<0.001	1.33	(1.26,1.4)	<0.001	1.30	(1.23,1.38)	<0.001	0.68	(0.65,0.72)	<0.001
Peripheral vascular bypass	1.52	(1.41,1.64)	<0.001	1.29	(1.23,1.34)	<0.001	1.19	(1.14,1.25)	<0.001	1.84	(1.76,1.93)	<0.001
Embolectomy/endarterectomy lower limbs	1.13	(1.04,1.22)	0.002	1.28	(1.23,1.34)	<0.001	1.33	(1.27,1.4)	<0.001	0.92	(0.88,0.96)	<0.001
Procedures on spleen	1.51	(1.29,1.77)	<0.001	1.34	(1.24,1.44)	<0.001	1.28	(1.17,1.39)	<0.001	1.07	(1,1.14)	0.046
Colostomy	1.31	(1.16,1.48)	<0.001	1.99	(1.89,2.1)	<0.001	2.09	(1.97,2.21)	<0.001	3.12	(3.02,3.23)	<0.001
Ileostomy	1.55	(1.4,1.72)	<0.001	2.04	(1.93,2.14)	<0.001	2.04	(1.93,2.16)	<0.001	2.45	(2.34,2.56)	<0.001
Gastrectomy	0.82	(0.72,0.94)	0.005	0.94	(0.89,1)	0.059	0.97	(0.91,1.04)	0.405	0.66	(0.63,0.7)	<0.001
Small bowel resection	1.09	(0.94,1.26)	0.251	0.95	(0.89,1.01)	0.081	0.89	(0.84,0.96)	0.001	1.16	(1.11,1.2)	<0.001
Colorectal resection	1.06	(0.99,1.13)	0.106	1.04	(1.01,1.08)	0.009	1.04	(1,1.08)	0.028	0.75	(0.73,0.77)	<0.001
Appendectomy	1.07	(0.91,1.26)	0.423	0.98	(0.91,1.06)	0.677	0.96	(0.88,1.05)	0.343	1.09	(1.04,1.14)	<0.001
Cholecystectomy	1.02	(0.93,1.13)	0.612	1.13	(1.09,1.19)	<0.001	1.14	(1.08,1.2)	<0.001	0.84	(0.81,0.88)	<0.001
Inguinal/femoral hernia repair	1.03	(0.85,1.24)	0.767	1.11	(1.02,1.21)	0.021	1.10	(1,1.21)	0.044	1.03	(0.99,1.09)	0.157
Hernia repair, other	0.95	(0.86,1.04)	0.248	1.01	(0.96,1.05)	0.796	1.02	(0.97,1.08)	0.360	0.75	(0.72,0.77)	<0.001
Exploratory laparotomy	1.41	(1.14,1.76)	0.002	4.22	(3.9,4.57)	<0.001	4.78	(4.39,5.2)	<0.001	1.24	(1.16,1.33)	<0.001
Lysis of adhesions	0.98	(0.91,1.06)	0.644	1.06	(1.03,1.1)	0.001	1.08	(1.04,1.12)	<0.001	1.05	(1.03,1.07)	<0.001
Resection or removal of urinary obstruction	1.08	(0.96,1.23)	0.208	1.32	(1.25,1.39)	<0.001	1.34	(1.27,1.42)	<0.001	0.81	(0.78,0.84)	<0.001
Nephrectomy	1.05	(0.94,1.18)	0.387	0.85	(0.8,0.9)	<0.001	0.79	(0.74,0.85)	<0.001	0.68	(0.65,0.7)	<0.001
Kidney transplant	1.28	(0.56,2.89)	0.557	0.75	(0.51,1.12)	0.158	0.62	(0.38,1.01)	0.053	0.25	(0.18,0.34)	<0.001
TURP	1.17	(1.02,1.33)	0.027	0.78	(0.72,0.84)	<0.001	0.67	(0.62,0.73)	<0.001	0.56	(0.53,0.59)	<0.001
Open prostatectomy	0.92	(0.8,1.06)	0.235	0.68	(0.63,0.74)	<0.001	0.61	(0.56,0.67)	<0.001	0.47	(0.44,0.5)	<0.001
Oophorectomy	0.90	(0.76,1.07)	0.245	0.86	(0.79,0.93)	<0.001	0.86	(0.78,0.94)	0.001	0.78	(0.75,0.81)	<0.001



Other operation on ovaries	0.98	(0.62,1.54)	0.935	0.97	(0.76,1.23)	0.790	0.98	(0.75,1.28)	0.873	0.87	(0.8,0.96)	0.004
Hysterectomy	1.02	(0.85,1.23)	0.838	0.86	(0.78,0.95)	0.002	0.82	(0.74,0.91)	<0.001	0.66	(0.63,0.69)	<0.001
Repair of cystocele and rectocele	0.48	(0.35,0.67)	<0.001	0.38	(0.31,0.47)	<0.001	0.35	(0.27,0.45)	<0.001	0.18	(0.16,0.2)	<0.001
Arthroplasty, knee	0.83	(0.78,0.89)	<0.001	0.42	(0.4,0.43)	<0.001	0.25	(0.24,0.27)	<0.001	4.24	(4.07,4.42)	<0.001
Hip replacement	1.03	(0.96,1.1)	0.474	0.59	(0.56,0.61)	<0.001	0.43	(0.41,0.45)	<0.001	4.17	(4,4.34)	<0.001
Arthroplasty, other than hip or knee	0.71	(0.64,0.77)	<0.001	0.42	(0.4,0.45)	<0.001	0.31	(0.28,0.33)	<0.001	1.37	(1.32,1.42)	<0.001
Amputation of lower extremity	1.14	(1.04,1.25)	0.006	1.70	(1.62,1.78)	<0.001	1.87	(1.77,1.97)	<0.001	8.54	(8.16,8.94)	<0.001
Spinal fusion	1.40	(1.31,1.5)	<0.001	0.82	(0.79,0.86)	<0.001	0.61	(0.58,0.64)	<0.001	3.88	(3.74,4.03)	<0.001
Year												
2013	reference			reference			reference					
2014	0.98	(0.93,1.03)	0.397	0.99	(0.96,1.01)	0.352	0.99	(0.96,1.02)	0.527	0.93	(0.91,0.94)	<0.001
2015	0.91	(0.86,0.96)	<0.001	0.94	(0.91,0.96)	<0.001	0.95	(0.92,0.98)	0.002	0.81	(0.8,0.83)	<0.001
2016	0.79	(0.75,0.83)	<0.001	0.92	(0.89,0.95)	<0.001	0.99	(0.95,1.02)	0.444	0.67	(0.66,0.69)	<0.001
2017	0.78	(0.74,0.82)	<0.001	0.89	(0.86,0.92)	<0.001	0.95	(0.91,0.99)	0.009	0.55	(0.54,0.56)	<0.001
2018	0.81	(0.76,0.85)	<0.001	0.86	(0.83,0.89)	<0.001	0.89	(0.86,0.93)	<0.001	0.49	(0.48,0.51)	<0.001