Supplemental Digital Content 1

Table 1. Details of the SQL Logic to Create the Analyzed Dataset

1. All cases from Epic preanesthesia evaluation and operating room scheduling system with surgery dates between November 16, 2010 and June 3, 2013 were extracted.

2. All preoperatively available information currently existing in Epic was included.

3. Multiple entries per patient were identified and eliminated if the record indicated the same anesthetic (0.56% = 446/79,327).

4. Anesthetics excluded were those (a) for which no anesthesiologist signed the anesthesia record electronically (0.23% = 183/78,881), (b) the induction time was missing even if the patient entered an OR (0.08% = 65 / 78,698), and/or (c) the OR status was listed as “cancelled” (0.02% = 14/78,633).

5. The focus of the study was on anesthetics with the five different agents: propofol, etomidate, sevoflurane, desflurane, and rocuronium. Anesthetics when at least one of these five agents was present were considered to represent general anesthetics. Timing of the first induction dose of these five agents after the anesthesia start times were used. Anesthetics with all five agents absent were not considered general anesthetics and thus were excluded (12.4% = 9,768/78,619), This reduced the number of anesthetics to 68,851.

6. The primary outcome variables were the first recordings of BP and SpO_2 after the anesthesia start time. Cases performed entirely using a transport monitor and without a single vital sign entered manually into the anesthesia information management system were excluded from analysis: without BP (0.16% = 113/ 68,851) or SpO_2 (0.75% = 518/68,738). Therefore, 68,220 general anesthetics were used.

7. If patient’s age at the time of surgery was not available, this information was determined based on the date of birth and the date of surgery.

BP = blood pressure; Epic = Epic Systems anesthesia information management system (Epic Systems Corporation, Verona, WI); OR = operating room; SpO2 = pulse oximetry measured oxygen saturation.

Table 2. Descriptive Statistics for Continuous Variables that Were Not Used for Both Endpoints Based on Lack of Predictive Value

Variable	n	Mean ± SD	Median (Q25, Q75)
Duration of surgery (hours from the patient entered into the operating room to the patient is out of the operating room)	63,885	2.85 ± 2.07	2.20 (1.43 , 3.65)
Patient weight (kg)	68,183	75.64 ± 33.95	77.7 (59.0, 95.9)
American Society of Anesthesiologists' Base Units of the primary surgical procedure performed	68,220	6.07 ± 3.41	5.0 (4.0, 7.0)

Table 3. Descriptive Statistics for Categorical Variables that were Not Used for Both Endpoints Based on Lack of Predictive Value, within Category Listed in Descending Frequency of Occurrence

PREOPERATIVE VARIABLES	**% (N)**
Female	50.73 (34,608)
Anesthetic started with a patient transfer from an intensive care unit	3.33 (2274)
RESPIRATORY	
Asthma	10.69 (7,291)
Cough	8.13 (5,544)
Confirmed Sleep apnea	5.97 (4,070)
Supplemental oxygen administration when the patient arrived to the operating room	2.66 (1,818)
Chronic obstructive pulmonary disease	2.18 (1,487)
Chest airway infection	2.17 (1,477)
History of pulmonary embolism	1.76 (1,202)
Apnea of prematurity	0.30 (207)
HEAD, EYES, EARS, NOSE, AND THROAT	
Neck pain	5.60 (3,823)
Deafness	2.48 (1,693)
Blindness	1.66 (1,130)
History of radiation on the face	1.30 (890)
Rheumatoid arthritis	1.14 (777)
Nosebleeds	1.12 (762)
Facial swelling	0.76 (516)
MUSCULAR/SKELETAL	
Back pain	10.88 (7,421)
Gait Problem	8.89 (6,068)
Positioning limitations	4.14 (2,823)
Wheelchair	1.73 (1,181)
RENAL GENITOURINARY SYSTEM	
Renal Insufficiency	3.71 (2,533)
Dialysis	0.68 (464)
Renal devices	0.00 (0)

Variable	% (N)
CARDIOVASCULAR	
Hypertension	32.96 (22,486)
Hyperlipidemia	18.20 (12,415)
Coronary artery disease	6.92 (4,719)
Myocardial infarction	1.93 (1,315)
Coronary artery bypass graft	1.70 (1,162)
Drug eluting stents	1.27 (865)
Bare metal stents	0.82 (558)
Angioplasty	0.56 (379)
Percutaneous transluminal coronary angioplasty	0.43 (296)
Shortness of breath	6.26 (4,271)
Cardiac arrhythmia	4.82 (3,289)
Leg swelling	3.83 (2,614)
Valvular heart disease	3.62 (2,472)
Aortic	1.51 (1,029)
Mitral	1.31 (892)
Tricuspid	0.42 (285)
Pulmonic	0.23 (157)
Congenital heart disease	2.97 (2,026)
Congestive heart failure	2.46 (1,677)
Chest pain	2.43 (1,655)
Peripheral vascular disease	2.12 (1,443)
Palpitations	1.63 (1,114)
Pacemaker Automatic Implantable Cardioverter Defibrillators	1.37 (932)
Orthopnea	0.72 (491)
Ventricular assist device	0.07 (49)

Variable	% (N)
EXERCISE TOLERANCE	
Metabolic equivalents (MET) 1-3	5.91 (4,033)
4	12.41 (8,463)
5-6	43.25 (29,503)
7-9	12.15 (8,292)
>10	5.23 (3,570)
Missing	21.05 (14,359)
ENDOCRINE/CHEMOTHERAPY	
Diabetes mellitus	12.17 (8,305)
Steroid use	11.56 (7,886)
Hypothyroidism	7.61 (5,193)
Chemotherapy	4.81 (3,280)
Adriamycin	0.49 (335)
Hyperparathyroidism	0.42 (288)
Hyperthyroidism	0.37 (253)
Bleomycin	0.10 (67)
Addison's disease	0.06 (43)
Cushing's syndrome	0.05 (33)
Hypoparathyroidism	0.05 (31)
Acromegaly	0.02 (6)
SKIN	
Wound	3.78 (2,581)
Rash	1.96 (1,334)
Discoloration	1.06 (726)

Variable		% (N)
NEUROLOGY		
Paresthesias		10.35 (7,063)
Headaches		7.94 (5,416)
Seizures		4.26 (2,903)
Dizziness		3.07 (2,091)
Cerebrovascular accident		2.59 (1,764)
Neurologic deficits		2.18 (1,490)
	Hemiparesis	0.51 (349)
	Quadriparesis	0.06 (38)
	Hemiplegia	0.07 (46)
	Paraplegia	0.18 (125)
	Quadriplegia	0.11 (78)
Transient ischemic attack		1.43 (973)
Syncope		1.19 (810)
Cervical spine cleared		0.91 (620)
	Ventriculoperitoneal shunt	0.32 (215)
Increased intracranial pressure		0.61 (417)
Down's syndrome		0.43 (294)
Parkinson		0.31 (214)
PSYCHOLOGY		
Depression		14.72(10,041)
Anxiety/ Nervousness		12.29 (8,384)
Claustrophobia		2.97 (2,024)
Agitation		0.59 (400)
Dementia		0.42 (287)

Variable	% (N)
GASTROINTESTINAL	
Gastroesophageal reflux disease	26.71 (18,220)
Nausea	3.23 (2,202)
Vomiting	2.08 (1,422)
Hepatitis	1.98 (1,351)
Feeding tube	1.55 (1,054)
Hiatal Hernia	1.39 (951)
Small bowel obstruction	0.74 (508)
Cirrhosis	0.62 (426)
HEMATOLOGIC	
Blood thinners	10.62 (7,248)
Anemia	3.54 (2,415)
Easy Bleeding	1.81 (1,233)
Coagulopathy	1.62 (1,106)
Easy bruising	0.94 (643)
Hemophilia	0.08 (53)
Sickle cell disease	0.07 (51)

Variable	% (N)
SURGICAL SPECIALTY OF THE PROCEDURE	
Orthopedics	22.72 (15,501)
Surgical-Adult/Plastic	14.69 (10,022)
Otolaryngology	11.75 (8,017)
Urology	9.39 (6,403)
Ophthalmology	8.25 (5,625)
Neurosurgery	7.13 (4,861)
Gynecology	5.61 (3,824)
Cardiothoracic surgery	4.02 (2,741)
Other	3.68 (2,511)
Pediatrics Surgery	3.17 (2,162)
Dentistry	2.90 (1,976)
Psychiatry	2.21 (1,506)
Vascular Surgery	1.85 (1,263)
Obstetrics	1.61 (1098)
Surgery Transplant	1.04 (709)
LOCATION THAT THE SURGICAL PROCEDURE WAS PERFORMED	
Main operating room	65.98 (45,010)
Ambulatory Surgery Center	23.0 (15,730)
Urology operating room	4.16 (2,841)
Nonoperating room	4.05 (2,765)
Electroconvulsive therapy	2.21 (1,506)
Labor & Delivery operating room	0.54 (367)
OPERATING ROOM URGENCY CLASS	
Elective	90.52 (57,576)
Within 4 h	5.63 (3,582)
Emergency	3.72 (2,368)
Obstetrics	0.12 (79)
Missing	6.76 (4,615)

Variable	% (N)
Patient was inpatient preoperatively? (Yes/No)	18.36 (12,524)
Anesthesiologist Supervising Multiple Rooms of general anesthesia or monitored anesthesia care (yes/no)*	
Multiple inductions within 15 min	28.21 (19,242)
Multiple inductions within 20 min	33.78 (23,046)
Multiple inductions within 22 min	36.05 (24,591)
Multiple inductions within 25 min	38.54 (26,289)
Multiple inductions within 30 min	41.89 (28,577)

* Anesthesiologist Supervising Multiple Rooms of general anesthesia or monitored anesthesia care within 15 min (yes/no): Marked as “Yes” if the anesthesiologist is participating in the induction of anesthesia in multiple rooms and the time of inducting the first agent for an anesthetic in a room is less than or equal to 15 min of the time of the administration of the first studied for another anesthetic; and “No”, otherwise.

The mean squared error for the blood pressure metric with age as the covariate was 0.0468. The use of age in the model reduced the mean squared error more than the use of any of the other 134 variables. Once age was included, adding none of the other 134 variables meaningfully reduced the mean squared error (% reduction on the mean squared error for each other variable ≤ 0.25).

Table 4. Summary Results for Each 6-month Periods for the Blood Pressure Metric with the Prior Probability of at Least One Anesthesiologist in the Department during the Studied 6-month Period Having a Significantly Greater Incidence of BP First Checked ≥5 min after Induction than the Other Anesthesiologists Was Set to 0.05

	Jan 2011 - June 2011	**July 2011 - Dec 2011**	**Jan 2012 - June 2012**	**July 2012 - Dec 2012**	**Jan 2013 - June 2013**
Number of anesthetics evaluated	11,799	13,392	13,408	13,571	11,743
Number of evaluated anesthesiologists supervising at least one anesthetics	53	56	55	59	57
Number of anesthetics per Anesthesiologists Median (range)	207 (11 to 574)	220 (3 to 546)	212 (11 to 548)	201 (16 to 515)	181 (15 to 422)
Incidence of evaluated anesthetics with BP noncompliance n(%)	761 (6.45 %)	728 (5.4 %)	717 (5.3 %)	666 (4.9 %)	545 (4.6 %)
Anesthesiologists identified as performance outliers					
Frequentist	n = 23	n = 14	n = 13	n = 16	n = 14
Bayesian unadjusted	n = 1	n = 1	n = 2	n = 0	n = 1
(anesthesiologist identifier)	# 3	# 38	(#3, #38)		#3
Bayesian adjusted	n = 1	n = 1	n = 1	n = 1	n = 1
(anesthesiologist identifier)	# 3	# 38	# 38	# 25	# 10

The adjusted model includes the patient's age.
For interpretation, see the legend of table 3.
Anesthesiologists were labeled according to their number of anesthetics during the whole 2.5 years period. For example, anesthesiologist #1 performed the most number of anesthetics, and #2 is the second most anesthetics.
BP = blood pressure.

Table 5. Summary Results for Each 6-month Periods for SpO_2 with the Prior Probability of at Least One Anesthesiologist in the Department during the Studied 6-month Period Having a Significantly Greater Incidence of SpO_2 First Checked ≥5 min after Induction than the Other Anesthesiologists was set to 0.05

	Jan 2011 - June 2011	**July 2011 - Dec 2011**	**Jan 2012 - June 2012**	**July 2012 - Dec 2012**	**Jan 2013 - June 2013**
Number of anesthetics evaluated	11,799	13,392	13,408	13,571	11,743
Number of evaluated anesthesiologists supervising at least one anesthetics	53	56	55	59	57
Number of anesthetics per Anesthesiologists Median (range)	207 (11 to 574)	220 (3 to 546)	212 (11 to 548)	201 (16 to 515)	181 (15 to 422)
Incidence of evaluated anesthetics with SpO_2 noncompliance n(%)	229 (1.94%)	156 (1.16%)	153 (1.14%)	141 (1.04%)	100 (0.85%)
Anesthesiologists identified as performance outliers					
Frequentist	n = 37	n = 19	n =25	n = 18	n = 13
Bayesian unadjusted	n = 0	n = 1	n = 0	n = 0	n = 1
(anesthesiologist identifier)		# 23			#23
Bayesian adjusted	n = 0	n = 1	n = 0	n = 0	n = 0
(anesthesiologist identifier)		# 23			

The adjusted model includes the following covariates. ASA is 1 when the American Society of Anesthesiologist's physical status score is ≥4 and 0 (zero) otherwise. Start of the day is a binary variable indicating if the time from the start of the surgical day to induction were ≤5 min *vs*. > 5 min. At the University of Iowa, the surgical day starts at 8:00 AM on Monday and Tuesday and at 7:15 AM on Wednesday, Thursday, and Friday. The "From ICU" variable reports if the preceding location before the patient was in an OR was an intensive care unit. This includes the cardiovascular intensive care unit, medical intensive care unit, neonatal intensive care unit, pediatric intensive care unit and surgical and neuroscience intensive care.
For interpretation, see the legend of table 3.
Anesthesiologists were labeled according to their number of anesthetics during the whole 2.5-yr period. For example, anesthesiologist #1 performed the most number of anesthetics, and #2 is the second most anesthetics.
ASA = American Society of Anesthesiologists; ICU = Intensive care unit; OR = Operating room; SpO2 = pulse oximetry measured oxygen saturation.