

Supplemental Digital Content 1. Composite postoperative pulmonary complication components and ICD-9 and ICD-10 codes.

ICD-9	ICD-10	Description
Pneumonia complication codes		
481	J 13	Pneumococcal pneumonia [Streptococcus pneumoniae pneumonia]
482	J 15.0	Pneumonia due to Klebsiella pneumoniae
482.1	J 15.1	Pneumonia due to Pseudomonas
482.3	J 15.4	Pneumonia due to Streptococcus, unspecified
482.4	J 15.20	Pneumonia due to Staphylococcus, unspecified
482.41	J 15.211	Pneumonia due to Staphylococcus aureus
482.42	J 15.212	Methicillin resistant pneumonia due to staphylococcus aureus
482.82	J 15.5	Pneumonia due to escherichia coli [E. coli]
482.83	J 15.6	Pneumonia due to other gram-negative bacteria
482.89	J 15.8	Pneumonia due to other specified bacteria
482.9	J 15.9	Bacterial pneumonia, unspecified
486	J 18.9	Pneumonia, organism unspecified
483.8	J 16.8	Pneumonia due to other specified organism
484.6	B 44.0	Pneumonia in aspergillosis
485	J 18.0	Bronchopneumonia, organism unspecified
Respiratory failure complication codes		
518.51	J 95.821, J 96.00	Acute respiratory failure following trauma and surgery
518.52	J 95.1, J 95.2	Other pulmonary insufficiency, not elsewhere classified, following trauma and surgery
518.81	J 96.00, J 6.90	Respiratory failure
518.82	J 80	Other pulmonary insufficiency, not elsewhere classified
518.84	J 96.20	Acute and chronic respiratory failure
Other respiratory complication codes		
507	J 69.0	Pneumonitis due to inhalation of food or vomitus
514	J 18.2	Pulmonary congestion and hypostasis
997.39	J 95.859, J 95.88, J 95.89	Other respiratory complications
415.11	T 80.0XXA, T 81.718A, T 81.72XA, T 82.817A, T 82.818A, I 26.90, I 26.99	Iatrogenic pulmonary embolism and infarction
512.1	J 95.811	Iatrogenic pneumothorax

Supplemental Digital Content 2. Exact matching criteria

Age	Matched within 5 years of age
Sex	
	Male
	Female
American Society of Anesthesiologists Physical Status Classification	
	Physical Status 1 - A normal healthy patient (e.g. healthy, non-smoking, no or minimal alcohol use)
	Physical Status 2 - A patient with mild systemic disease (e.g. current smoker, social alcohol drinker, pregnancy, well-controlled diabetes mellitus or hypertension, mild lung disease)
	Physical Status 3 - A patient with severe systemic disease (e.g. poorly controlled diabetes or hypertension, active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, end stage renal disease undergoing regularly scheduled dialysis, history (>3 months) of myocardial infarction or cerebrovascular accident, coronary artery disease)
	Physical Status 4 - A patient with severe systemic disease that is a constant threat to life (e.g., recent (< 3 months) myocardial infarction or cerebrovascular accident, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis)
World Health Organization Body Mass Index Category	
	Underweight (BMI < 18.5 mg/kg ²)
	Normal (18.5 - 24.9)
	Overweight (25.0 - 29.9)
	Obese - Class I (30.0 - 34.9)
	Obese - Class II (35.0 - 39.9)
	Obese - Class III (>= 40.0)
Elixhauser comorbidities	
	Cardiac Arrhythmia (ICD9 426.10, 426.11, 426.13, 426.2–426.53, 426.6–426.8, 427.0, 427.2, 427.31, 427.60, 427.9, 785.0, V45.0, V53.3) (ICD 10 I44.1–I44.3, I45.6, I45.9, I47.x–I49.x, R00.0, R00.1, R00.8, T82.1, Z45.0, Z95.0)
	Chronic Pulmonary Disease (ICD9 490–492.8, 493.00–493.91, 494.x–505.x, 506.4) (ICD10 I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3)
	Congestive Heart Failure (ICD9 398.91, 402.11, 402.91, 404.11, 404.13, 404.91, 404.93, 428.x) (ICD10 I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0)
	Liver Disease (ICD9 070.32, 070.33, 070.54, 456.0, 456.1, 456.2, 571.0, 571.2–571.9, 572.3, 572.8, V42.7) (ICD10 B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, K71.3–K71.5, K71.7, K72.x–K74.x, K76.0, K76.2–K76.9, Z94.4)
	Paralysis (ICD9 342.0, 342.1, 342.9–344.x) (ICD10 G04.1, G11.4, G80.1, G80.2, G81.x, G82.x, G83.0–G83.4, G83.9)

Surgical procedure category	
	Major Upper and Lower Abdomen (anesthesiology base CPT code 00752, 00754, 00756, 00790, 00792, 00794, 00796, 00797, 00770, 00832, 00836, 00840, 00844, 00848, 00866, 00904, 00880, 00882)
	Major Thoracic (anesthesiology base CPT code 00406, 00452, 00470, 00472, 00474, 00500, 00520, 00528, 00529, 00539, 00540, 00541, 00546, 00548, 00542)
	Other procedures (all other procedures)
Neuromuscular blockade	
	Rocuronium alone
	Vecuronium +/- Rocuronium

Supplemental Digital Content 3. Definitions of additional preoperative and intraoperative covariates.

Variable	Definition	Values
Last train-of-four count documented within 30 minutes of extubation	Using a peripheral nerve stimulator, the anesthesiologist evaluates the patients depth of neuromuscular blockade by stimulating the peripheral nerve axon 4 times. The number of end muscle twitches reflects the train of four count; an increasing number of twitches denotes increasing neuromuscular strength. At 4 out of 4 twitches, the patient may still have up to 75% of neuromuscular junctions blocked despite visible signs of movement. The train of four count documented prior to, but within 30 minutes of extubation, was recorded for each operation. Train of four documentation is not a required monitoring element according to the American Society of Anesthesiologists, but is recommended by the Anesthesia Patient Safety Foundation.	Not documented 0 or 1 twitches 2 twitches 3 or 4 twitches
General anesthesia technique	Three distinct pharmacologic classes are commonly used to maintain general anesthesia: inhaled halogenated volatile agents (isoflurane, sevoflurane, or desflurane); intravenous propofol infusion; and inhaled nitrous oxide (in combination with either a volatile agent or propofol infusion). Each class of medication has different levels of inherent neuromuscular relaxation action	Inhaled volatile, +/- nitrous, +/- propofol infusion Propofol infusion, no inhaled volatile, no nitrous Nitrous oxide, with propofol, without inhaled volatile
Elixhauser comorbidities	Each Elixhauser comorbidity, as defined by Quan and colleagues (Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi J-C, Saunders LD, Beck CA, Feasby TE, Ghali WA: Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care 2005; 43:1130–9), using ICD9 or ICD10 diagnoses codes without present on admission indicator flags.	AIDS/HIV Alcohol Abuse Blood Loss Anemia Coagulopathy Deficiency Anemia Depression Diabetes (complicated) Diabetes (uncomplicated) Drug Abuse Fluid/Electrolyte Disorders Hypertension (complicated) Hypertension (uncomplicated) Hypothyroidism Lymphoma Metastatic Cancer Other Neurological Disorders

		Peptic Ulcer Disease, Excluding Bleeding Peripheral Vascular Disorders Psychoses Pulmonary Circulation Disorders Rheumatoid Arthritis Collagen Vascular Diseases Solid Tumor Without Metastasis Valvular Disease Weight Loss
Primary in-room anesthesiology provider	Anesthesiology services are provided by a dedicated in room provider which may be an anesthesiology faculty alone. More commonly, a certified registered nurse anesthetist or anesthesiology trainee (resident or fellow), is the primary in-room provider, with faculty supervision	Faculty Only Resident/Fellow CRNA
Estimated blood loss	The intraoperative estimated blood loss documented by the anesthesiology team in the electronic health record, in milliliters	0 - 500 ml 501 - 1000 ml ≥ 1001 ml
Procedure type	Primary surgical procedure body region and invasiveness (major or minor) defined by base anesthesiology CPT code	
	00102, 00144, 00145, 00162, 00172, 00174, 00176, 00192, 00210, 00211, 00214, 00215, 00216, 00218, 00220, 00222, 00320, 00326, 00350	Head/Neck Major
	00100, 00103, 00104, 00120, 00124, 00126, 00140, 00142, 00147, 00148, 00160, 00164, 00170, 00190, 00212, 00300, 00322, 00352	Head/Neck Minor
	00406, 00452, 00470, 00472, 00474, 00500, 00520, 00528, 00529, 00534, 00537, 00539, 00540, 00541, 00542, 00546, 00548, 00550, 00560, 00561, 00562, 00563, 00566, 00567, 00580	Thoracic Major
	00400, 00402, 00404, 00410, 00450, 00454, 00522, 00524, 00530, 00532	Thoracic Minor
	00600, 00604, 00620, 00622, 00625, 00626, 00630, 00632, 00634, 00670	Spine/Spinal Cord Major
	00635, 00640	Spine/Spinal Cord Minor

	00732, 00752, 00754, 00756, 00770, 00790, 00792, 00794, 00796, 00797, 00832, 00836, 00840, 00844, 00848, 00866, 00880, 00882, 0090	Upper and Lower Abdomen Major
	00700, 00702, 00730, 00731, 00740, 00750, 00800, 00802, 00810, 00811, 00812, 00813, 00820, 00830, 00834, 00902	Upper and Lower Abdomen Minor
	00846, 00851, 00860, 00862, 00864, 00865, 00868, 00872, 00908, 00922, 00928, 00944, 01120, 01140, 01150, 01170, 01173	Urologic/Gynecologic/Male Reproductive System/Pelvis Major
	00842, 00870, 00873, 00906, 00910, 00912, 00914, 00916, 00918, 00920, 00921, 00924, 00926, 00930, 00932, 00934, 00936, 00938, 00940, 00942, 00948, 00950, 00952, 01112, 01130, 01160, 01180, 01190	Urologic/Gynecologic/Male Reproductive System/Pelvis Minor
	01210, 01212, 01214, 01215, 01230, 01234, 01270, 01274, 01402, 01432, 01440, 01442, 01444, 01486, 01500, 01502, 01634, 01636, 01638, 01650, 01652, 01654, 01656, 01756, 01760, 01770, 01772, 01832, 01840, 01842, 01844	Hip/Leg/Foot/Shoulder/Arm/Hand Major
	01200, 01202, 01220, 01232, 01250, 01260, 01272, 01320, 01340, 01360, 01380, 01382, 01390, 01392, 01400, 01404, 01420, 01430, 01462, 01464, 01470, 01472, 01474, 01480, 01482, 01484, 01490, 01520, 01522, 01610, 01620, 01622, 01630, 01670, 01680, 01682, 01710, 01712, 01714, 01716, 01730, 01732, 01740, 01742, 01744, 01758, 01780, 01782, 01810, 01820, 01829, 01830, 01850, 01852, 01860	Hip/Leg/Foot/Shoulder/Arm/Hand Minor
	01920, 01922, 01925, 01926, 01931, 01932, 01933	Radiologic Major
	01916, 01924, 01930, 01935, 01936	Radiologic Minor
	01961, 01962, 01963, 01990	Burn/Obstetrics/Other Procedures Major
	01951, 01952, 01953, 01958, 01960, 01964, 01965, 01966, 01967, 01968, 01969, 01991, 01992, 01995, 01996, 01999	Burn/Obstetrics/Other Procedures Minor
Procedure duration	The actual procedure length of time, including operative time, anesthesia induction, and anesthesia emergence	continuous (hours)

Fluid balance	The mathematical sum of all IV fluids, blood products, and other inputs administered during the procedure, minus all outputs (urine, estimated blood loss, gastric suction, ascites, etc). The absolute volume is then scaled to patient weight and procedure duration.	continuous (ml / kg * hr)
Intraoperative opioid administered (in morphine equivalents)	The amount of intraoperative opioid medications administered to the patient, with published conversions for route of administration (IV, intrathecal, etc) and medication (morphine, fentanyl, hydromorphone, sufentanil, methadone). Includes bolus and infusions. Each medication is converted to "morphine equivalents" based upon a potency conversion rubric. Scaled for patient weight and procedure duration.	continuous (mg / kg * hr)
Intraoperative neuromuscular blockade administered (in ED 95 equivalents)	The amount of intraoperative vecuronium and/or rocuronium administered to the patient, with published conversions for medication (0.05 mg/kg for vecuronium, 0.3 mg/kg for rocuronium) required to achieve 95% efficacy (ED 95). Includes bolus and infusion administrations. Scaled for patient weight and procedure duration.	continuous (ED 95 units / kg * hr)
Median ventilator driving pressure	Intraoperative ventilator parameter data are collected and stored every 60 seconds, including measured peak inspiratory pressure, PEEP, and tidal volume. Excessively high driving pressure has been implicated as a potential mechanism underlying ventilator associated lung injury and postoperative complications. Modified driving pressure was calculated for each 60 second period by subtracting PEEP from peak inspiratory pressure. The median for each case was then derived.	continuous (cm H20)
Time from last NMB dose to reversal, 15 minute interval	Time from the last bolus NMB administration or cessation of infusion to administration of sugammadex or neostigmine. In cases of multiple doses of reversal, the first dose is used.	15 minute intervals
Time from last NMB to extubation, 15 minute interval	Time from the last bolus NMB administration or cessation of infusion to patient extubation. In cases of multiple extubation documentation events, the first event is used.	15 minute intervals

Supplemental Digital Content 4: Patient characteristics of match-eligible population with missing ICD 9/10 outcomes data.

	Missing ICD 9/10 Outcomes n=21,418	Match Eligible n=119,611	ASD
Age (years), median [interquartile range]	56 [42, 67]	57 [45, 68]	0.084
Male Sex, frequency (percent)	9,233 (43.5)	52,745 (44.1)	0.012
ASA Status, mean (standard deviation)	2.49 (0.67)	2.52 (0.64)	0.054
BMI, median [interquartile Range]	28.3 [24.3, 33.5]	28.4 [24.4, 33.7]	0.023
Procedure Type, frequency (percent)			
Head/Neck Major	1,790 (8.4)	12,755 (10.7)	0.061
Head/Neck Minor	1,502 (7.0)	4,416 (3.7)	0.164
Thoracic Major	1,279 (6.0)	9,617 (8.1)	0.066
Thoracic Minor	962 (4.5)	4,333 (3.6)	0.057
Spine/Spinal Cord Major	1,486 (6.9)	11,164 (9.4)	0.072
Upper and Lower Abdomen Major	5,791 (27.0)	38,197 (32.0)	0.071
Urologic/Gynecologic/Male Reproductive System/Pelvis Major	1,929 (9.0)	13,018 (10.9)	0.044
Hip/Leg/Foot/Shoulder/Arm/Hand Major	1,358 (6.3)	10,274 (8.6)	0.07
Hip/Leg/Foot/Shoulder/Arm/Hand Minor	1,632 (7.6)	6,838 (5.7)	0.093
Other	2,438 (12.1)	8,754 (7.3)	0.161

ASD = absolute standardized difference

Supplemental Digital Content 5. Standardized differences across all Elixhauser comorbidities and procedure types after matching.

	Neostigmine		Sugammadex		ASD
	22,856		22,856		
Elixhauser Comorbidity	N	Row %	N	Row %	ASD
AIDS/HIV	39	0.2%	40	0.2%	0.00
Alcohol Abuse	236	1.0%	50	0.2%	0.09
Blood Loss Anemia	170	0.7%	235	1.0%	0.02
Coagulopathy	560	2.5%	635	2.8%	0.01
Deficiency Anemia	421	1.8%	526	2.3%	0.02
Depression	2,772	12.1%	2,343	10.3%	0.06
Diabetes (complicated)	134	0.6%	208	0.9%	0.03
Diabetes (uncomplicated)	2,883	12.6%	2,963	13.0%	0.00
Drug Abuse	364	1.6%	379	1.7%	0.00
Fluid/Electrolyte Disorders	1,875	8.2%	1,677	7.3%	0.03
Hypertension (complicated)	81	0.4%	375	1.6%	0.10
Hypertension (uncomplicated)	9,987	43.7%	9,966	43.6%	0.02
Hypothyroidism	2,417	10.6%	2,317	10.1%	0.02
Lymphoma	203	0.9%	214	0.9%	0.00
Metastatic Cancer	2,065	9.0%	2,136	9.3%	0.00
Other Neurological Disorders	1,043	4.6%	1,058	4.6%	0.00
Peptic Ulcer Disease, Excluding Bleeding	144	0.6%	135	0.6%	0.01
Peripheral Vascular Disorders	1,199	5.2%	1,105	4.8%	0.02
Psychoses	143	0.6%	76	0.3%	0.04
Pulmonary Circulation Disorders	364	1.6%	355	1.6%	0.01
Rheumatoid Arthritis Collagen Vascular Diseases	625	2.7%	602	2.6%	0.01
Solid Tumor Without Metastasis	4,885	21.4%	6,519	28.5%	0.11
Valvular Disease	714	3.1%	681	3.0%	0.01
Weight Loss	933	4.1%	897	3.9%	0.01
Procedure Type					
Head/Neck Major	2,644	11.6%	2,721	11.9%	0.01
Head/Neck Minor	833	3.6%	879	3.8%	0.01
Thoracic Major	1,391	6.1%	1,391	6.1%	0.00
Thoracic Minor	754	3.3%	766	3.4%	0.00
Spine/Spinal Cord Major	2,326	10.2%	2,145	9.4%	0.03
Spine/Spinal Cord Minor	1	0.0%	5	0.0%	0.02
Upper and Lower Abdomen Major	6,937	30.4%	6,937	30.4%	0.00
Upper and Lower Abdomen Minor	511	2.2%	499	2.2%	0.00
Urologic/Gynecologic/Male Reproductive System/Pelvis Major	2,665	11.7%	3,114	13.6%	0.06
Urologic/Gynecologic/Male Reproductive System/Pelvis Minor	440	1.9%	547	2.4%	0.03

Hip/Leg/Foot/Shoulder/Arm/Hand Major	2,228	9.7%	1,938	8.5%	0.04
Hip/Leg/Foot/Shoulder/Arm/Hand Minor	1,425	6.2%	1,169	5.1%	0.05
Radiologic Major	431	1.9%	447	2.0%	0.01
Radiologic Minor	195	0.9%	227	1.0%	0.02
Burn/Obstetrics/Other Procedures Major	35	0.2%	26	0.1%	0.01
Burn/Obstetrics/Other Procedures Minor	40	0.2%	45	0.2%	0.01

ASD = absolute standardized difference

Supplemental Digital Content 6. Adjusted conditional logistic regression predicting composite postoperative pulmonary complications for sugammadex cases versus matched neostigmine cases, N=45,276.

	Odds Ratio	95% Lower Bound	95% Upper Bound	p-value
Sugammadex	0.70	0.63	0.77	<0.0001
Neostigmine	reference	reference	reference	reference
Not documented	1.07	0.91	1.26	0.39
0 or 1 twitches	0.88	0.54	1.43	0.60
2 twitches	1.67	1.10	2.53	0.02
3 or 4 twitches	reference	reference	reference	reference
Volatile, with or without propofol infusion or inhaled nitrous oxide	reference	reference	reference	reference
Propofol infusion, without inhaled volatile or nitrous oxide	1.12	0.75	1.68	0.59
Nitrous oxide, with propofol infusion	2.31	0.42	12.84	0.34
Hypertension (complicated)	1.14	0.74	1.76	0.55
Solid Tumor Without Metastasis	1.27	1.08	1.50	0.00
Head/Neck Major	0.43	0.23	0.79	0.01
Head/Neck Minor	0.40	0.20	0.80	0.01
Thoracic Minor	0.50	0.25	1.01	0.05
Spine/Spinal Cord Major	0.29	0.15	0.55	0.00
Spine/Spinal Cord Minor	0.43	0.02	7.67	0.56
Upper and Lower Abdomen Minor	1.29	0.64	2.57	0.48
Urologic/Gynecologic/Male Reproductive System/Pelvis Major	0.34	0.18	0.64	<0.001
Urologic/Gynecologic/Male Reproductive System/Pelvis Minor	0.23	0.11	0.50	<0.001
Hip/Leg/Foot/Shoulder/Arm/Hand Major	0.23	0.12	0.44	<0.001
Hip/Leg/Foot/Shoulder/Arm/Hand Minor	0.45	0.24	0.87	0.02
Radiologic Major	0.42	0.21	0.85	0.02
Radiologic Minor	reference	reference	reference	reference
Burn/Obstetrics/Other Procedures Major	0.53	0.04	6.41	0.62
Burn/Obstetrics/Other Procedures Minor	4.06	0.47	35.45	0.20
Intraoperative opioid administered (in morphine equivalents) mg/kg*hr	0.93	0.60	1.45	0.76

Time from last NMB dose to first reversal, 15 minute interval	0.90	0.84	0.96	<0.001
Time from last NMB to extubation, 15 minute interval	1.13	1.06	1.20	<0.001
ED 95 of NMB per hour of case duration	1.09	0.98	1.20	0.11

Calibration: Hosmer-Lemeshow p-value=0.1246

Supplemental Digital Content 7. Adjusted conditional logistic regression predicting pneumonia for sugammadex cases versus matched neostigmine cases, N=45,276.

	Odds Ratio	95% Lower Bound	95% Upper Bound	p-value
Sugammadex	0.53	0.44	0.62	<0.0001
Neostigmine	reference	reference	reference	reference
Not documented	1.10	0.85	1.42	0.46
0 or 1 twitches	0.83	0.36	1.96	0.68
2 twitches	1.52	0.73	3.14	0.26
3 or 4 twitches	reference	reference	reference	reference
Volatile, with or without propofol infusion or inhaled nitrous oxide	reference	reference	reference	reference
Propofol infusion, without inhaled volatile or nitrous oxide	0.72	0.36	1.45	0.36
Nitrous oxide, with propofol infusion	>999.999	<0.001	>999.999	0.98
Hypertension (complicated)	1.61	0.82	3.17	0.16
Solid Tumor Without Metastasis	1.03	0.80	1.32	0.83
Head/Neck Major	0.36	0.14	0.95	0.04
Head/Neck Minor	0.42	0.14	1.28	0.13
Thoracic Minor	0.71	0.22	2.28	0.57
Spine/Spinal Cord Major	0.27	0.09	0.75	0.01
Spine/Spinal Cord Minor	>999.999	<0.001	>999.999	0.99
Upper and Lower Abdomen Minor	2.20	0.69	6.98	0.18
Urologic/Gynecologic/Male Reproductive System/Pelvis Major	0.32	0.12	0.87	0.03
Urologic/Gynecologic/Male Reproductive System/Pelvis Minor	0.25	0.08	0.85	0.03
Hip/Leg/Foot/Shoulder/Arm/Hand Major	0.23	0.08	0.62	<0.001
Hip/Leg/Foot/Shoulder/Arm/Hand Minor	0.36	0.12	1.09	0.07
Radiologic Major	0.36	0.12	1.09	0.07
Radiologic Minor	reference	reference	reference	reference
Burn/Obstetrics/Other Procedures Major	-	-	-	-
Burn/Obstetrics/Other Procedures Minor	0.95	0.13	6.74	0.96
Intraoperative opioid administered (in morphine equivalents) mg/kg*hr	0.85	0.43	1.68	0.64

Time from last NMB dose to first reversal, 15 minute interval	0.93	0.84	1.02	0.11
Time from last NMB to extubation, 15 minute interval	1.10	1.00	1.21	0.04
ED 95 of NMB per hour of case duration	1.12	0.96	1.30	0.14

Calibration: Hosmer-Lemeshow p-value=0.2672

Supplemental Digital Content 8. Adjusted conditional logistic regression predicting respiratory failure for sugammadex cases versus matched neostigmine cases, N=45,276.

	Odds Ratio	95% Lower bound	95% Upper bound	p-value
Sugammadex	0.45	0.37	0.56	<0.0001
Neostigmine	reference	reference	reference	reference
Not documented	1.11	0.82	1.51	0.5
0 or 1 twitches	0.57	0.22	1.46	0.24
2 twitches	1.27	0.59	2.69	0.54
3 or 4 twitches	reference	reference	reference	reference
Volatile, with or without propofol infusion or inhaled nitrous oxide	reference	reference	reference	reference
Propofol infusion, without inhaled volatile or nitrous oxide	1.23	0.55	2.71	0.62
Nitrous oxide, with propofol infusion	>999.999	<0.001	>999.999	0.99
Hypertension (complicated)	2.41	1.14	5.09	0.21
Solid Tumor Without Metastasis	0.73	0.54	0.99	0.04
Head/Neck Major	0.36	0.06	1.98	0.24
Head/Neck Minor	0.37	0.06	2.19	0.28
Thoracic Minor	0.21	0.04	1.29	0.09
Spine/Spinal Cord Major	0.13	0.02	0.78	0.03
Spine/Spinal Cord Minor	<0.001	<0.001	>999.999	0.99
Upper and Lower Abdomen Minor	0.99	0.15	6.42	0.99
Urologic/Gynecologic/Male Reproductive System/Pelvis Major	0.14	0.02	0.82	0.03
Urologic/Gynecologic/Male Reproductive System/Pelvis Minor	0.12	0.02	0.91	0.04
Hip/Leg/Foot/Shoulder/Arm/Hand Major	0.11	0.02	0.66	0.02
Hip/Leg/Foot/Shoulder/Arm/Hand Minor	0.29	0.05	1.68	0.17
Radiologic Major	0.31	0.05	1.68	0.21
Radiologic Minor	reference	reference	reference	reference
Burn/Obstetrics/Other Procedures Major	<0.001	<0.001	>999.999	0.99
Burn/Obstetrics/Other Procedures Minor	3.62	0.23	55.93	0.36
Intraoperative opioid administered (in morphine equivalents) mg/kg*hr	0.63	0.25	1.58	0.32

Time from last NMB dose to first reversal, 15 minute interval	0.96	0.87	1.06	0.41
Time from last NMB to extubation, 15 minute interval	1.06	0.96	1.16	0.23
ED 95 of NMB per hour of case duration	1.00	0.83	1.19	0.95

Calibration: Hosmer-Lemeshow p-value=0.7149

Supplemental Digital Content 9. Prespecified sensitivity analyses.

	Neostigmine N (%)	Sugammadex N (%)	Adjusted Odds Ratio	95% Confidence Interval	p-value
Cases occurring after the transition from ICD-9 to ICD-10.	366 (4.2)	297 (3.4)	0.79	(0.66, 0.94)	0.0078
ICD-9 and ICD-10 outcome codes specific to post-surgical pulmonary complications.	196 (0.9)	141 (0.6)	0.68	(0.52, 0.88)	0.003
Adjusting for blood product administration	762 (3.3)	647 (2.8)	0.71	(0.63, 0.78)	<0.0001

All models were adjusted for the same covariates as the primary conditional logistic regression models.

Supplemental Digital Content 10: Post-hoc sensitivity analysis evaluating hospital-specific effects among hospitals with patient volume of 1000 or more cases.

Institution	Total Cases at Institution	Neostigmine Cases with Composite Outcome N (%)	Sugammadex Cases with Composite Outcome N (%)	Unadjusted Odds Ratio	95% Confidence Interval
Institution A	9,350	319 (6.8)	268 (5.7)	0.82	(0.69, 0.98)
Institution B	1,240	6 (1.0)	3 (0.5)	0.50	(0.13, 2.00)
Institution C	8,104	336 (8.3)	222 (5.5)	0.63	(0.53, 0.76)
Institution D	2,020	40 (4.0)	6 (0.6)	0.15	(0.06, 0.35)
Institution E	3,252	54 (3.3)	55 (3.4)	1.02	(0.69, 1.51)
Institution F	12,006	144 (2.4)	109 (1.8)	0.75	(0.58, 0.97)
Institution G	7,952	174 (4.4)	121 (3.0)	0.68	(0.53, 0.86)