Predictors of 30-day mortality among Dutch patients undergoing colorectal cancer surgery, 2011-2016

Bosch, T. van den; Warps, A.L.K.; Babberich, M.P.M.D.T.; Stamm, C.; Geerts, B.F.; Vermeulen, L.; ... ; Dutch ColoRectal Audit

Supplementary Online Content

van den Bosch T, Warps ALK, de Nerée tot Babberich MPM, et al; Dutch ColoRectal Audit. Predictors of 30-day mortality among Dutch patients undergoing colorectal cancer surgery, 2011-2016. *JAMA Netw Open.* 2021;4(4):e217737. doi:10.1001/jamanetworkopen.2021.7737

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

eTable 1. Characteristics of 62 501 Patient Records Included in This Study

	Total set (n = 62,501)	Missing (n=49,878)	Train set (n = 50,589)	Test set (n = 11,912)	*P* value
Sex		21 (0.0%)			.003
Male	35,116 (56.2%)		28,278 (55.9%)	6,838 (57.4%)	
Female	27,364 (43.8%)		22,293 (44.1%)	5,071 (42.6%)	
Age (years)		57 (0.1%)			<.001
<60	11,071 (17.7%)		9,088 (18.0%)	1,983 (16.6%)	
61-70	21,004 (33.6%)		16,714 (33.0%)	4,290 (36.0%)	
71-80	20,556 (32.9%)		16,603 (32.8%)	3,953 (33.2%)	
≥80	9,813 (15.7%)		8,146 (16.1%)	1,667 (14.0%)	
BMI (kg/m2)		3190 (5.1%)			
<18.5	1,038 (1.7%)		856 (1.7%)	182 (1.5%)	<.001
18.5-25.0	23,907 (38.3%)		19,450 (38.4%)	4,457 (37.4%)	
25.0-30.0	23,898 (38.2%)		19,350 (38.2%)	4,548 (38.2%)	
≥30	10,468 (16.8%)		8,128 (16.1%)	2,340 (19.6%)	
ASA-score		513 (0.8%)			<.001
I	11,964 (19.1%)		9,979 (19.7%)	1,985 (16.7%)	
II	35,679 (57.1%)		28,587 (56.5%)	7,092 (59.5%)	
III	13,370 (21.4%)		10,757 (21.3%)	2,613 (21.9%)	
IV	949 (1.5%)		740 (1.5%)	209 (1.8%)	
V	26 (0.0%)		22 (0.0%)	4 (0.0%)	
Comorbidities					
Cardiac		259 (0.4%)			
Angina Pectoris	2,726 (4.4%)		2,218 (4.4%)	508 (4.3%)	.53
Myocardial infarction	3,857 (6.2%)		3,125 (6.2%)	732 (6.1%)	.84
Percutaneous transluminal coronary angioplasty (PTCA)	2,498 (4.0%)		1,996 (3.9%)	502 (4.2%)	.21
Coronary artery bypass grafting (CABG)	2,274 (3.6%)		1,870 (3.7%)	404 (3.4%)	.10
Valvular heart disease	2,258 (3.6%)		1,802 (3.6%)	456 (3.8%)	.19
Cardiac valve replacement	685 (1.1%)		408 (0.8%)	120 (1.0%)	.47
Atrial fibrillation/ atrial flutter	5,184 (8.3%)		4,141 (8.2%)	1,043 (8.8%)	.06
Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	2,427 (3.9%)		1,952 (3.9%)	475 (4.0%)	.58
Congestive heart failure	1,346 (2.1%)		1,113 (2.2%)	233 (2.0%)	.10
Cardiomyopathy	528 (0.8%)		408 (0.8%)	120 (1.0%)	.04
Medical history of heart transplantation	9 (0.0%)		8 (0.0%)	1 (0.0%)	.85
Other heart disease	1,743 (2.8%)		1,355 (2.7%)	388 (3.3%)	.001

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Vascular		246 (0.4%)			
Hypertension	22,581 (36.1%)		18,084 (35.7%)	4,497 (37.8%)	<.001
Peripheral vascular disease	1,836 (2.9%)		1,464 (2.9%)	372 (3.1%)	.20
Carotid artery stenosis	320 (0.5%)		255 (0.5%)	65 (0.5%)	.62
Aortic aneurysm (abdominal/thoracic)	1,283 (2.1%)		1,028 (2.0%)	255 (2.1%)	.48
Other vascular disease	1,352 (2.2%)		1,097 (2.2%)	255 (2.1%)	.87
Diabetes mellitus		246 (0.4%)			
Non-insulin-dependent diabetes mellitus	7,251 (11.6%)		5,802 (11.5%)	1,449 (12.2%)	.05
Insulin-dependent diabetes mellitus	2,270 (3.6%)		1,828 (3.6%)	442 (3.7%)	.68
Diabetes mellitus with end-organ damage	273 (0.4%)		205 (0.4%)	68 (0.6%)	.02
Other diabetes mellitus related comorbidity	175 (0.3%)		151 (0.3%)	24 (0.2%)	.09
Pulmonary		82 (0.1%)			
COPD/asthma	6,803 (10.9%)		5,497 (10.9%)	1,306 (11.0%)	.79
Pulmonary fibrosis	83 (0.1%)		70 (0.1%)	13 (0.1%)	.52
History of lung surgery/transplantation	217 (0.4%)		178 (0.4%)	39 (0.3%)	.75
Other pulmonary disease	1,578 (2.5%)		1,187 (2.3%)	391 (3.3%)	.01
Neurological		71 (0.1%)			
Transient ischemic attack	2,661 (4.3%)		2,133 (4.2%)	528 (4.4%)	.30
Cerebrovascular attack	2,593 (4.2%)		2,108 (4.2%)	485 (4.1%)	.66
Myopathy	146 (0.2%)		118 (0.2%)	28 (0.2%)	1.00
Hemiplegia/paraplegia	119 (0.2%)		97 (0.2%)	22 (0.2%)	.97
Parkinson's disease/ dementia	857 (1.4%)		700 (1.4%)	157 (1.3%)	.61
Schizophrenia/ major depressive disorder/ psychosis	947 (1.5%)		54 (0.1%)	17 (0.1%)	.006
Other neurological disease	2,404 (3.9%)		1,934 (3.8%)	470 (3.9%)	.54

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Gastrointestinal		107 (0.2%)			
Gastroesophageal reflux disorder / peptic ulcer disease	2,016 (3.2%)		1,629 (3.2%)	387 (3.2%)	.91
Symptomatic cholelithiasis	855 (1.4%)		628 (1.2%)	227 (1.9%)	<.001
Pancreatitis (acute/chronic)	199 (0.3%)		158 (0.3%)	41 (0.3%)	.65
Inflammatory bowel disease (M. Crohn / Ulcerative Colitis)	556 (0.9%)		451 (0.9%)	105 (0.9%)	.95
Diverticulitis	789 (1.3%)		630 (1.2%)	159 (1.3%)	.47
Liver disease/ failure (cirrhosis/hepatitis)	453 (0.7%)		376 (0.7%)	77 (0.6%)	.27
Other gastrointestinal disease	1,503 (2.4%)		1,182 (2.3%)	321 (2.7%)	.02
Urogenital		86 (0.1%)			
Chronic kidney disease (creatinine <110)	1,652 (2.6%)		1,267 (2.5%)	385 (3.2%)	<.001
Dialysis-dependent kidney failure	70 (0.1%)		64 (0.1%)	6 (0.1%)	.04
Medical history of renal surgery/ transplantation	377 (0.6%)		309 (0.6%)	68 (0.6%)	.66
Pregnant at the time of surgery	5 (0.0%)		5 (0.0%)	0 (0.0%)	.61
Other urogenital disease	2,862 (4.6%)		2,264 (4.5%)	598 (5.0%)	.01
Hematologic		64 (0.1%)			
Deep venous thrombosis	1,111 (1.8%)		913 (1.8%)	198 (1.7%)	.30
Pulmonary embolism	872 (1.4%)		711 (1.4%)	161 (1.4%)	.68
Blood clotting disorder	116 (0.2%)		91 (0.2%)	25 (0.2%)	.57
Other hematologic disease	268 (0.4%)		222 (0.4%)	46 (0.4%)	.47
Immunodeficiency		84 (0.1%)			
Sarcoidosis/ Besnier Boeck	102 (0.2%)		89 (0.2%)	13 (0.1%)	.13
Rheumatoid Arthritis/ SLE/ scleroderma	1748 (2.8%)		1,405 (2.8%)	343 (2.9%)	.57
Vasculitis	27 (0.0%)		22 (0.0%)	5 (0.0%)	1.00
Other immunodeficiency	2,654 (4.3%)		2,145 (4.2%)	509 (4.3%)	.91

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Endocrine		72 (0.1%)			
Hypo-/hyperthyroidism	2,571 (4.1%)		2,056 (4.1%)	515 (4.3%)	.21
Hypo-/hyperparathyroidism	205 (0.3%)		151 (0.3%)	54 (0.5%)	.01
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)	52 (0.0%)		36 (0.1%)	16 (0.1%)	.05
Other endocrine disease	555 (0.9%)		405 (0.8%)	150 (1.3%)	.01
Infectious		22 (0.0%)			
HIV/AIDS	29 (0.1%)		24 (0.0%)	5 (0.0%)	.99
Tuberculosis	172 (0.3%)		147 (0.3%)	25 (0.2%)	.16
Malaria	30 (0.1%)		25 (0.0%)	5 (0.0%)	.92
Other infectious disease	274 (0.4%)		188 (0.4%)	86 (0.7%)	<.001
Malignancy		350 (0.6%)			
Current untreated malignancy	1,605 (2.6%)		1,268 (2.5%)	337 (2.8%)	.05
Curative malignancy treated <5 years ago	3,086 (4.9%)		2,483 (4.9%)	603 (5.1%)	.59
Curative malignancy treated >5 years ago	4,076 (6.5%)		3,180 (6.3%)	896 (7.5%)	<.001
Palliative treated and / or distant metastasis	430 (0.7%)		351 (0.7%)	79 (0.7%)	.73
Other types of cancer	173 (0.3%)		147 (0.3%)	26 (0.2%)	.20
Past surgical history		216 (0.4%)			
History of esophageal, gastric, pancreatic or spleen surgery	1,018 (1.6%)		850 (1.7%)	168 (1.4%)	.04
History of hepatobiliary surgery	4,175 (6.7%)		3,403 (6.7%)	772 (6.5%)	.33
History of bowel surgery	8,402 (13.4%)		6,783 (13.4%)	1,619 (13.6%)	.63
History of bladder-, prostate-, uterine or ovarian surgery	7,737 (12.4%)		6,382 (12.6%)	1,355 (11.4%)	<.001
Other abdominal surgery in the history	3,784 (6.1%)		3,093 (6.1%)	691 (5.8%)	.20
Stoma before surgical resection		216 (0.4%)			.71
No	61,706 (98.7%)		49,932 (98.7%)	11,774 (98.8%)	
Ileostomy	134 (0.2%)		111 (0.2%)	23 (0.2%)	
Colostomy	425 (0.7%)		345 (0.7%)	80 (0.7%)	
Type of stoma unknown	20 (0.0%)		18 (0.0%)	2 (0.0%)	

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Tumor found by screening		0 (0.0%)			<.001
No	56,639 (90.6%)		47,008 (92.9%)	9,631 (80.9%)	
Yes	5,862 (9.4%)		3,581 (7.1%)	2,281 (19.1%)	
Tumor location		65 (0.1%)			.001
Colon	42,910 (68.7%)		34,566 (68.3%)	8,344 (70.0%)	
Rectum	17,477 (28.0%)		14,301 (28.3%)	3,176 (26.7%)	
Multiple tumors	2,049 (3.3%)		1,660 (3.3%)	389 (3.3%)	
Number tumors found by endoscopy		730 (1.2%)			.67
1	59,668 (95.5%)		48,148 (95.2%)	11,520 (96.7%)	
2	1,930 (3.1%)		1,573 (3.1%)	357 (3.0%)	
3+	173 (0.3%)		140 (0.3%)	33 (0.3%)	
T-stage		2,768 (4.4%)			<.001
T0	155 (0.3%)		116 (0.2%)	39 (0.3%)	
T1	4,850 (7.8%)		3,521 (7.0%)	1,329 (11.2%)	
T2	11,471 (18.4%)		9,121 (18.0%)	2,350 (19.7%)	
T3	34,553 (55.3%)		28,376 (56.1%)	6,177 (51.9%)	
T4	8,704 (13.9%)		7,136 (14.1%)	1,568 (13.2%)	
M-stage		5,547 (8.9%)			<.001
M0	50,656 (81.1%)		40,663 (80.4%)	9,993 (83.9%)	
M1	6,298 (10.1%)		5,258 (10.4%)	1,040 (8.7%)	
Surgical procedure pre resection		47 (0.1%)			
Stoma	2,011 (3.2%)		1,652 (3.3%)	359 (3.0%)	.18
Stent	168 (0.3%)		147 (0.3%)	21 (0.2%)	.04
Metastasectomy	582 (0.9%)		478 (0.9%)	104 (0.9%)	.50
Appendectomy	141 (0.2%)		111 (0.2%)	30 (0.3%)	.57
Other	496 (0.8%)		357 (0.7%)	139 (1.2%)	<.001
Metastases		0 (0.0%)			
Liver metastases	2,015 (3.2%)		1,353 (2.7%)	662 (5.6%)	<.001
Pulmonary metastases	487 (0.8%)		342 (0.7%)	145 (1.2%)	<.001
Bone metastasis	34 (0.1%)		22 (0.0%)	12 (0.1%)	.03
Peritoneal metastasis	432 (0.7%)		249 (0.5%)	183 (1.5%)	<.001
Ovarian metastasis	69 (0.1%)		35 (0.1%)	34 (0.3%)	<.001
Brain metastases	10 (0.2%)		6 (0.0%)	4 (0.0%)	.20
Other metastases	329 (0.5%)		226 (0.4%)	103 (0.9%)	<.001

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Preoperative MDT		793 (1.3%)			<.001
No	9,040 (14.5%)		7,917 (15.6%)	1,123 (9.4%)	
Yes	52,668 (84.3%)		41,891 (82.8%)	10,777 (90.5%)	
Preoperative tumor complications		0 (0.0%)			
Fecal peritonitis due to preoperative colorectal perforation	860 (1.4%)		708 (1.4%)	152 (1.3%)	.32
Preoperative presence of an abscess	587 (0.9%)		469 (0.9%)	118 (1.0%)	.55
Preoperative bowel obstruction/ ileus due to malignancy	6,836 (10.9%)		5,720 (11.3%)	1,116 (9.4%)	<.001
Preoperative blood loss/ anemia	10,755 (17.2%)		8,974 (17.7%)	1,781 (15.0%)	<.001
Other preoperative tumor related complications	2,710 (4.3%)		2,328 (4.6%)	382 (3.2%)	<.001
Neoadjuvant radiotherapy		6,630 (10.6%)			<.001
None	43,163 (69.1%)		34,726 (68.6%)	8,437 (70.8%)	
Short course	6,422 (10.3%)		5,649 (11.2%)	773 (6.5%)	
Long course without chemotherapy	459 (0.7%)		432 (0.9%)	27 (0.2%)	
Chemoradiation	5,827 (9.3%)		4,822 (9.5%)	1,005 (8.4%)	
Neoadjuvant chemotherapy		7,708 (12.3%)			<.001
No	51,064 (81.7%)		41,459 (82.0%)	9,605 (80.6%)	
Yes	3,729 (6.0%)		3,132 (6.2%)	597 (5.0%)	
Setting		437 (0.7%)			<.001
Elective	54,051 (86.5%)		43,364 (85.7%)	10,687 (89.7%)	
Elective after placing a stent	347 (0.6%)		290 (0.6%)	57 (0.5%)	
Urgent	3,682 (5.9%)		3,110 (6.1%)	572 (4.8%)	
Emergency, direct procedure	3,984 (6.4%)		3,404 (6.7%)	580 (4.9%)	
Approach		437 (0.7%)			<.001
Open	23,977 (38.4%)		21,434 (42.4%)	2,543 (21.3%)	
Laparoscopic	36,965 (59.1%)		28,021 (55.4%)	8,944 (75.1%)	
Transanal endoscopic microsurgery (TEM)	745 (1.2%)		543 (1.1%)	202 (1.7%)	
Transanal local excision (open)	54 (0.1%)		43 (0.1%)	11 (0.1%)	
Transanal minimally invasive surgery	109 (0.2%)		77 (0.2%)	32 (0.3%)	

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Transanal total mesorectal excision (TaTME)	214 (0.3%)		69 (0.1%)	145 (1.2%)	
Surgical procedure		63 (0.1%)			<.001
Ileocecal resection	471 (0.8%)		413 (0.8%)	58 (0.5%)	
(extended) Right hemicolectomy	19,284 (30.9%)		15,428 (30.5%)	3,856 (32.4%)	
Resection of the transverse colon	1,073 (1.7%)		893 (1.8%)	180 (1.5%)	
(extended) Left hemicolectomy	4,851 (7.8%)		3,899 (7.7%)	952 (8.0%)	
(low) Anterior resection/sigmoid resection	27,805 (44.5%)		22,512 (44.5%)	5,293 (44.4%)	
Subtotal colectomy	1,008 (1.6%)		837 (1.7%)	171 (1.4%)	
Abdominoperineal resection	4,699 (7.5%)		3,957 (7.8%)	742 (6.2%)	
Panproctocolectomy	133 (0.2%)		124 (0.2%)	9 (0.1%)	
Local excision	718 (1.2%)		521 (1.0%)	197 (1.7%)	
Local excision follow by an abdominoperineal resection	64 (0.1%)		49 (0.1%)	15 (0.1%)	
Local excision followed by a total mesorectal excision	164 (0.3%)		115 (0.2%)	49 (0.4%)	
Same procedure for multiple tumors	910 (1.5%)		752 (1.5%)	158 (1.3%)	
Two different procedures of which at least 1 procedure for rectal cancer	207 (0.3%)		155 (0.3%)	52 (0.4%)	
Two different colon procedures	637 (1.0%)		514 (1.0%)	123 (1.0%)	
Other surgical procedures	414 (0.7%)		362 (0.7%)	52 (0.4%)	
***Surgical conversion**		0 (0.00%)			.02
No	58,039 (92.9%)		47,017 (92.9%)	11,022 (92.5%)	
Early	3,018 (4.8%)		2,387 (4.7%)	631 (5.3%)	
Late	1,444 (2.3%)		1,185 (2.3%)	259 (2.2%)	
***Reason for conversion**		219 (0.4%)			.01
Complexity	952 (1.5%)		737 (1.5%)	215 (1.8%)	
Accessibility	2,997 (4.8%)		2,415 (4.8%)	582 (4.9%)	
Preoperative tumor complication	294 (0.5%)		227 (0.4%)	67 (0.6%)	

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
***Additional resection for local ingrowth**		2,551 (4.1%)			<.001
No	54,395 (87.0%)		43,635 (86.3%)	10,760 (90.3%)	
Limited	2,428 (3.9%)		2,051 (4.1%)	377 (3.2%)	
Extensive	3,127 (5.0%)		2,563 (5.1%)	564 (4.7%)	
*Resection of the omentum	592 (1.0%)	0 (0.00%)	504 (1.0%)	88 (0.7%)	.01
*Resection of the liver, or RFA	858 (1.4%)	0 (0.00%)	675 (1.3%)	183 (1.5%)	.10
*Resection of the lung	30 (0.1%)	0 (0.00%)	26 (0.1%)	4 (0.0%)	.57
*Resection of the peritoneal metastases	429 (0.7%)	0 (0.00%)	358 (0.7%)	71 (0.6%)	.21
*Lymph node dissection	284 (0.5%)	0 (0.00%)	235 (0.5%)	49 (0.4%)	.48
*Resection of other abdominal organs	475 (0.8%)	0 (0.00%)	402 (0.8%)	73 (0.6%)	.05
*Other abdominal resection	2,345 (3.8%)	0 (0.00%)	1,924 (3.8%)	421 (3.5%)	.17
***Radio- or chemotherapy during surgery**		0 (0.00%)			<.001
No	62,170 (99.5%)		50,352 (99.5%)	11,818 (99.2%)	
IORTC	149 (0.2%)		124 (0.2%)	25 (0.2%)	
HIPEC	182 (0.3%)		113 (0.2%)	69 (0.6%)	
***Intraoperative complications**		3,422 (5.5%)			<.001
No	57,730 (92.4%)		46,207 (91.3%)	11,523 (96.7%)	
Yes, blood loss for which blood transfusion was required	360 (0.6%)		310 (0.6%)	50 (0.4%)	
Yes, damage of the spleen for which a splenectomy was required	79 (0.1%)		76 (0.2%)	3 (0.0%)	
Yes, damage to the pancreas, liver, d. choledochus, gallbladder	41 (0.1%)		35 (0.1%)	6 (0.1%)	
Yes, damage to the intestine	509 (0.8%)		411 (0.8%)	98 (0.8%)	
Yes, damage to the ureter/urethra	201 (0.3%)		172 (0.3%)	29 (0.2%)	
Yes, damage to the urine bladder	101 (0.2%)		72 (0.1%)	29 (0.2%)	
Yes, damage to the vagina	39 (0.1%)		34 (0.1%)	5 (0.0%)	

eTable 1 continued: Characteristics of 62,501 patient records included in this study

	Total set	Missing	Train set	Test set	*P* value
Perforation intra-abdominal during a transanal local excision	19 (0.0%)		17 (0.0%)	2 (0.0%)	
***Primary anastomosis**		1,508 (2.4%)			<.001
No	13,044 (20.9%)		10,910 (21.6%)	2,134 (17.9%)	
Yes	47,949 (76.7%)		38,397 (75.9%)	9,552 (80.2%)	
***Stoma**		1,451 (2.3%)			<.001
No	41,485 (66.4%)		32,799 (64.8%)	8,686 (72.9%)	
Loop ileostomy	6,268 (10.0%)		5,343 (10.6%)	925 (7.8%)	
End ileostomy	1,271 (2.0%)		1,041 (2.1%)	230 (1.9%)	
Loop colostomy	1,104 (1.8%)		982 (1.9%)	122 (1.0%)	
End colostomy	10,851 (17.4%)		9,137 (18.1%)	1,714 (14.4%)	
Stoma of unknown type	71 (0.1%)		47 (0.1%)	24 (0.2%)	
Outcomes		0 (0.0%)			
Mortality	1693 (2.7%)		1,458 (2.9%)	235 (2.0%)	<.001
Complicated course	11443 (18.3%)		9,579 (18.9%)	1,864 (15.6%)	<.001
ICU intake	11931 (19.1%)		9,957 (19.7%)	1,974 (16.6%)	<.001
Hospital readmission	4496 (7.2%)		3,451 (6.8%)	1,045 (8.8%)	<.001
Prolonged hospital stay	4874 (7.8%)		4,207 (8.3%)	667 (5.6%)	<.001

eTable 1: Characteristics of 62,501 patients included in this study**.** Overview of the dataset. Model split of test (column 4) and train (column 5) sets for shown, with the corresponding *P*-value determined by the chi-square test (column 6). Variables indicated with a * are considered intraoperative variables and are excluded from some analyses as indicated in the main text.

eTable 2. Machine Learning Model Specifications for Each Outcome

Outcome	Method	Balancing	Missing flags	Test set AUC (95%CI)
Mortality	SVM	Yes	Yes	0.81 (0.79 - 0.84)
	SVM	Yes	No	0.82 (0.79 - 0.85)
	RF	Yes*	Yes	0.82 (0.79 - 0.85)
	RF	No	Yes	0.80 (0.77 - 0.83)
	RF	Yes*	No	0.82 (0.79 - 0.84)
	RF	No	No	0.79 (0.76 - 0.82)
	GBM	Yes	Yes	0.82 (0.79 - 0.85)
	GBM	No	Yes	0.81 (0.78 - 0.84)
	GBM	Yes	No	0.82 (0.79 - 0.84)
	GBM	No	No	0.80 (0.77 - 0.83)
	ENR	Yes	Yes	0.82 (0.79 - 0.85)
	ENR	No	Yes	0.82 (0.79 - 0.85)
	ENR	Yes	No	0.82 (0.79 - 0.85)
	ENR	No	No	0.82 (0.79 - 0.85)
	LR	Yes	Yes	0.80 (0.77 - 0.83)
	LR	No*	Yes	0.81 (0.78 - 0.84)
	LR	Yes	No	0.81 (0.78 - 0.84)
	LR	No	No	0.81 (0.79 - 0.84)
Complicated Course	RF	Yes*	Yes	0.67 (0.65 - 0.68)
	RF	No	Yes	0.66 (0.64 - 0.67)
	RF	Yes*	No	0.67 (0.65 - 0.68)
	RF	No	No	0.66 (0.64 - 0.67)
	GBM	Yes*	Yes*	0.68 (0.67 - 0.69)
	GBM	No	Yes	0.66 (0.65 - 0.67)
	GBM	Yes	No	0.67 (0.66 - 0.68)
	GBM	No*	No*	0.68 (0.67 - 0.69)
	ENR	Yes	Yes	0.68 (0.67 - 0.69)
	ENR	No*	Yes	0.68 (0.67 - 0.69)
	ENR	Yes	No	0.68 (0.67 - 0.69)
	ENR	No	No	0.68 (0.67 - 0.69)
	LR	Yes	Yes	0.68 (0.67 - 0.69)
	LR	No	Yes	0.68 (0.67 - 0.69)
	LR	Yes	No	0.68 (0.67 - 0.69)
	LR	No	No	0.68 (0.67 - 0.69)
ICU admission	RF	Yes*	Yes	0.72 (0.71 - 0.74)
	RF	No	Yes	0.72 (0.70 - 0.73)
	RF	Yes*	No	0.72 (0.71 - 0.74)
	RF	No	No	0.71 (0.70 - 0.73)
	GBM	Yes	Yes*	0.73 (0.71 - 0.74)

eTable 2 continued: Machine learning model specifications for each outcome

	Method	Balancing	Missing flags	Test set AUC (95%CI)
	GBM	No*	Yes*	0.74 (0.73 - 0.75)
	GBM	Yes	No	0.72 (0.70 - 0.73)
	GBM	No*	No	0.74 (0.72 - 0.75)
	ENR	Yes	Yes*	0.74 (0.72 - 0.75)
	ENR	No	Yes	0.74 (0.72 - 0.75)
	ENR	Yes	No	0.73 (0.72 - 0.75)
	ENR	No	No	0.73 (0.72 - 0.75)
	LR	Yes	Yes	0.74 (0.72 - 0.75)
	LR	No	Yes	0.74 (0.72 - 0.75)
	LR	Yes	No	0.73 (0.72 - 0.75)
	LR	No	No	0.73 (0.72 - 0.75)
Prolonged stay	RF	Yes*	Yes*	0.71 (0.69 - 0.73)
	RF	No	Yes	0.69 (0.67 - 0.71)
	RF	Yes	No	0.70 (0.68 - 0.72)
	RF	No	No	0.70 (0.68 - 0.72)
	GBM	Yes	Yes	0.71 (0.69 - 0.73)
	GBM	No	Yes	0.70 (0.68 - 0.72)
	GBM	Yes*	No	0.71 (0.69 - 0.73)
	GBM	No	No	0.71 (0.69 - 0.73)
	ENR	Yes	Yes	0.71 (0.69 - 0.73)
	ENR	No	Yes	0.71 (0.69 - 0.72)
	ENR	Yes	No	0.71 (0.69 - 0.73)
	ENR	No	No	0.71 (0.69 - 0.72)
	LR	Yes	Yes	0.70 (0.68 - 0.72)
	LR	No	Yes	0.70 (0.68 - 0.72)
	LR	Yes	No	0.70 (0.68 - 0.72)
	LR	No	No	0.70 (0.68 - 0.72)
Readmission	RF	Yes*	Yes	0.63 (0.61 - 0.65)
	RF	No	Yes	0.61 (0.59 - 0.62)
	RF	Yes*	No	0.63 (0.61 - 0.65)
	RF	No	No	0.60 (0.59 - 0.62)
	GBM	Yes*	Yes	0.63 (0.62 - 0.65)
	GBM	No	Yes	0.61 (0.59 - 0.63)
	GBM	Yes	No	0.62 (0.61 - 0.64)
	GBM	No	No*	0.62 (0.61 - 0.64)
	ENR	Yes	Yes*	0.62 (0.60 - 0.64)
	ENR	No	Yes	0.62 (0.61 - 0.64)
	ENR	Yes	No	0.61 (0.59 - 0.63)
	ENR	No*	No	0.62 (0.61 - 0.64)

eTable 2 continued: Machine learning model specifications for each outcome

	Method	Balancing	Missing flags	Test set AUC (95%CI)
	LR	Yes	Yes	0.62 (0.60 - 0.64)
	LR	No	Yes	0.62 (0.60 - 0.64)
	LR	Yes	No	0.62 (0.60 - 0.63)
	LR	No	No	0.62 (0.60 - 0.64)

eTable 2: AUC scores for all machine learning models. AUC scores for Elastic Net Regression, Random Forest, Gradient Boosting Models and Support Vector Machine. The best performing model for each response is highlighted in bold. Significantly different AUC (deLong *P*<.05) is denoted by a * when a model with/without balancing or with/without missing flags performs better than the model without/with that method for data handling.

eTable 3. Multicollinearity in the DCRA Dataset

Variable	VIF
Procedure: 2 equal procedures for multiple tumors	5.21
Approach: Transanal endoscopic microsurgery (TEM)	5.43
Procedure: Local excision	5.61
Tumor location: rectum	6.02
Number of tumors found: 2	35.43
Tumor location: multiple tumors	45.77

eTable 3 | Multicollinearity in the DCRA dataset All variables with Variance Inflation Factor >5 in the analyzed dataset. In total, 103 variables were analyzed. Categorical variables are transformed into a single variable for each level, totaling to 144 features of which 7 have a VIF>5. All variables with VIF>5 are levels of a categorical, indicating a low overall multicollinearity.

eTable 4. Goodness-of-Fit of Multivariate Logistic Regression Model

Model	AIC	Log-likelihood	*P* value
Full model	12906	-6309	
Ground model	15561	-7779	$< 10^{-300}$
Case-mix model (no CCI)	13271	-6615	$8.5 \cdot 10^{-66}$
Case-mix model (including CCI variables)	13144	-6524	$7.11 \cdot 10^{-44}$

eTable 4: Goodness of fit of multivariable logistic regression model. Comparison of multivariable logistic regression models on mortality containing all variables (full model), no variables (ground model), the DCRA case-mix variables without CCI and the DCRA case-mix variables combined with all variables in the CCI. *P*-values were calculated by the likelihood-ratio test of each model relative to the model containing all variables. The Akaike Information Criterium (AIC) penalizes model goodness of fit with the number of variables in a model. Low AIC indicates good model performance.

eTable 5. Multivariate Logistic Regression Analyses for Mortality After Colorectal Cancer Surgery

Characteristics		β	95% CI	*P* value
(Intercept)		-5.24	-5.63 - -4.85	<.001
Sex	Male	Ref.		
	Female	-0.18	-0.29 - -0.06	.003
Comorbidities	Angina Pectoris	0.23	0.04 - 0.42	.02
	Myocardial infarction	0.22	0.05 - 0.39	.01
	Percutaneous transluminal coronary angioplasty (PTCA)	-0.14	-0.37 - 0.09	.22
	Coronary artery bypass grafting (CABG)	0.07	-0.15 - 0.28	.54
	Valvular heart disease	-0.15	-0.37 - 0.06	.16
	Cardiac valve replacement	0.18	-0.17 - 0.52	.31
	Atrial fibrillation/ atrial flutter	0.21	0.07 - 0.36	.003
	Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	0.16	-0.04 - 0.37	.12
	Congestive heart failure	0.22	0.01 - 0.44	.04
	Cardiomyopathy	0.29	-0.07 - 0.65	.12
	Medical history of heart transplantation	1.19	-0.96 - 3.20	.29
	Other heart disease	0.16	-0.08 - 0.40	.18
	Hypertension	0.02	-0.09 - 0.13	.77
	Peripheral vascular disease	0.40	0.19 - 0.60	<.001
	Carotid artery stenosis	0.20	-0.26 - 0.66	.40
	Aortic aneurysm (abdominal/thoracic)	0.08	-0.18 - 0.35	.54
	Other vascular disease	-0.06	-0.38 - 0.25	.70
	Non-insulin-dependent diabetes mellitus	0.12	-0.03 - 0.26	.11
	Insulin-dependent diabetes mellitus	0.27	0.04 - 0.49	.02
	Diabetes mellitus with end-organ damage	-0.15	-0.70 - 0.40	.59
	Other diabetes mellitus related comorbidity	0.59	-0.06 - 1.23	.07
	COPD/asthma	0.40	0.27 - 0.53	<.001
	Pulmonary fibrosis	0.23	-0.73 - 1.19	.63
	History of lung surgery/transplantation	0.88	0.38 - 1.39	<.001
	Other pulmonary disease	0.24	-0.01 - 0.50	.06
	Transient ischemic attack	0.20	0.00 - 0.40	.04
	Cerebrovascular attack	0.25	0.07 - 0.44	.008
	Myopathy	0.10	-0.81 - 1.01	.83
	Hemiplegia/ paraplegia	0.02	-0.93 - 0.97	.97
	Parkinson’s disease/ dementia	0.56	0.30 - 0.82	<.001
	Schizophrenia/ major depressive disorder/ psychosis	0.46	0.12 - 0.79	.007
	Other neurological disease	0.14	-0.09 - 0.36	.23
	Gastroesophageal reflux disorder / peptic ulcer disease	-0.25	-0.53 - 0.03	.07
	Symptomatic cholelithiasis	-0.07	-0.48 - 0.33	.72
	Pancreatitis (acute/chronic)	-0.97	-2.15 - 0.22	.11
	Inflammatory bowel disease (M. Crohn/ Ulcerative Colitis)	-0.12	-0.72 - 0.48	.69
	Diverticulitis	-0.01	-0.41 - 0.38	.94
	Liver disease/ failure (cirrhosis/hepatitis)	0.94	0.55 - 1.34	<.001
	Other gastrointestinal disease	0.11	-0.19 - 0.40	.47
	Chronic kidney disease (creatinine <110)	0.37	0.16 - 0.57	<.001
	Dialysis-dependent kidney failure	0.67	-0.10 - 1.44	.08
	Medical history of renal surgery/ transplantation	0.32	-0.20 - 0.83	.22
	Pregnant at the time of surgery	-13.78	-3296.82 - 3269.26	.99
	Other urogenital disease	-0.09	-0.31 - 0.13	.41
	Deep venous thrombosis	0.09	-0.25 - 0.42	.61
	Pulmonary embolism	0.14	-0.21 - 0.50	.43
	Blood clotting disorder	-0.19	-1.24 - 0.86	.72
	Other hematologic disease	0.18	-0.49 - 0.86	.59

eTable 5 continued: Multivariate logistic regression analyses for mortality after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Sarcoidosis/ Besnier Boeck	-0.74	-2.74 - 1.27	.47
	Rheumatoid Arthritis/ SLE/ scleroderma	-0.04	-0.31 - 0.24	.80
	Vasculitis	0.50	-1.01 - 2.02	.51
	Other immunodeficiency	0.05	-0.17 - 0.28	.65
	Hypo-/hyperthyroidism	-0.06	-0.31 - 0.18	.60
	Hypo-/hyperparathyroidism	-0.05	-0.77 - 0.68	.90
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)		-13.69	-1028.69 - 1001.31	.98
	Other endocrine disease	-0.49	-1.06 - 0.08	.09
	HIV/AIDS	0.52	-1.54 - 2.58	.62
	Tuberculosis	0.01	-0.80 - 0.82	.98
	Malaria	-14.66	-1345.42 - 1316.10	.98
	Other infectious disease	0.30	-0.28 - 0.88	.31
	Current untreated malignancy	0.45	0.20 - 0.70	<.001
	Curative malignancy treated <5 years ago	-0.03	-0.26 - 0.19	.76
	Curative malignancy treated >5 years ago	0.15	-0.03 - 0.32	.10
	Palliative treated and / or distant metastasis	0.26	-0.18 - 0.70	.25
	Other types of cancer	0.80	0.25 - 1.34	.004
Surgical history	History of esophageal, gastric, pancreatic or spleen surgery	0.06	-0.29 - 0.41	.73
	History of hepatobiliary surgery	0.13	-0.06 - 0.32	.19
	History of bowel surgery	-0.01	-0.16 - 0.14	.88
	History of bladder-, prostate-, uterine or ovarian surgery	-0.18	-0.35 - -0.01	.04
	Other abdominal surgery in the history	0.02	-0.18 - 0.22	.84
Stoma before surgical resection	No stoma	Ref.		
	Ileostomy	-13.8	-643.53 - 616.01	.97
	Colostomy	-0.25	-0.87 - 0.38	.44
	Type unknown	0.10	-2.00 - 2.21	.92
Number of tumors found by endoscopy	1	Ref.		
	2	-0.1	-1.60 - 1.50	.95
	3+	-0.22	-1.83 - 1.39	.79
Preoperative MDT		-0.14	-0.30 - 0.01	.07
Preoperative surgical procedure	Stoma	0.03	-0.32 - 0.39	.87
	Stent	0.20	-0.71 - 1.12	.66
	Metastasectomy	-1.32	-2.50 - -0.14	.03
	Appendectomy	-0.01	-1.44 - 1.42	.99
	Other	-0.04	-0.67 - 0.60	.91
Neoadjuvant radiotherapy	No neoadjuvant radiotherapy	Ref.		
	Short course	-0.03	-0.32 - 0.25	.81
	Long course without chemotherapy	0.32	-0.09 - 0.73	.12
	Chemoradiation	-0.35	-0.74 - 0.04	.08
Neoadjuvant chemotherapy		0.05	-0.25 - 0.35	.73
ASA score	I	Ref.		
	II	0.69	0.42 - 0.97	<.001
	III	1.36	1.07 - 1.64	<.001
	IV	2.20	1.86 - 2.53	<.001
	V	3.18	2.24 - 4.12	<.001
Setting	Elective	Ref.		
	Elective after placing a stent	-0.25	-1.17 - 0.67	.59
	Urgent	0.42	0.20 - 0.63	<.001
	Emergency, direct procedure	0.61	0.37 - 0.85	<.001
Tumor complications	No tumor complications	Ref.		
	Fecal peritonitis due to preoperative colorectal perforation	0.92	0.64 - 1.20	<.001

eTable 5 continued: Multivariate logistic regression analyses for mortality after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Preoperative presence of an abscess	0.04	-0.41 - 0.49	.86
	Preoperative bowel obstruction/ ileus due to malignancy	0.00	-0.19 - 0.20	.97
	Preoperative blood loss/ anemia	0.05	-0.09 - 0.19	.47
	Other preoperative tumor related complications	0.07	-0.17 - 0.31	.55
Approach	Open	Ref.		
	Laparoscopic	-0.52	-0.64 - -0.39	<.001
	Transanal endoscopic microsurgery (TEM)	-0.21	-1.63 - 1.23	.78
	Transanal local excision (open)	-1.07	-3.17 - 1.03	.31
	Transanal minimally invasive surgery (TAMIS)	-13.09	-707.27 - 681.09	.97
	Transanal total mesorectal excision (TaTME)	-13.49	-512.88 - 485.91	.96
Metastasis	Liver metastasis	-0.10	-0.40 - 0.21	.53
	Pulmonary metastasis	-0.39	-0.95 - 0.17	.16
	Bone metastasis	1.69	0.67 - 2.7	.001
	Peritoneal metastasis	0.17	-0.34 - 0.67	.51
	Ovarian metastasis	0.31	-1.25 - 1.86	.70
	Brain metastasis	-13.78	-2290.19 - 2262.63	.99
	Other metastasis	-0.33	-1.00 - 0.33	.32
Age	60-70	Ref.		
	<60	-0.36	-0.62 - -0.10	.006
	≥80	1.24	1.08 - 1.40	<.001
	70-80	0.59	0.44 - 0.74	<.001
BMI	18.5-25.0	Ref.		
	<18.5	0.45	0.17 - 0.72	.001
	≥30.0	-0.04	-0.19 - 0.11	.63
	25.0-30.0	-0.12	-0.24 - -0.00	.04
Tumor location	Colon	Ref.		
	Rectum	0.25	-0.04 - 0.54	.09
	Multiple tumors	0.09	-1.56 - 1.74	.91
Tumor found by screening		-0.17	-0.47 - 0.12	.025
Procedure	(low) Anterior/ sigmoid resection	Ref.		
	Ileocecal resection	0.40	-0.01 - 0.81	.06
	(extended) Right hemicolectomy	0.20	0.06 - 0.34	.005
	Local excision followed by a total mesorectal excision	0.32	-1.76 - 2.40	.76
	Same procedure for multiple tumors	0.18	-0.58 - 0.93	.64
	Two different procedures of which at least 1 procedure for rectal cancer	1.23	0.34 - 2.12	.006
	Two different colon procedures	0.73	-0.01 - 1.47	.05
	Transversectomy	0.44	0.12 - 0.75	.006
	(extended) Left hemicolectomy	0.29	0.09 - 0.49	.004
	Subtotal colectomy	0.87	0.54 - 1.20	<.001
	Abdominoperineal resection	0.16	-0.11 - 0.43	.23
	Panproctocolectomy	1.28	0.53 - 2.02	<.001
	Other	0.39	-0.13 - 0.91	.14
	Local excision	-1.48	-3.20 - 0.23	.09
	Local excision followed by an abdominoperineal resection	-0.57	-2.08 - 0.94	.45
M-stage	M0	Ref.		
	M1	0.52	0.34 - 0.69	<.001
T-stage	T1	Ref.		
	T2	-0.11	-0.35 - 0.13	.36
	T3	-0.09	-0.31 - 0.14	.45
	T4	0.05	-0.20 - 0.30	.69
	T0	-0.06	-1.28 - 1.16	.92

eTable 5: Logistic regression coefficients for 30-day mortality on 62,501 patient records. The *P*-values are given as calculated by the Wald test. When no reference level is reported, variables are binary and the reference level is absence of that variable.

eTable 6. Multivariate Logistic Regression Analyses for Complicated Course After Colorectal Cancer Surgery

Characteristics		β	95% CI	*P* value
(Intercept)		-2.11	-2.24 - -1.97	<.001
Sex	Male	Ref.		
	Female	-0.42	-0.47 - -0.37	<.001
Comorbidities	Angina Pectoris	0.03	-0.07 - 0.13	.60
	Myocardial infarction	0.05	-0.04 - 0.14	.23
	Percutaneous transluminal coronary angioplasty (PTCA)	-0.06	-0.17 - 0.05	.30
	Coronary artery bypass grafting (CABG)	-0.04	-0.15 - 0.07	.47
	Valvular heart disease	-0.06	-0.17 - 0.05	.28
	Cardiac valve replacement	0.36	0.18 - 0.54	<.001
	Atrial fibrillation/ atrial flutter	0.12	0.05 - 0.19	.002
	Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	0.08	-0.03 - 0.18	.16
	Congestive heart failure	0.22	0.09 - 0.35	<.001
	Cardiomyopathy	0.20	-0.00 - 0.40	.05
	Medical history of heart transplantation	0.79	-0.66 - 2.24	.28
	Other heart disease	0.02	-0.10 - 0.14	.75
	Hypertension	-0.01	-0.05 - 0.04	.79
	Peripheral vascular disease	0.19	0.08 - 0.31	<.001
	Carotid artery stenosis	0.03	-0.24 - 0.30	.81
	Aortic aneurysm (abdominal/thoracic)	0.16	0.02 - 0.29	.02
	Other vascular disease	0.03	-0.11 - 0.17	.66
	Non-insulin-dependent diabetes mellitus	-0.03	-0.09 - 0.04	.42
	Insulin-dependent diabetes mellitus	-0.02	-0.13 - 0.09	.71
	Diabetes mellitus with end-organ damage	-0.19	-0.50 - 0.12	.23
	Other diabetes mellitus related comorbidity	0.12	-0.25 - 0.49	.52
	COPD/asthma	0.27	0.20 - 0.33	<.001
	Pulmonary fibrosis	0.61	0.13 - 1.09	.01
	History of lung surgery/transplantation	0.08	-0.25 - 0.40	.63
	Other pulmonary disease	0.04	-0.09 - 0.17	.52
	Transient ischemic attack	0.11	0.02 - 0.21	.02
	Cerebrovascular attack	0.03	-0.07 - 0.14	.50
	Myopathy	0.34	-0.05 - 0.74	.09
	Hemiplegia/ paraplegia	0.05	-0.39 - 0.49	.83
	Parkinson's disease/ dementia	0.24	0.08 - 0.40	.003
	Schizophrenia/ major depressive disorder/ psychosis	0.07	-0.10 - 0.24	.44
	Other neurological disease	0.13	0.02 - 0.23	.01
	Gastroesophageal reflux disorder / peptic ulcer disease	0.06	-0.06 - 0.18	.31
	Symptomatic cholelithiasis	0.17	-0.01 - 0.35	.05
	Pancreatitis (acute/chronic)	0.26	-0.08 - 0.60	.13
	Inflammatory bowel disease (M. Crohn/ Ulcerative Colitis)	-0.09	-0.31 - 0.14	.45
	Diverticulitis	0.12	-0.06 - 0.29	.20
	Liver disease/ failure (cirrhosis/hepatitis)	0.38	0.16 - 0.60	<.001
	Other gastrointestinal disease	0.03	-0.10 - 0.17	.64
	Chronic kidney disease (creatinine <110)	0.16	0.04 - 0.28	.01
	Dialysis-dependent kidney failure	0.48	-0.05 - 1.02	.07
	Medical history of renal surgery/ transplantation	0.10	-0.16 - 0.37	.43
	Pregnant at the time of surgery	0.35	-1.90 - 2.60	.76
	Other urogenital disease	0.02	-0.08 - 0.11	.75
	Deep venous thrombosis	-0.03	-0.19 - 0.13	.74
	Pulmonary embolism	0.20	0.03 - 0.37	.02
	Blood clotting disorder	-0.18	-0.67 - 0.32	.48

eTable 6 continued: Multivariate logistic regression analyses for complicated course after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Other hematologic disease	-0.05	-0.37 - 0.27	.75
	Sarcoidosis/ Besnier Boeck	0.35	-0.13 - 0.83	.14
	Rheumatoid Arthritis/ SLE/ scleroderma	0.10	-0.02 - 0.23	.11
	Vasculitis	0.22	-0.66 - 1.09	.62
	Other immunodeficiency	0.13	0.02 - 0.23	.01
	Hypo-/hyperthyroidism	0.03	-0.08 - 0.14	.56
	Hypo-/hyperparathyroidism	-0.09	-0.46 - 0.28	.61
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)		0.60	-0.04 - 1.24	.06
	Other endocrine disease	0.06	-0.17 - 0.28	.63
	HIV/AIDS	0.41	-0.42 - 1.25	.33
	Tuberculosis	-0.03	-0.42 - 0.37	.90
	Malaria	-0.45	-1.45 - 0.55	.37
	Other infectious disease	-0.04	-0.35 - 0.28	.82
	Current untreated malignancy	0.22	0.09 - 0.34	<.001
	Curative malignancy treated <5 years ago	0.04	-0.06 - 0.14	.42
	Curative malignancy treated >5 years ago	0.11	0.03 - 0.20	.008
	Palliative treated and / or distant metastasis	0.02	-0.22 - 0.25	.90
	Other types of cancer	0.02	-0.35 - 0.38	.94
Surgical history	History of esophageal, gastric, pancreatic or spleen surgery	0.14	-0.01 - 0.30	.07
	History of hepatobiliary surgery	0.10	0.01 - 0.18	.03
	History of bowel surgery	0.11	0.05 - 0.18	<.001
	History of bladder-, prostate-, uterine or ovarian surgery	0.01	-0.06 - 0.08	.72
	Other abdominal surgery in the history	-0.04	-0.13 - 0.05	.43
Stoma before surgical resection	No stoma	Ref.		
	Ileostomy	0.38	-0.01 - 0.78	.05
	Colostomy	-0.13	-0.38 - 0.12	.31
	Type unknown	0.55	-0.42 - 1.52	.26
Number of tumors found by endoscopy	1	Ref.		
	2	-0.27	-0.99 - 0.44	.45
	3+	-0.22	-0.97 - 0.54	.57
Preoperative MDT		-0.08	-0.15 - -0.00	.04
Preoperative surgical procedure	Stoma	-0.13	-0.26 - -0.00	.04
	Stent	0.16	-0.27 - 0.59	.45
	Metastasectomy	-0.38	-0.62 - -0.13	.002
	Appendectomy	-0.19	-0.68 - 0.30	.44
	Other	0.28	0.06 - 0.50	.01
Neoadjuvant radiotherapy	No neoadjuvant radiotherapy	Ref.		
	Short course	0.27	0.16 - 0.38	<.001
	Long course without chemotherapy	0.16	-0.01 - 0.32	.06
	Chemoradiation	0.09	-0.04 - 0.22	.17
Neoadjuvant chemotherapy		0.15	0.06 - 0.25	.002
ASA score	I	Ref.		
	II	0.14	0.07 - 0.20	<.001
	III	0.50	0.42 - 0.59	<.001
	IV	0.98	0.82 - 1.14	<.001
	V	1.14	0.29 - 1.98	.008
Setting	Elective	Ref.		
	Elective after placing a stent	-0.10	-0.42 - 0.22	.54
	Urgent	0.24	0.14 - 0.35	<.001
	Emergency, direct procedure	0.38	0.26 - 0.50	<.001
Tumor complications	Fecal peritonitis due to preoperative colorectal perforation	0.70	0.53 - 0.87	<.001
	Preoperative presence of an abscess	0.39	0.20 - 0.59	<.001

eTable 6 continued: Multivariate logistic regression analyses for complicated course after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Preoperative bowel obstruction/ ileus due to malignancy	0.10	0.00 - 0.19	.05
	Preoperative blood loss/ anemia	0.10	0.04 - 0.16	<.001
	Other preoperative tumor related complications	0.19	0.09 - 0.29	<.001
Approach	Open	Ref.		
	Laparoscopic	-0.37	-0.42 - -0.32	<.001
	Transanal endoscopic microsurgery (TEM)	-0.75	-1.30 - -0.20	.007
	Transanal local excision (open)	-0.24	-0.96 - 0.48	.51
	Transanal minimally invasive surgery (TAMIS)	-0.71	-1.47 - 0.04	.06
	Transanal total mesorectal excision (TaTME)	-0.11	-0.44 - 0.23	.54
Metastasis	Liver metastasis	-0.04	-0.18 - 0.10	.59
	Pulmonary metastasis	-0.28	-0.52 - -0.03	.03
	Bone metastasis	0.55	-0.19 - 1.30	.14
	Peritoneal metastasis	0.19	-0.06 - 0.43	.13
	Ovarian metastasis	0.54	-0.04 - 1.122	.06
	Brain metastasis	-0.04	-1.65 - 1.57	.96
	Other metastasis	0.17	-0.10 - 0.44	.20
Age	60-70	Ref.		
	<60	-0.05	-0.11 - 0.02	.19
	≥80	0.32	0.25 - 0.39	<.001
	70-80	0.12	0.06 - 0.17	<.001
BMI	18.5-25.0	Ref.		
	<18.5	0.13	-0.01 - 0.27	.07
	≥30.0	0.17	0.11 - 0.23	<.001
	25.0-30.0	0.03	-0.02 - 0.08	.28
Tumor location	Colon	Ref.		
	Rectum	0.50	0.38 - 0.61	<.001
	Multiple tumors	0.28	-0.48 - 1.05	.46
Tumor found by screening		-0.15	-0.24 - -0.06	<.001
Procedure	(low) Anterior/sigmoid resection	Ref.		
	Ileocecal resection	-0.05	-0.28 - 0.19	.70
	(extended) Right hemicolectomy	0.09	0.03 - 0.15	.005
	Local excision followed by a total mesorectal excision	0.26	-0.35 - 0.87	.39
	Same procedure for multiple tumors	0.35	0.01 - 0.70	.04
Two different procedures of which at least 1 procedure for rectal cancer		0.72	0.29 - 1.16	.001
	Two different colon procedures	0.64	0.29 - 0.99	<.001
	Transversectomy	0.15	-0.02 - 0.31	.07
	(extended) Left hemicolectomy	0.31	0.22 - 0.39	<.001
	Subtotal colectomy	1.10	0.93 - 1.26	<.001
	Abdominoperineal resection	-0.12	-0.21 - -0.04	.005
	Panproctocolectomy	0.74	0.35 - 1.13	<.001
	Other	0.00	-0.26 - 0.25	.97
	Local excision	-1.46	-2.09 - -0.83	<.001
	Local excision followed by an abdominoperineal resection	-0.06	-0.50 - 0.38	.79
M-stage	M0	Ref.		
	M1	0.08	-0.01 - 0.17	.06
T-stage	T1	Ref.		
	T2	0.10	0.00 - 0.19	.05
	T3	0.16	0.07 - 0.250	<.001
	T4	0.35	0.25 - 0.46	<.001
	T0	0.36	-0.09 - 0.81	.11

eTable 6: Logistic regression coefficients for complicated course on 62,501 patient records. The *P*-values are given as calculated by the Wald test. When no reference level is reported, variables are binary and the reference level is absence of that variable.

eTable 7. Multivariate Logistic Regression Analyses for ICU Admission After Colorectal Cancer Surgery

Characteristics		β	95% CI	*P* value
(Intercept)		-2.05	-2.19 - -1.91	<.001
Sex	Male	Ref.		
	Female	-0.25	-0.30 - -0.21	<.001
Comorbidities	Angina Pectoris	0.12	0.02 - 0.22	.02
	Myocardial infarction	0.16	0.07 - 0.24	<.001
	Percutaneous transluminal coronary angioplasty (PTCA)	0.08	-0.03 - 0.19	.13
	Coronary artery bypass grafting (CABG)	0.04	-0.07 - 0.14	.49
	Valvular heart disease	0.18	0.07 - 0.28	<.001
	Cardiac valve replacement	0.26	0.08 - 0.43	.005
	Atrial fibrillation/ atrial flutter	0.26	0.19 - 0.33	<.001
	Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	0.16	0.05 - 0.26	.003
	Congestive heart failure	0.32	0.20 - 0.45	<.001
	Cardiomyopathy	0.50	0.31 - 0.70	<.001
	Medical history of heart transplantation	0.44	-1.08 - 1.96	.56
	Other heart disease	0.21	0.09 - 0.33	<.001
	Hypertension	0.03	-0.02 - 0.08	.17
	Peripheral vascular disease	0.09	-0.03 - 0.20	.13
	Carotid artery stenosis	0.06	-0.20 - 0.33	.63
	Aortic aneurysm (abdominal/thoracic)	0.19	0.06 - 0.33	.005
	Other vascular disease	-0.06	-0.21 - 0.08	.39
	Non-insulin-dependent diabetes mellitus	0.10	0.03 - 0.16	.004
	Insulin-dependent diabetes mellitus	0.11	0.00 - 0.22	.05
	Diabetes mellitus with end-organ damage	0.15	-0.14 - 0.43	.30
	Other diabetes mellitus related comorbidity	-0.20	-0.61 - 0.20	.31
	COPD/asthma	0.27	0.21 - 0.33	<.001
	Pulmonary fibrosis	0.49	0.00 - 0.99	.05
	History of lung surgery/transplantation	0.70	0.40 - 1.00	<.001
	Other pulmonary disease	0.28	0.16 - 0.40	<.001
	Transient ischemic attack	0.02	-0.08 - 0.12	.68
	Cerebrovascular attack	0.06	-0.04 - 0.16	.23
	Myopathy	0.19	-0.22 - 0.60	.36
	Hemiplegia/ paraplegia	0.65	0.24 - 1.06	.002
	Parkinson's disease/ dementia	0.02	-0.15 - 0.19	.85
	Schizophrenia/ major depressive disorder/ psychosis	0.06	-0.11 - 0.23	.48
	Other neurological disease	-0.10	-0.22 - 0.01	.06
	Gastroesophageal reflux disorder / peptic ulcer disease	0.05	-0.07 - 0.16	.44
	Symptomatic cholelithiasis	0.10	-0.08 - 0.29	.27
	Pancreatitis (acute/chronic)	0.23	-0.11 - 0.58	.18
	Inflammatory bowel disease (M. Crohn/ Ulcerative Colitis)	-0.06	-0.29 - 0.17	.59
	Diverticulitis	0.01	-0.17 - 0.20	.90
	Liver disease/ failure (cirrhosis/hepatitis)	0.46	0.24 - 0.69	<.001
	Other gastrointestinal disease	-0.15	-0.29 - -0.01	.04
	Chronic kidney disease (creatinine <110)	0.20	0.08 - 0.32	.001
	Dialysis-dependent kidney failure	0.82	0.28 - 1.37	.003
	Medical history of renal surgery/ transplantation	0.28	0.03 - 0.54	.03
	Pregnant at the time of surgery	0.29	-1.96 - 2.55	.80
	Other urogenital disease	-0.19	-0.29 - -0.09	<.001
	Deep venous thrombosis	0.06	-0.10 - 0.22	.44
	Pulmonary embolism	0.10	-0.08 - 0.27	.27
	Blood clotting disorder	0.08	-0.38 - 0.54	.74
	Other hematologic disease	0.06	-0.25 - 0.37	.70
	Sarcoidosis/ Besnier Boeck	0.49	0.01 - 0.97	.05

eTable 7 continued: Multivariate logistic regression analyses for ICU admission after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Rheumatoid Arthritis/ SLE/ scleroderma	-0.12	-0.25 - 0.01	.06
	Vasculitis	0.38	-0.49 - 1.24	.39
	Other immunodeficiency	-0.05	-0.16 - 0.06	.36
	Hypo-/hyperthyroidism	-0.01	-0.12 - 0.10	.85
	Hypo-/hyperparathyroidism	0.04	-0.32 - 0.40	.83
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)		0.54	-0.14 - 1.22	.11
	Other endocrine disease	-0.16	-0.40 - 0.08	.18
	HIV/AIDS	-0.98	-2.21 - 0.26	.12
	Tuberculosis	0.27	-0.10 - 0.64	.14
	Malaria	0.53	-0.28 - 1.34	.20
	Other infectious disease	-0.04	-0.36 - 0.27	.79
	Current untreated malignancy	0.17	0.05 - 0.30	.006
	Curative malignancy treated <5 years ago	0.01	-0.09 - 0.10	.90
	Curative malignancy treated >5 years ago	0.09	0.01 - 0.18	.03
	Palliative treated and / or distant metastasis	0.03	-0.21 - 0.26	.84
	Other types of cancer	-0.10	-0.47 - 0.28	.62
Surgical history	History of esophageal, gastric, pancreatic or spleen surgery	0.10	-0.06 - 0.26	.20
	History of hepatobiliary surgery	0.02	-0.07 - 0.11	.69
	History of bowel surgery	0.08	0.02 - 0.15	.01
	History of bladder-, prostate-, uterine or ovarian surgery	0.06	-0.01 - 0.13	.11
	Other abdominal surgery in the history	-0.04	-0.13 - 0.05	.43
Stoma before surgical resection	No stoma	Ref.		
	Ileostomy	0.35	-0.05 - 0.74	.08
	Colostomy	0.25	0.02 - 0.48	.03
	Type unknown	-0.56	-1.75 - 0.63	.35
Number of tumors found by endoscopy	1	Ref.		
	2	-0.04	-0.70 - 0.62	.90
	3+	0.17	-0.54 - 0.88	.63
Preoperative MDT		-0.12	-0.19 - -0.05	.001
Preoperative surgical procedure	Stoma	0.28	0.16 - 0.40	<.001
	Stent	-0.32	-0.75 - 0.10	.13
	Metastasectomy	0.23	0.01 - 0.45	.04
	Appendectomy	0.40	-0.04 - 0.83	.07
	Other	0.36	0.14 - 0.57	.001
Neoadjuvant radiotherapy	No neoadjuvant radiotherapy	Ref.		
	Short course	0.17	0.05 - 0.29	.005
	Long course without chemotherapy	0.21	0.04 - 0.38	.02
	Chemoradiation	0.42	0.29 - 0.55	<.001
Neoadjuvant chemotherapy		0.07	-0.02 - 0.17	<.001
ASA score	I	Ref.		
	II	0.19	0.12 - 0.26	<.001
	III	0.79	0.71 - 0.88	<.001
	IV	1.50	1.34 - 1.66	<.001
	V	1.80	0.83 - 2.76	<.001
Setting	Elective	Ref.		
	Elective after placing a stent	0.56	0.29 - 0.84	<.001
	Urgent	0.23	0.12 - 0.33	<.001
	Emergency, direct procedure	0.47	0.36 - 0.59	<.001
Tumor complications	No tumor complications	Ref.		
	Fecal peritonitis due to preoperative colorectal perforation	1.05	0.88 - 1.22	<.001
	Preoperative presence of an abscess	0.55	0.36 - 0.74	<.001
	Preoperative bowel obstruction/ ileus due to malignancy	0.19	0.10 - 0.28	<.001

eTable 7 continued: Multivariate logistic regression analyses for ICU admission after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Preoperative blood loss/ anemia	0.27	0.21 - 0.33	<.001
	Other preoperative tumor related complications	0.11	0.00 - 0.21	.05
Approach	Open	Ref.		
	Laparoscopic	-0.58	-0.63 - -0.53	<.001
	Transanal endoscopic microsurgery (TEM)	-0.39	-0.95 - 0.18	.17
	Transanal local excision (open)	0.02	-0.71 - 0.75	.95
	Transanal minimally invasive surgery (TAMIS)	-2.15	-3.61 - -0.69	.004
	Transanal total mesorectal excision (TaTME)	-1.29	-1.79 - -0.79	<.001
Metastasis	Liver metastasis	-0.03	-0.17 - 0.11	.65
	Pulmonary metastasis	-0.47	-0.72 - -0.22	<.001
	Bone metastasis	0.10	-0.69 - 0.90	.79
	Peritoneal metastasis	0.65	0.420 - 0.88	<.001
	Ovarian metastasis	1.54	1.00 - 2.09	<.001
	Brain metastasis	0.76	-0.61 - 2.14	.27
	Other metastasis	0.06	-0.21 - 0.33	.67
Age	60-70	Ref.		
	<60	-0.09	-0.17 - -0.02	.009
	≥80	0.44	0.37 - 0.51	<.001
	70-80	0.17	0.12 - 0.23	<.001
BMI	18.5-25.0	Ref.		
	<18.5	0.14	-0.01 - 0.28	.06
	≥30.0	0.24	0.178 - 0.30	<.001
	25.0-30.0	0.09	0.04 - 0.14	<.001
Tumor location	Colon	Ref.		
	Rectum	0.08	-0.04 - 0.20	.18
	Multiple tumors	-0.13	-0.85 - 0.58	.71
Tumor found by screening		-0.09	-0.18 - 0.01	.07
Procedure	(low) Anterior/ sigmoid resection	Ref.		
	Ileocecal resection	-0.47	-0.72 - -0.22	<.001
	(extended) Right hemicolectomy	-0.16	-0.22 - -0.10	<.001
	Local excision followed by a total mesorectal excision	0.22	-0.46 - 0.89	.53
	Same procedure for multiple tumors	0.16	-0.20 - 0.52	.38
	Two different procedures of which at least 1 procedure for rectal cancer	0.54	0.08 - 1.00	.02
	Two different colon procedures	0.34	-0.04 - 0.71	.07
	Transversectomy	-0.07	-0.23 - 0.10	.43
	(extended) Left hemicolectomy	0.15	0.07 - 0.24	<.001
	Subtotal colectomy	0.71	0.53 - 0.88	<.001
	Abdominoperineal resection	0.32	0.24 - 0.41	<.001
	Panproctocolectomy	-0.49	-1.01 - 0.04	.07
	Other	-0.27	-0.53 – 0.00	.05
	Local excision	-14.04	-115.48 - 87.40	.78
	Local excision followed by an abdominoperineal resection	0.14	-0.32 - 0.60	.54
M-stage	M0	Ref.		
	M1	0.15	0.07 - 0.24	<.001
T-stage	T1	Ref.		
	T2	0.05	-0.05 - 0.15	.30
	T3	0.02	-0.07 - 0.12	.60
	T4	0.30	0.19 - 0.40	<.001
	T0	0.30	-0.15 - 0.74	.19

eTable 7: Logistic regression coefficients for ICU admission on 62,501 patient records. The *P*-values are given as calculated by the Wald test. When no reference level is reported, variables are binary and the reference level is absence of that variable.

eTable 8. Multivariate Logistic Regression Analyses for Readmission After Colorectal Cancer Surgery

Characteristics		β	95% CI	*P-value*
(Intercept)		-3.77	-4.03 - -3.52	<.001
Sex	Male	Ref.		
	Female	-0.10	-0.17 - -0.03	.007
Comorbidities	Angina Pectoris	0.06	-0.09 - 0.21	.44
	Myocardial infarction	0.01	-0.12 - 0.15	.84
	Percutaneous transluminal coronary angioplasty (PTCA)	0.12	-0.04 - 0.27	.15
	Coronary artery bypass grafting (CABG)	0.07	-0.09 - 0.23	.38
	Valvular heart disease	0.05	-0.11 - 0.22	.52
	Cardiac valve replacement	0.28	0.02 - 0.55	.04
	Atrial fibrillation/ atrial flutter	0.14	0.03 - 0.25	.02
	Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	-0.05	-0.21 - 0.12	.56
	Congestive heart failure	-0.21	-0.44 - 0.03	.08
	Cardiomyopathy	0.09	-0.23 - 0.40	.60
	Medical history of heart transplantation	-11.08	-346.08 - 323.92	.95
	Other heart disease	0.12	-0.06 - 0.30	.18
	Hypertension	0.04	-0.03 - 0.11	.29
	Peripheral vascular disease	-0.06	-0.24 - 0.13	.55
	Carotid artery stenosis	0.29	-0.08 - 0.67	.12
	Aortic aneurysm (abdominal/thoracic)	0.26	0.06 - 0.46	.009
	Other vascular disease	0.08	-0.13 - 0.29	.44
	Non-insulin-dependent diabetes mellitus	0.07	-0.03 - 0.17	.17
	Insulin-dependent diabetes mellitus	0.06	-0.10 - 0.22	.47
	Diabetes mellitus with end-organ damage	-0.10	-0.56 - 0.36	.66
	Other diabetes mellitus related comorbidity	0.19	-0.34 - 0.72	.48
	COPD/asthma	0.00	-0.10 - 0.10	1.00
	Pulmonary fibrosis	0.05	-0.79 - 0.90	.90
	History of lung surgery/transplantation	-0.02	-0.52 - 0.48	.93
	Other pulmonary disease	-0.02	-0.22 - 0.18	.84
	Transient ischemic attack	0.04	-0.12 - 0.19	.63
	Cerebrovascular attack	0.20	0.06 - 0.35	.006
	Myopathy	-0.20	-0.89 - 0.49	.56
	Hemiplegia/ paraplegia	-0.11	-0.81 - 0.60	.77
	Parkinson’s disease/ dementia	-0.02	-0.29 - 0.26	.91
	Schizophrenia/ major depressive disorder/ psychosis	0.21	-0.03 - 0.44	.08
	Other neurological disease	-0.09	-0.25 - 0.08	.29
	Gastroesophageal reflux disorder / peptic ulcer disease	0.07	-0.11 - 0.24	.44
	Symptomatic cholelithiasis	0.23	-0.02 - 0.49	.07
	Pancreatitis (acute/chronic)	0.27	-0.21 - 0.75	.26
	Inflammatory bowel disease (M. Crohn/ Ulcerative Colitis)	0.30	0.01 - 0.59	.04
	Diverticulitis	-0.04	-0.33 - 0.25	.76
	Liver disease/ failure (cirrhosis/hepatitis)	0.25	-0.07 - 0.58	.13
	Other gastrointestinal disease	0.10	-0.10 - 0.29	.32
	Chronic kidney disease (creatinine <110)	0.18	-0.01 - 0.36	.06
	Dialysis-dependent kidney failure	0.63	-0.08 - 1.33	.08
	Medical history of renal surgery/ transplantation	0.11	-0.27 - 0.483	.58
	Pregnant at the time of surgery	-10.91	-479.61 - 457.78	.96
	Other urogenital disease	0.02	-0.13 - 0.17	.77
	Deep venous thrombosis	0.06	-0.16 - 0.29	.58
	Pulmonary embolism	0.32	0.09 - 0.56	.007
	Blood clotting disorder	-0.80	-1.81 - 0.22	.12

eTable 8 continued : Multivariate logistic regression analyses for readmission after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Other hematologic disease	-0.38	-0.91 - 0.16	.16
	Sarcoidosis/ Besnier Boeck	0.15	-0.56 - 0.85	.68
	Rheumatoid Arthritis/ SLE/ scleroderma	0.05	-0.14 - 0.23	.62
	Vasculitis	-0.03	-1.51 - 1.44	.97
	Other immunodeficiency	0.03	-0.12 - 0.19	.67
	Hypo-/hyperthyroidism	0.06	-0.10 - 0.22	.45
	Hypo-/hyperparathyroidism	0.46	0.02 - 0.91	.04
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)		-0.08	-1.12 - 0.97	.89
	Other endocrine disease	0.26	-0.04 - 0.56	.09
	HIV/AIDS	-0.34	-1.81 - 1.13	.65
	Tuberculosis	0.27	-0.26 - 0.80	.32
	Malaria	-0.01	-1.48 - 1.46	.99
	Other infectious disease	-0.36	-0.89 - 0.18	.18
	Current untreated malignancy	0.13	-0.06 - 0.32	.17
	Curative malignancy treated <5 years ago	0.01	-0.14 - 0.15	.93
	Curative malignancy treated >5 years ago	0.12	-0.01 - 0.24	.06
	Palliative treated and / or distant metastasis	-0.43	-0.87 - 0.01	.05
	Other types of cancer	0.20	-0.34 - 0.73	.46
Surgical history	History of esophageal, gastric, pancreatic or spleen surgery	0.06	-0.18 - 0.30	.62
	History of hepatobiliary surgery	0.01	-0.13 - 0.14	.94
	History of bowel surgery	0.17	0.08 - 0.26	<.001
	History of bladder-, prostate-, uterine or ovarian surgery	0.07	-0.04 - 0.17	.21
	Other abdominal surgery in the history	-0.06	-0.20 - 0.07	.35
Stoma before surgical resection	No stoma	Ref.		
	Ileostomy	0.40	-0.11 - 0.91	.12
	Colostomy	0.37	0.06 - 0.68	.02
	Type unknown	0.91	-0.35 - 2.18	.15
Number of tumors found by endoscopy	1	Ref.		
	2	-1.70	-3.73 - 0.34	.10
	3+	-1.48	-3.54 - 0.58	.16
Preoperative MDT		0.24	0.11 - 0.36	<.001
Preoperative surgical procedure	Stoma	-0.02	-0.20 - 0.16	.83
	Stent	-0.01	-0.72 - 0.70	.98
	Metastasectomy	-0.11	-0.41 - 0.20	.49
	Appendectomy	-0.19	-0.89 - 0.50	.58
	Other	-0.05	-0.39 - 0.28	.75
Neoadjuvant radiotherapy	No Neoadjuvant radiotherapy	Ref.		
	Short course	0.11	-0.04 - 0.25	.13
	Long course without chemotherapy	-0.03	-0.26 - 0.20	.81
	Chemoradiation	0.31	0.15 - 0.48	<.001
Neoadjuvant chemotherapy		0.02	-0.11 - 0.14	.13
ASA score	I	Ref.		
	II	0.19	0.09 - 0.28	<.001
	III	0.40	0.28 - 0.52	<.001
	IV	0.01	-0.29 - 0.31	.94
	V	-10.67	-214.24 - 192.90	.92
Setting	Elective	Ref.		
	Elective after placing a stent	-0.04	-0.50 - 0.42	.85
	Urgent	0.18	0.01 - 0.36	.04
	Emergency, direct procedure	0.19	-0.02 - 0.39	.08

eTable 8 continued : Multivariate logistic regression analyses for readmission after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
Tumor complications	Fecal peritonitis due to preoperative colorectal perforation	0.00	-0.31 - 0.31	.99
	Preoperative presence of an abscess	-0.13	-0.48 - 0.22	.46
	Preoperative bowel obstruction/ ileus due to malignancy	0.09	-0.06 - 0.24	.22
	Preoperative blood loss/ anemia	0.12	0.04 - 0.21	.003
	Other preoperative tumor related complications	0.16	0.02 - 0.31	.03
Approach	Open	Ref.		
	Laparoscopic	0.13	0.05 - 0.20	.001
	Transanal endoscopic microsurgery (TEM)	0.40	-0.24 - 1.05	.21
	Transanal local excision (open)	0.34	-0.56 - 1.24	.45
	Transanal minimally invasive surgery (TAMIS)	-0.69	-1.80 - 0.41	.21
	Transanal total mesorectal excision (TaTME)	0.52	0.10 - 0.93	.01
Surgical conversion	No conversion	Ref.		
	Early	0.23	-0.56 - 1.03	.56
	Late	0.22	-0.59 - 1.02	.59
Reason for surgical conversion	No conversion	Ref.		
	Complexity	0.08	-0.74 - 0.90	.85
	Accessibility	0.01	-0.78 - 0.81	.97
	Preoperative tumor complication	0.05	-0.84 - 0.94	.91
Intraoperative complications	Blood loss for which blood transfusion was required	-0.21	-0.62 - 0.20	.32
	Damage of the spleen for which a splenectomy was required	0.41	-0.35 - 1.16	.29
	Damage to the pancreas, liver, d. choledochus, gallbladder	0.96	0.12 - 1.80	.02
	Damage to the intestine	0.52	0.25 - 0.80	<.001
	Damage to the ureter/urethra	0.36	-0.07 - 0.79	.10
	Damage to the urine bladder	0.27	-0.38 - 0.92	.41
	Damage to the vagina	0.41	-0.55 - 1.38	.40
	Perforation intra-abdominal during a transanal local excision	1.84	0.82 - 2.86	<.001
Primary anastomosis		-0.08	-0.24 - 0.08	.31
Stoma	No stoma	Ref.		
	Loop ileostomy	0.55	0.44 - 0.66	<.001
	End ileostomy	0.49	0.26 - 0.73	<.001
	Loop colostomy	-0.03	-0.27 - 0.22	.83
	End colostomy	0.05	-0.13 - 0.22	.59
	Stoma of unknown type	-1.96	-3.97 - 0.06	.05
Radio- or chemo therapy during surgery	No	Ref.		
	IORTC	0.09	-0.45 - 0.63	.74
	HIPEC	0.97	0.41 - 1.53	<.001
Additional resection for local ingrowth	No	Ref.		
	Extensive	0.14	-0.03 - 0.31	.11
	Limited	0.02	-0.13 - 0.17	.78
Specification additional resection	Resection of the omentum	-0.19	-0.58 - 0.21	.35
	Resection of the liver. or RFA	0.23	-0.04 - 0.49	.09
	Resection of the lung	-0.26	-1.75 - 1.23	.73
	Resection of peritoneal metastases	0.13	-0.33 - 0.58	.58
	Lymph node dissection	-0.06	-0.50 - 0.39	.80
	Resection of other abdominal organs	-0.22	-0.62 - 0.19	.29
	Other abdominal resection	0.11	-0.05 - 0.27	.17
Metastasis	Liver metastasis	0.16	-0.05 - 0.37	.12

eTable 8 continued : Multivariate logistic regression analyses for readmission after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Pulmonary metastasis	-0.21	-0.58 - 0.16	.25
	Bone metastasis	0.53	-0.55 - 1.62	.33
	Peritoneal metastasis	0.02	-0.37 - 0.42	.91
	Ovarian metastasis	0.90	0.16 - 1.63	.02
	Brain metastasis	-11.6	-339.35 - 316.19	.94
	Other metastasis	-0.03	-0.45 - 0.38	.88
Age	60-70	Ref.		
	<60	0.11	0.02 - 0.20	.02
	≥80	-0.26	-0.37 - -0.15	<.001
	70-80	-0.02	-0.10 - 0.06	.56
BMI	18.5-25.0	Ref.		
	<18.5	-0.21	-0.45 - 0.02	.07
	≥30.0	0.05	-0.04 - 0.14	.24
	25.0-30.0	0.04	-0.03 - 0.11	.24
Tumor location	Colon	Ref.		
	Rectum	0.52	0.37 - 0.67	<.001
	Multiple tumors	2.00	-0.08 - 4.08	.06
Tumor found by screening		0.01	-0.11 - 0.13	.85
Procedure	(low) Anterior/ sigmoid resection	Ref.		
	Ileocecal resection	0.37	0.01 - 0.73	.04
	(extended) Right hemicolectomy	0.24	0.14 - 0.34	<.001
	Local excision followed by a total mesorectal excision	-0.08	-0.98 - 0.82	.86
	Same procedure for multiple tumors	0.06	-0.47 - 0.59	.82
	Two different procedures of which at least 1 procedure for rectal cancer	0.23	-0.43 - 0.89	.48
	Two different colon procedures	0.18	-0.37 - 0.72	.53
	Transversectommy	0.23	-0.04 - 0.50	.10
	(extended) Left hemicolectomy	0.40	0.27 - 0.54	<.001
	Subtotal colectomy	0.31	0.02 - 0.59	.03
	Abdominoperineal resection	0.04	-0.10 - 0.18	.58
	Panproctocolectomy	-0.13	-0.77 - 0.50	.68
	Other	-0.13	-0.55 - 0.30	.56
	Local excision	-0.27	-0.94 - 0.41	.43
	Local excision followed by an abdominal perineal resection	-1.00	-1.82 - -0.18	.02
M-stage	M0	Ref.		
	M1	0.03	-0.11 - 0.18	.64
T-stage	T1	Ref.		
	T2	0.12	-0.02 - 0.26	.09
	T3	0.11	-0.02 - 0.24	.10
	T4	0.16	0.00 - 0.32	.05
	T0	0.41	-0.21 - 1.03	.19

eTable 8: Logistic regression coefficients for readmission on 62,501 patient records. The *P*-values are given as calculated by the Wald test. When no reference level is reported, variables are binary and the reference level is absence of that variable.

eTable 9. Multivariate Logistic Regression Analyses for Prolonged Stay in Hospital After Colorectal Cancer Surgery

Characteristics		β	95% CI	*P* value
(Intercept)		-3.16	-3.41 - -2.92	<.001
Sex	Male	Ref.		
	Female	-0.27	-0.34 - -0.20	<.001
Comorbidities	Angina Pectoris	-0.07	-0.21 - 0.08	.36
	Myocardial infarction	0.03	-0.09 - 0.16	.60
	Percutaneous transluminal coronary angioplasty (PTCA)	0.01	-0.15 - 0.16	.91
	Coronary artery bypass grafting (CABG)	-0.17	-0.33 - -0.01	.04
	Valvular heart disease	-0.04	-0.19 - 0.12	.62
	Cardiac valve replacement	0.11	-0.15 - 0.37	.41
	Atrial fibrillation/ atrial flutter	0.02	-0.09 - 0.13	.71
	Cardiac arrhythmia (exclusive atrial fibrillation and flutter)	0.01	-0.14 - 0.16	.93
	Congestive heart failure	0.24	0.07 - 0.41	.006
	Cardiomyopathy	0.06	-0.22 - 0.35	.66
	Medical history of heart transplantation	1.01	-0.67 - 2.69	.23
	Other heart disease	-0.03	-0.21 - 0.14	.70
	Hypertension	-0.06	-0.13 - 0.01	.07
	Peripheral vascular disease	0.13	-0.03 - 0.29	.12
	Carotid artery stenosis	-0.04	-0.42 - 0.34	.83
	Aortic aneurysm (abdominal/thoracic)	0.12	-0.07 - 0.30	.22
	Other vascular disease	0.05	-0.15 - 0.25	.61
	Non-insulin-dependent diabetes mellitus	0.03	-0.06 - 0.12	.52
	Insulin-dependent diabetes mellitus	0.09	-0.06 - 0.25	.22
	Diabetes mellitus with end-organ damage	-0.27	-0.71 - 0.17	.23
	Other diabetes mellitus related comorbidity	0.04	-0.50 - 0.57	.89
	COPD/asthma	0.21	0.12 - 0.30	<.001
	Pulmonary fibrosis	0.71	0.11 - 1.30	.02
	History of lung surgery/transplantation	-0.09	-0.56 - 0.37	.69
	Other pulmonary disease	-0.13	-0.31 - 0.06	.18
	Transient ischemic attack	0.00	-0.14 - 0.15	.98
	Cerebrovascular attack	0.06	-0.08 - 0.19	.43
	Myopathy	0.42	-0.11 - 0.95	.11
	Hemiplegia/ paraplegia	0.39	-0.15 - 0.94	.15
	Parkinson’s disease/ dementia	0.15	-0.07 - 0.37	.19
	Schizophrenia/ major depressive disorder/ psychosis	0.04	-0.20 - 0.28	.74
	Other neurological disease	0.16	0.01 - 0.30	.03
	Gastroesophageal reflux disorder / peptic ulcer disease	0.03	-0.14 - 0.19	.75
	Symptomatic cholelithiasis	0.05	-0.20 - 0.30	.71
	Pancreatitis (acute/chronic)	0.43	-0.00 - 0.87	.05
	Inflammatory bowel disease (M. Crohn/ Ulcerative Colitis)	-0.17	-0.50 - 0.16	.31
	Diverticulitis	-0.06	-0.32 - 0.19	.63
	Liver disease/ failure (cirrhosis/hepatitis)	0.19	-0.13 - 0.50	.25
	Other gastrointestinal disease	0.15	-0.04 - 0.33	.11
	Chronic kidney disease (creatinine <110)	0.08	-0.09 - 0.25	.33
	Dialysis-dependent kidney failure	0.55	-0.11 - 1.20	.10
	Medical history of renal surgery/ transplantation	-0.08	-0.47 - 0.30	.67
	Pregnant at the time of surgery	-9.06	-179.73 - 161.62	.92
	Other urogenital disease	0.02	-0.12 - 0.15	.82
	Deep venous thrombosis	0.17	-0.04 - 0.38	.10
	Pulmonary embolism	0.03	-0.21 - 0.27	.79
	Blood clotting disorder	-0.53	-1.33 - 0.27	.19
	Other hematologic disease	0.16	-0.25 - 0.58	.43
	Sarcoidosis/ Besnier Boeck	0.03	-0.71 - 0.78	.93

eTable 9 continued: Multivariate logistic regression analyses for prolonged stay in hospital after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Rheumatoid Arthritis/ SLE/ scleroderma	0.08	-0.09 - 0.25	.35
	Vasculitis	0.02	-1.23 - 1.27	.98
	Other immunodeficiency	0.21	0.07 - 0.34	.003
	Hypo-/hyperthyroidism	-0.02	-0.17 - 0.14	.82
	Hypo-/hyperparathyroidism	-0.07	-0.59 - 0.45	.79
Adrenal disease (Addison Disease/ Cushing Syndrome/ Conn syndrome)		0.32	-0.64 - 1.27	.51
	Other endocrine disease	0.07	-0.24 - 0.38	.65
	HIV/AIDS	0.45	-0.67 - 1.56	.43
	Tuberculosis	0.15	-0.37 - 0.68	.56
	Malaria	-0.54	-2.02 - 0.93	.47
	Other infectious disease	0.45	0.08 - 0.82	.02
	Current untreated malignancy	0.15	-0.03 - 0.32	.09
	Curative malignancy treated <5 years ago	0.07	-0.07 - 0.20	.31
	Curative malignancy treated >5 years ago	0.09	-0.02 - 0.21	.11
	Palliative treated and / or distant metastasis	-0.02	-0.35 - 0.31	.92
	Other types of cancer	-0.44	-1.02 - 0.14	.13
Surgical history	History of esophageal, gastric, pancreatic or spleen surgery	0.13	-0.09 - 0.34	.24
	History of hepatobiliary surgery	0.16	0.03 - 0.28	.01
	History of bowel surgery	0.05	-0.04 - 0.14	.29
	History of bladder-, prostate-, uterine or ovarian surgery	0.03	-0.08 - 0.12	.62
	Other abdominal surgery in the history	-0.05	-0.18 - 0.08	.42
Stoma before surgical resection	No stoma	Ref.		
	Ileostomy	0.40	-0.12 - 0.91	.13
	Colostomy	-0.23	-0.59 - 0.12	.19
	Type unknown	0.65	-0.49 - 1.80	.26
Number of tumors found by endoscopy	1	Ref.		
	2	0.67	-0.06 - 1.41	.07
	3+	0.53	-0.29 - 1.34	.20
Preoperative MDT		-0.16	-0.26 - -0.06	.002
Preoperative surgical procedure	Stoma	0.02	-0.16 - 0.20	.83
	Stent	0.67	0.13 - 1.21	.01
	Metastasectomy	-0.26	-0.60 - 0.08	.13
	Appendectomy	-0.45	-1.23 - 0.33	.25
	Other	0.18	-0.14 - 0.48	.25
Neoadjuvant radiotherapy	No neoadjuvant radiotherapy	Ref.		
	Short course	0.27	0.12 - 0.42	<.001
	Long course without chemotherapy	0.12	-0.11 - 0.35	.31
	Chemoradiation	-0.08	-0.25 - 0.10	.37
Neoadjuvant chemotherapy		0.17	0.04 - 0.31	.01
ASA score	I	Ref.		
	II	0.23	0.13 - 0.33	<.001
	III	0.60	0.48 - 0.72	<.001
	IV	0.79	0.57 - 1.00	<.001
	V	-0.43	-1.73 - 0.86	.51
Setting	Elective	Ref.		
	Elective after placing a stent	-0.43	-0.91 - 0.05	.08
	Urgent	0.34	0.20 - 0.49	<.001
	Emergency, direct procedure	0.27	0.11 - 0.44	<.001
Tumor complications	Fecal peritonitis due to preoperative colorectal perforation	0.61	0.40 - 0.82	<.001
	Preoperative presence of an abscess	0.30	0.04 - 0.55	.02
	Preoperative bowel obstruction/ ileus due to malignancy	-0.03	-0.16 - 0.10	.61

eTable 9 continued: Multivariate logistic regression analyses for prolonged stay in hospital after colorectal cancer surgery

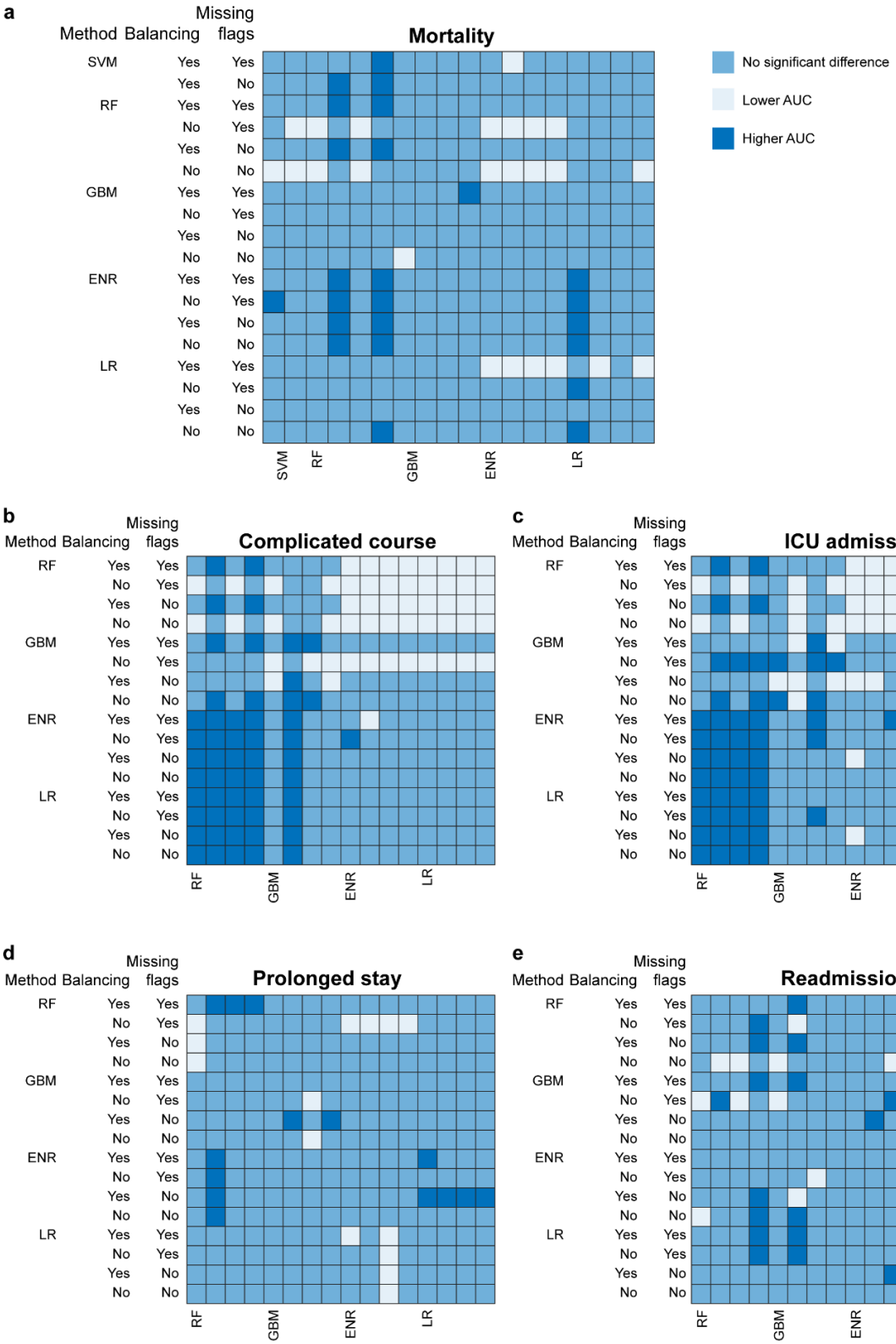
Characteristics		β	95% CI	*P* value
	Preoperative blood loss/ anemia	0.02	-0.06 - 0.10	.61
	Other preoperative tumor related complications	0.22	0.08 - 0.36	.001
Approach	Open	Ref.		
	Laparoscopic	-0.47	-0.55 - -0.40	<.001
	Transanal endoscopic microsurgery (TEM)	0.14	-0.41 - 0.69	.61
	Transanal local excision (open)	-0.12	-1.06 - 0.83	.80
	Transanal minimally invasive surgery (TAMIS)	0.33	-0.38 - 1.04	.36
	Transanal total mesorectal excision (TaTME)	-0.36	-0.86 - 0.14	.16
Surgical conversion	No conversion	Ref.		
	Early	0.64	-0.05 - 1.33	.07
	Late	0.95	0.25 - 1.64	.007
Reason for surgical conversion	No conversion	Ref.		
	Complexity	-0.23	-0.94 - 0.48	.52
	Accessibility	-0.18	-0.87 - 0.51	.61
	Preoperative tumor complications	-0.15	-0.93 - 0.62	.70
Intraoperative complications	Blood loss for which blood transfusion was required	0.15	-0.18 - 0.48	.38
	Damage of the spleen for which a splenectomy was required	0.37	-0.29 - 1.03	.27
	Damage to the pancreas, liver, d. choledochus, gallbladder	1.19	0.44 - 1.94	.002
	Damage to the intestine	0.39	0.12 - 0.65	.004
	Damage to the ureter/urethra	0.67	0.28 - 1.05	<.001
	Damage to the urine bladder	0.39	-0.22 - 1.00	.21
	Damage to the vagina	1.01	0.20 - 1.83	.01
	Perforation intra-abdominal during a transanal local excision	0.77	-0.38 - 1.92	.18
Primary anastomosis		0.04	-0.12 - 0.19	.65
Stoma	No stoma	Ref.		
	Loop ileostomy	0.69	0.58 - 0.81	<.001
	End ileostomy	0.19	-0.04 - 0.41	.10
	Loop colostomy	0.21	-0.01 - 0.43	.05
	End colostomy	0.21	0.04 - 0.38	.01
	Stoma of unknown type	-0.07	-0.86 - 0.73	.87
Radio- or chemo-therapy during surgery	No	Ref.		
	IORTC	-0.21	-0.82 - 0.39	.49
	HIPEC	0.92	0.41 - 1.42	<.001
Additional resection for local ingrowth	No additional resection	Ref.		
	Extensive	0.45	0.31 - 0.59	<.001
	Limited	0.05	-0.08 - 0.19	.43
Specification additional resection	Resection of the omentum	-0.06	-0.38 - 0.27	.74
	Resection of the liver. or RFA	0.45	0.21 - 0.70	<.001
	Resection of the lung	0.14	-1.36 - 1.64	.85
	Resection of peritoneal metastases	-0.04	-0.43 - 0.35	.84
	Lymph node dissection	0.08	-0.31 - 0.48	.67
	Resection of other abdominal organs	0.16	-0.16 - 0.47	.33
	Other abdominal resection	0.20	0.06 - 0.34	.004
Metastasis	Liver metastasis	-0.11	-0.32 - 0.09	.28
	Pulmonary metastasis	-0.56	-0.97 - -0.16	.006
	Bone metastasis	-0.70	-2.18 - 0.77	.34
	Peritoneal metastasis	-0.41	-0.80 - -0.01	.04
	Ovarian metastasis	0.35	-0.43 - 1.13	.37

eTable 9 continued: Multivariate logistic regression analyses for prolonged stay in hospital after colorectal cancer surgery

Characteristics		β	95% CI	*P* value
	Brain metastasis	-0.01	-2.17 - 2.15	.99
	Other metastasis	0.24	-0.12 - 0.61	.18
Age	60-70	Ref.		
	<60	-0.20	-0.30 - -0.10	<.001
	≥80	0.33	0.23 - 0.43	<.001
	70-80	0.22	0.14 - 0.30	<.001
BMI	18.5-25.0	Ref.		
	<18.5	0.13	-0.06 - 0.32	.18
	≥30.0	0.11	0.03 - 0.20	.01
	25.0-30.0	-0.01	-0.08 - 0.06	.73
Tumor location	Colon	Ref.		
	Rectum	0.29	0.13 - 0.44	<.001
	Multiple tumors	-0.31	-1.12 - 0.51	.45
Tumor found by screening		-0.34	-0.49 - -0.20	<.001
Procedure	(low) Anterior/sigmoid resection	Ref.		
	Ileocecal resection	0.02	-0.32 - 0.35	.93
	(extended) Right hemicolectomy	0.14	0.05 - 0.24	.003
	Local excision followed by a total mesorectal excision	1.29	0.66 - 1.91	<.001
	Same procedure for multiple tumors	0.02	-0.42 - 0.46	.93
	Two different procedures of which at least 1 procedure for rectal cancer	0.04	-0.55 - 0.64	.88
	Two different colon procedures	0.21	-0.24 - 0.66	.36
	Transversectomy	0.18	-0.05 - 0.41	.13
	(extended) Left hemicolectomy	0.26	0.14 - 0.39	<.001
	Subtotal colectomy	0.79	0.55 - 1.02	<.001
	Abdominoperineal resection	0.05	-0.09 - 0.19	.50
	Panproctocolectomy	0.65	0.12 - 1.17	.01
	Other	0.21	-0.12 - 0.53	.21
	Local excision	-2.28	-3.11 - -1.45	<.001
	Local excision followed by an abdominoperineal resection	1.05	0.61 - 1.48	<.001
M-stage	M0	Ref.		
	M1	0.00	-0.12 - 0.13	.95
T-stage	T1	Ref.		
	T2	0.02	-0.12 - 0.16	.77
	T3	0.10	-0.03 - 0.24	.14
	T4	0.18	0.03 - 0.34	.02
	T0	0.53	-0.08 - 1.14	.08

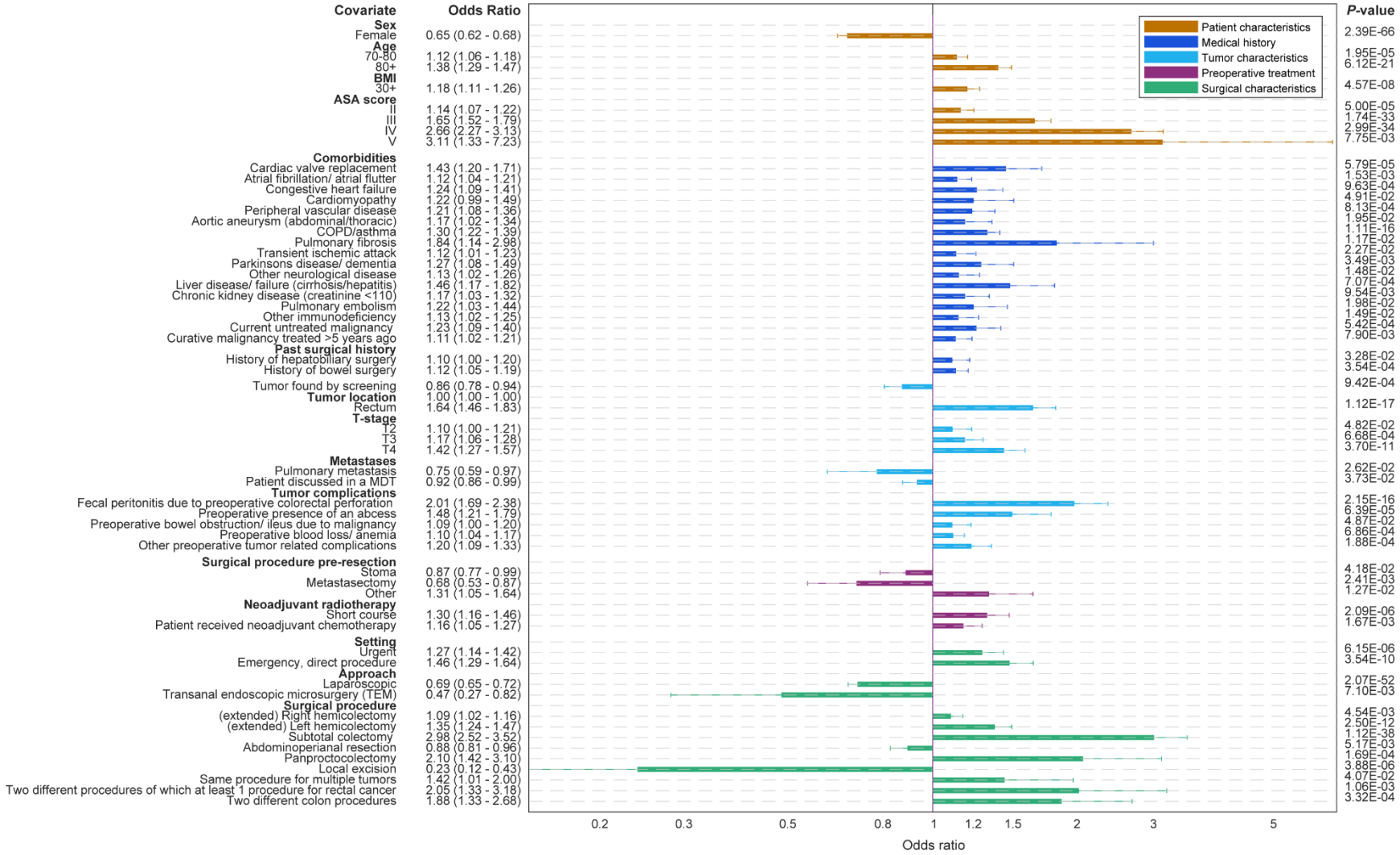
eTable 9: Logistic regression coefficients for prolonged stay in hospital on 62,501 patient records. The *P*-values are given as calculated by the Wald test. When no reference level is reported, variables are binary and the reference level is absence of that variable.

eFigure 1. Pairwise AUC Comparisons for all Models



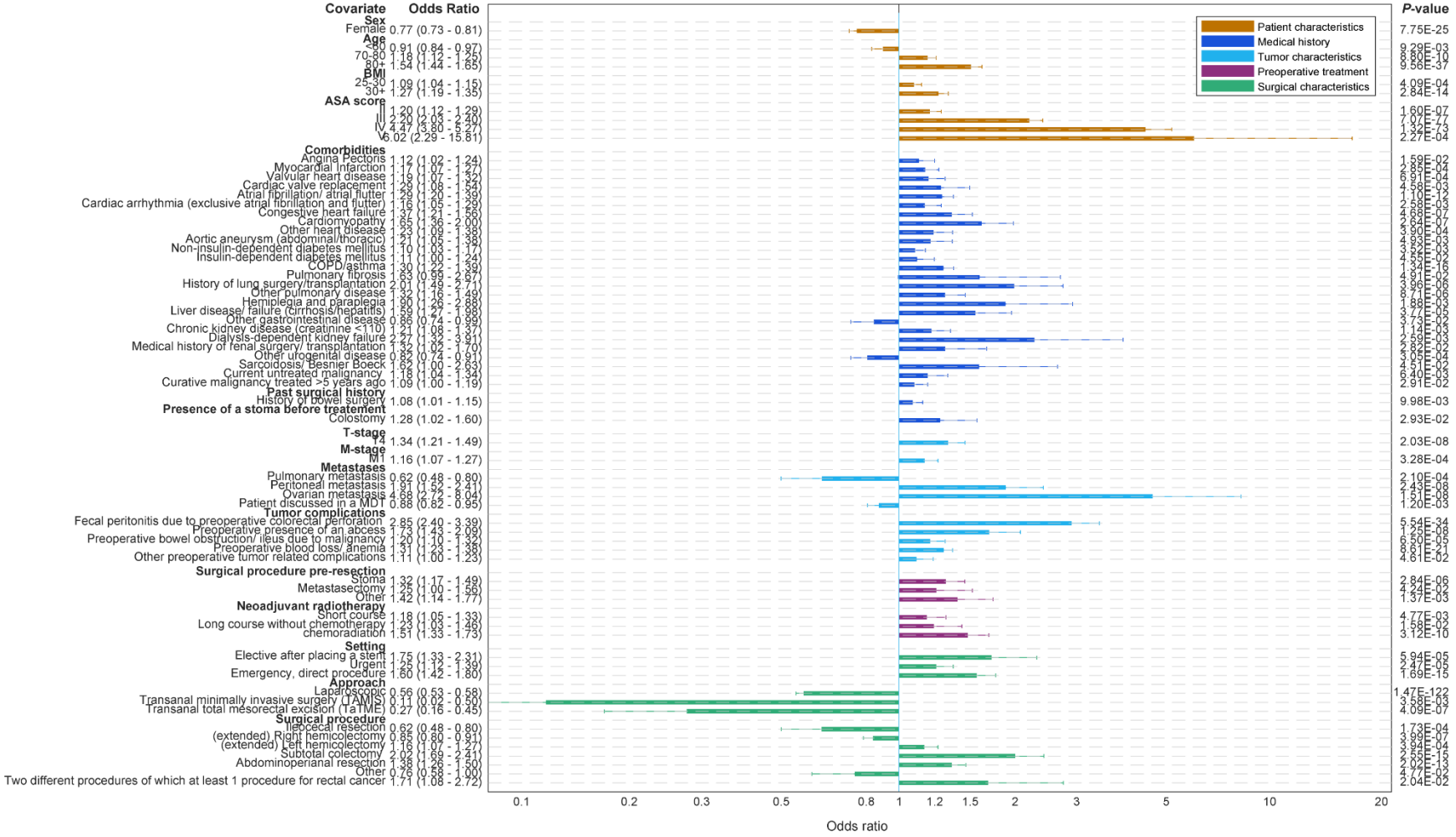
eFigure 1: Pairwise comparison of AUC scores for Elastic Net Regression, Random Forest, Gradient Boosting Models and Support Vector Machine for predicting mortality (**a**), complicated course(**b**), ICU admission(**c**), prolonged stay(**d**) and readmission(**e**). Models were compared by the deLong test, and significant differences (*P*<.05) were reported along with whether the model on the y-axis has a higher (dark blue) or lower (gray) AUC than the model on the x-axis. Models are ordered the same on both axis.

eFigure 2. Significant Predictors in Multivariate Logistic Regression Models for Complicated Course



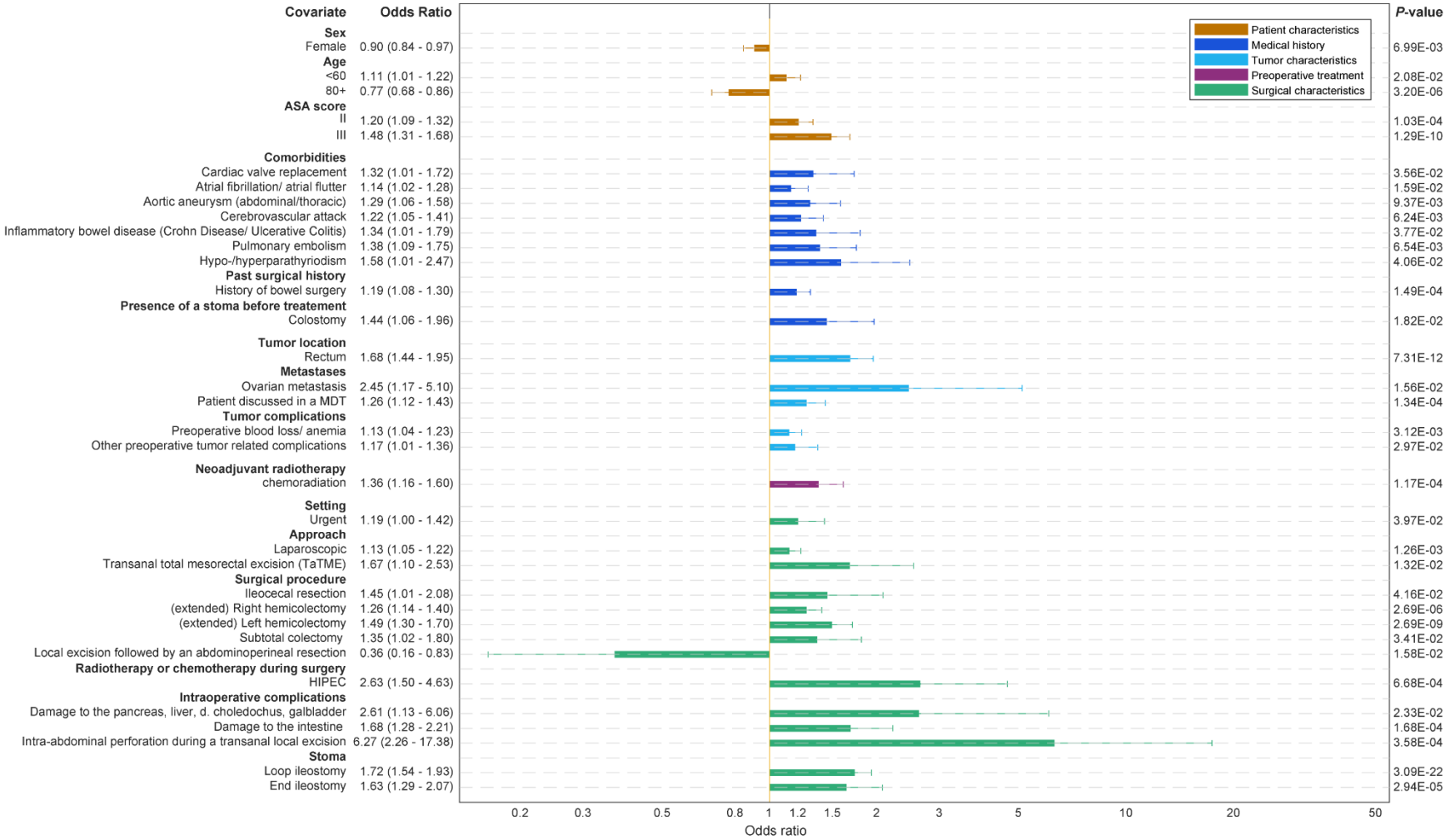
eFigure 2: Significant predictors in multivariate logistic regression model for complicated course on 62,501 patient records. All Regression coefficients with Wald *P*-value < 0.05 are translated to odds ratios and shown in the figure. Error bars represent 95% CIs. Variables are grouped by colors: Patient characteristics (red), comorbidities (blue), tumor characteristics (light blue), surgical complifcations (purple) and surgical characteristics (green). References values for categorical variables are Male (gender), 18.5-25 (BMI), 60-70 (age), ASA score I (ASA score), No pre-existing stoma (presence of a stoma before treatment), 1 tumor found (Number of colorectal tumors found by scopy), T1 (T-stage), M1 (M-stage), Colon Tumor (Tumor location), Elective (Setting), Open (Approach), low Anterior-resection/sigmoid resection (Surgical procedure), No conversion (Surgical convesion), No stoma (Stoma) and No intraoperative therapy (Radiotherapy of chemotherapy during surgery).

eFigure 3. Significant Predictors in Multivariate Logistic Regression Models for ICU Admission



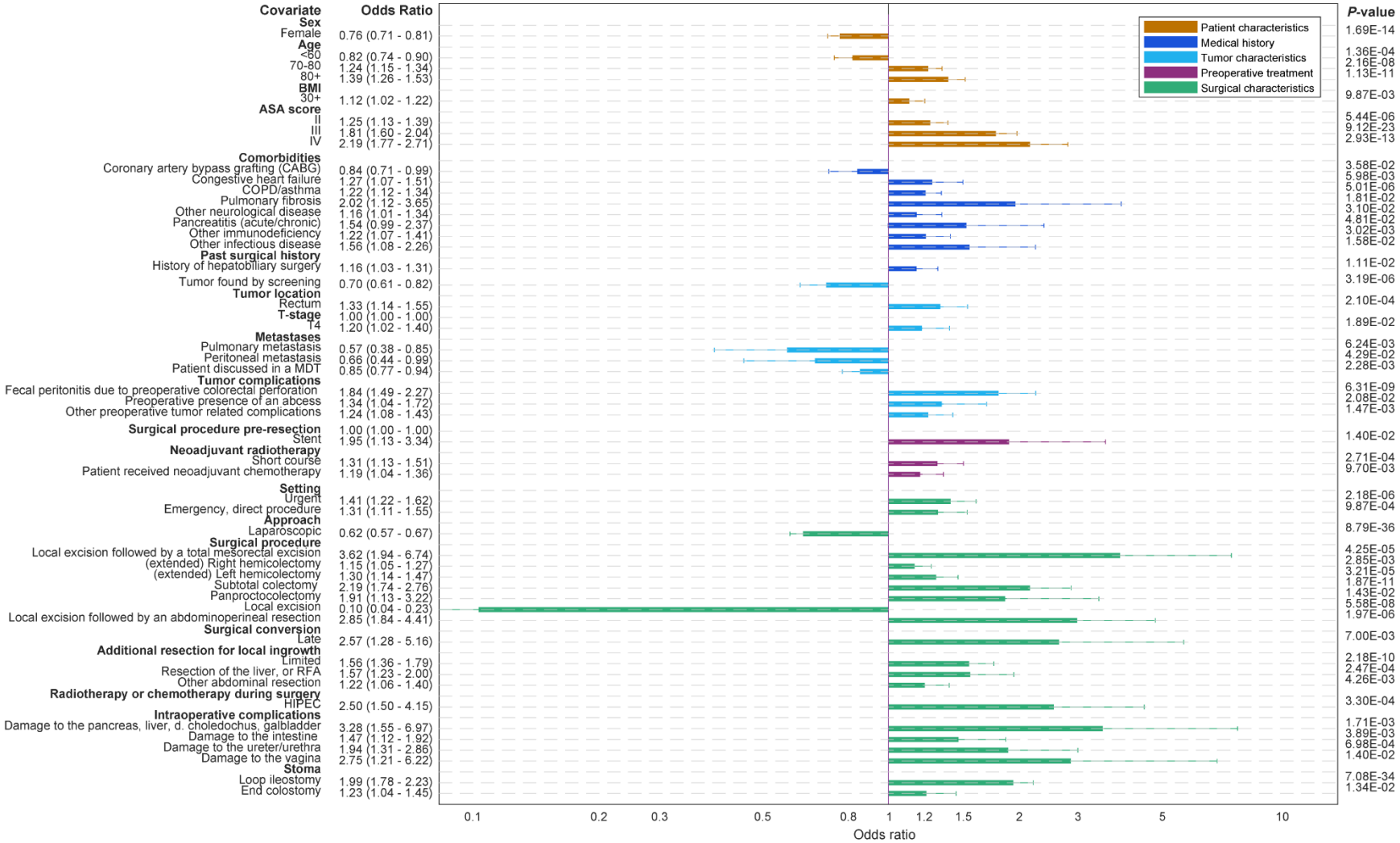
eFigure 3: Significant predictors in multivariate logistic regression model for ICU admission on 62,501 patient records. All Regression coefficients with Wald *P*-value < 0.05 are translated to odds ratios and shown in the figure. Error bars represent 95% CIs. Variables are grouped by colors: Patient characteristics (red), comorbidities (blue), tumor characteristics (light blue), surgical complifcations (purple) and surgical characteristics (green). References values for categorical variables are Male (gender), 18.5-25 (BMI), 60-70 (age), ASA score I (ASA score), No pre-existing stoma (presence of a stoma before treatment), 1 tumor found (Number of colorectal tumors found by scopy), T1 (T-stage), M1 (M-stage), Colon Tumor (Tumor location), Elective (Setting), Open (Approach), low Anterior-resection/sigmoid resection (Surgical procedure), No conversion (Surgical convesion), No stoma (Stoma) and No intraoperative therapy (Radiotherapy of chemotherapy during surgery).

eFigure 4. Significant Predictors in Multivariate Logistic Regression Models for Readmission



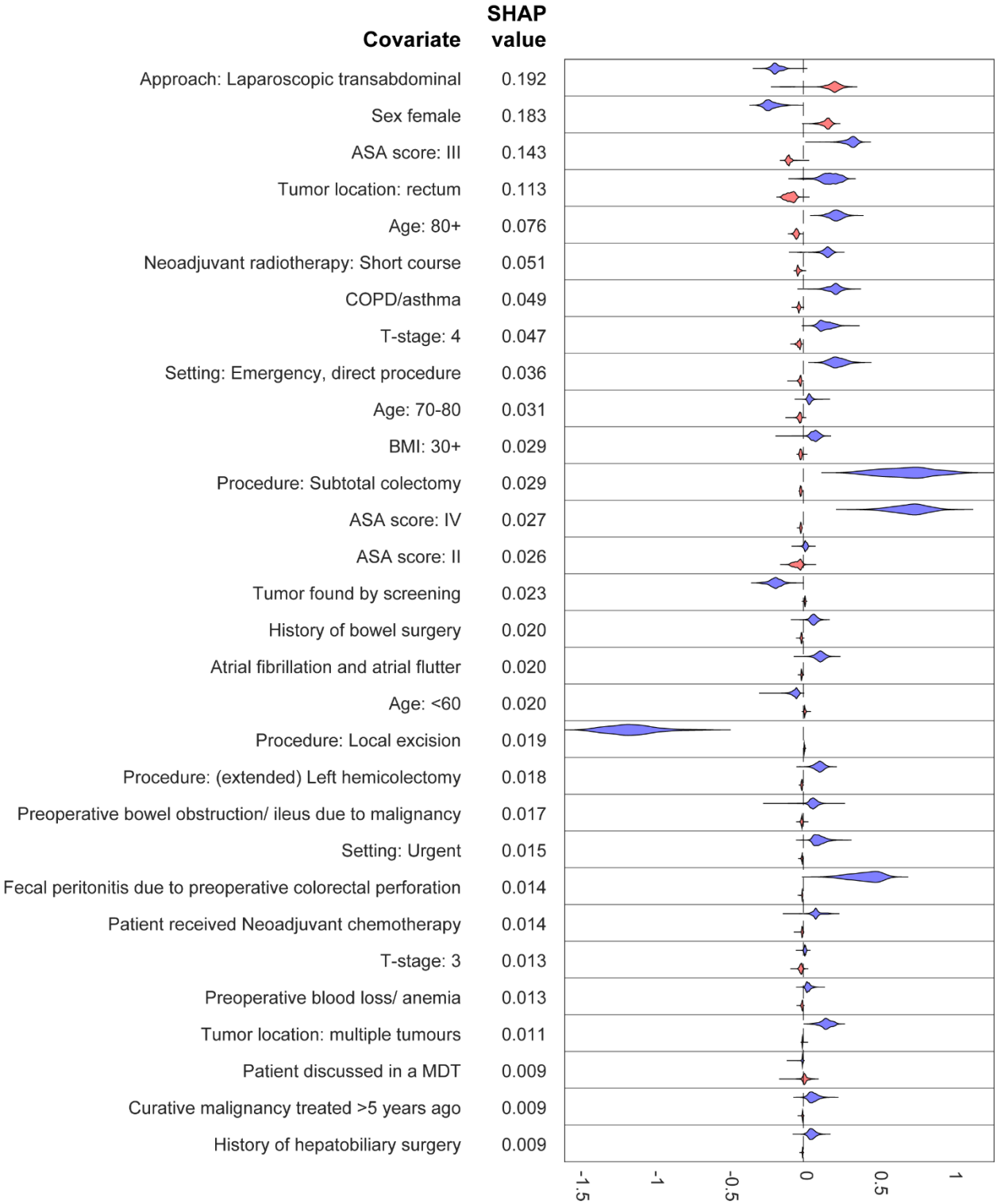
eFigure 4: Significant predictors in multivariate logistic regression model for readmission on 62,501 patient records. All Regression coefficients with Wald *P*-value < 0.05 are translated to odds ratios and shown in the figure. Error bars represent 95% CIs. Variables are grouped by colors: Patient characteristics (red), comorbidities (blue), tumor characteristics (light blue), surgical complifcations (purple) and surgical characteristics (green). References values for categorical variables are Male (gender), 18.5-25 (BMI), 60-70 (age), ASA score I (ASA score), No pre-existing stoma (presence of a stoma before treatment), 1 tumor found (Number of colorectal tumors found by scopy), T1 (T-stage), M1 (M-stage), Colon Tumor (Tumor location), Elective (Setting), Open (Approach), low Anterior-resection/sigmoid resection (Surgical procedure), No conversion (Surgical convesion), No stoma (Stoma) and No intraoperative therapy (Radiotherapy of chemotherapy during surgery).

eFigure 5. Significant Predictors in Multivariate Logistic Regression Models for Prolonged Length of Hospital Stay



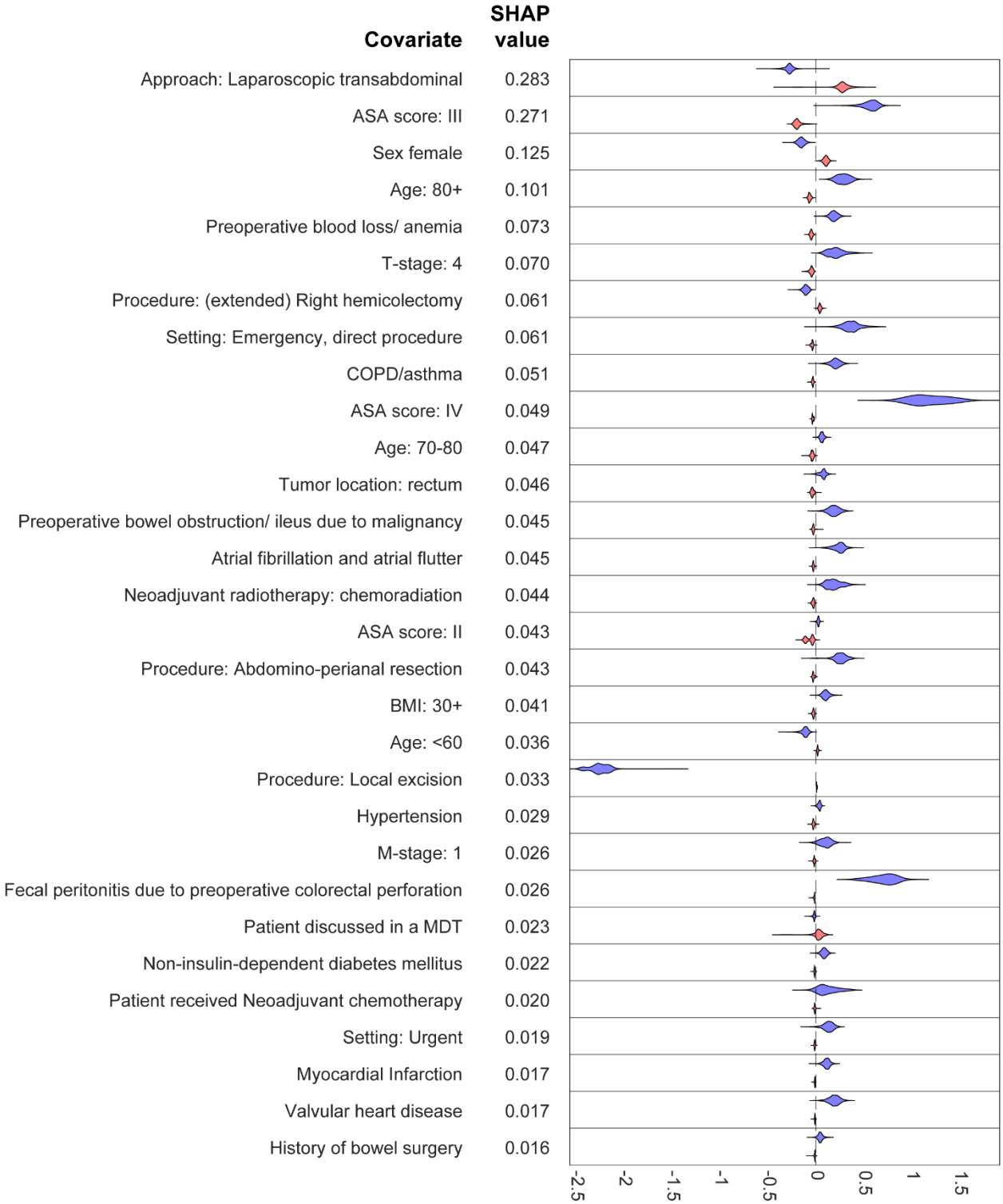
eFigure 5: Significant predictors in multivariate logistic regression model for prolonged length of hospital stay on 62,501 patient records. All Regression coefficients with Wald *P*-value < 0.05 are translated to odds ratios and shown in the figure. Error bars represent 95% CIs. Variables are grouped by colors: Patient characteristics (red), comorbidities (blue), tumor characteristics (light blue), surgical complifcations (purple) and surgical characteristics (green). References values for categorical variables are Male (gender), 18.5-25 (BMI), 60-70 (age), ASA score I (ASA score), No pre-existing stoma (presence of a stoma before treatment), 1 tumor found (Number of colorectal tumors found by scopy), T1 (T-stage), M1 (M-stage), Colon Tumor (Tumor location), Elective (Setting), Open (Approach), low Anterior-resection/sigmoid resection (Surgical procedure), No conversion (Surgical convesion), No stoma (Stoma) and No intraoperative therapy (Radiotherapy of chemotherapy during surgery).

eFigure 6. Most Influential Predictor Variables for Complicated Course



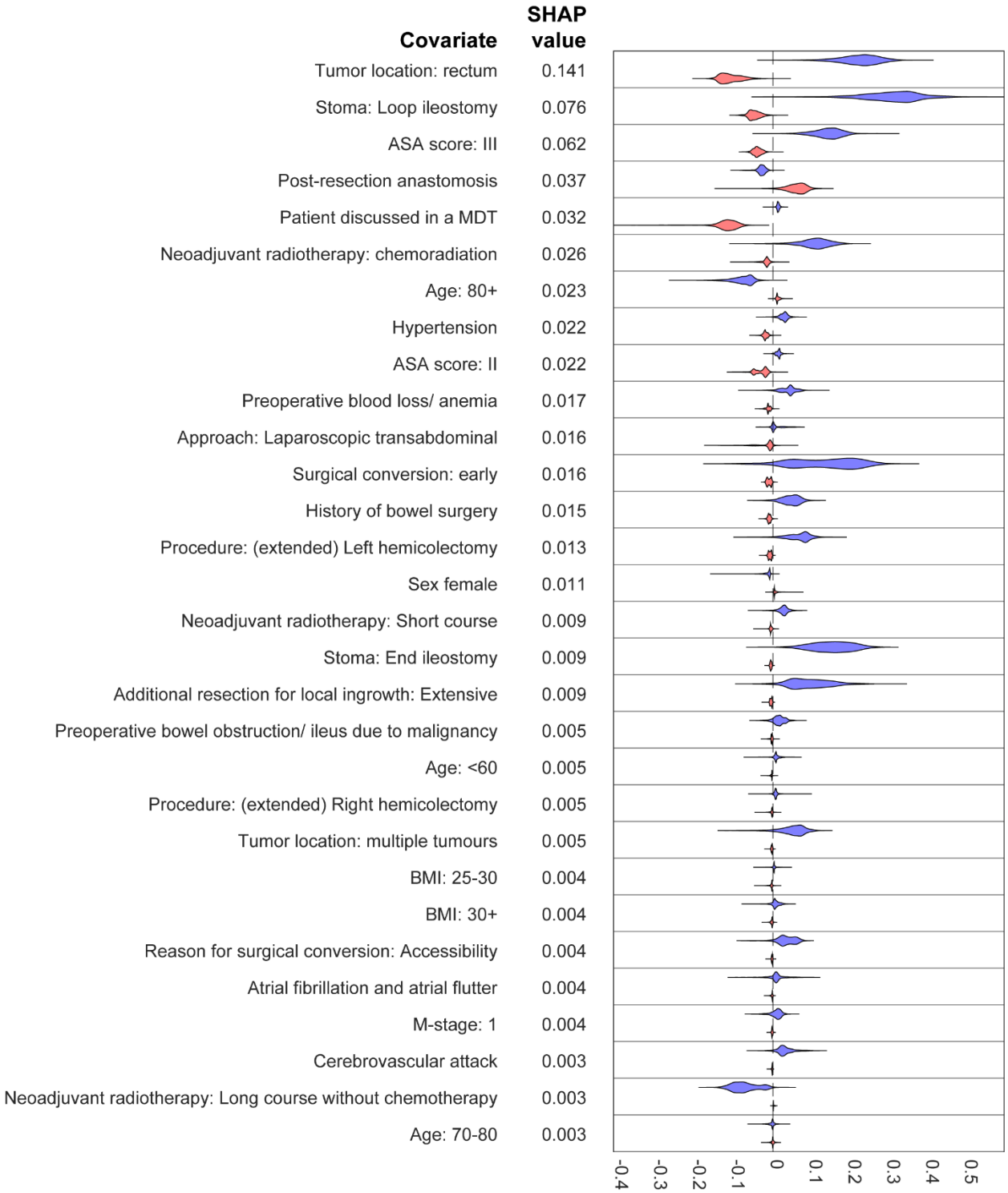
eFigure 6: Top 30 SHAP feature values of the gradient-boosting model for prediction of complicated course. Top 30 SHAP feature values of the gradient-boosting model for prediction of 30-day mortality. SHAP values were calculated per variable for all patients in the test set. Distributions of SHAP values for patients are shown in blue (patients that are positive for a variable) and red (patients that are negative for a variable). SHAP values were ranked by the mean of the absolute value across all patients in the test set.

eFigure 7. Most Influential Predictor Variables for ICU Admission



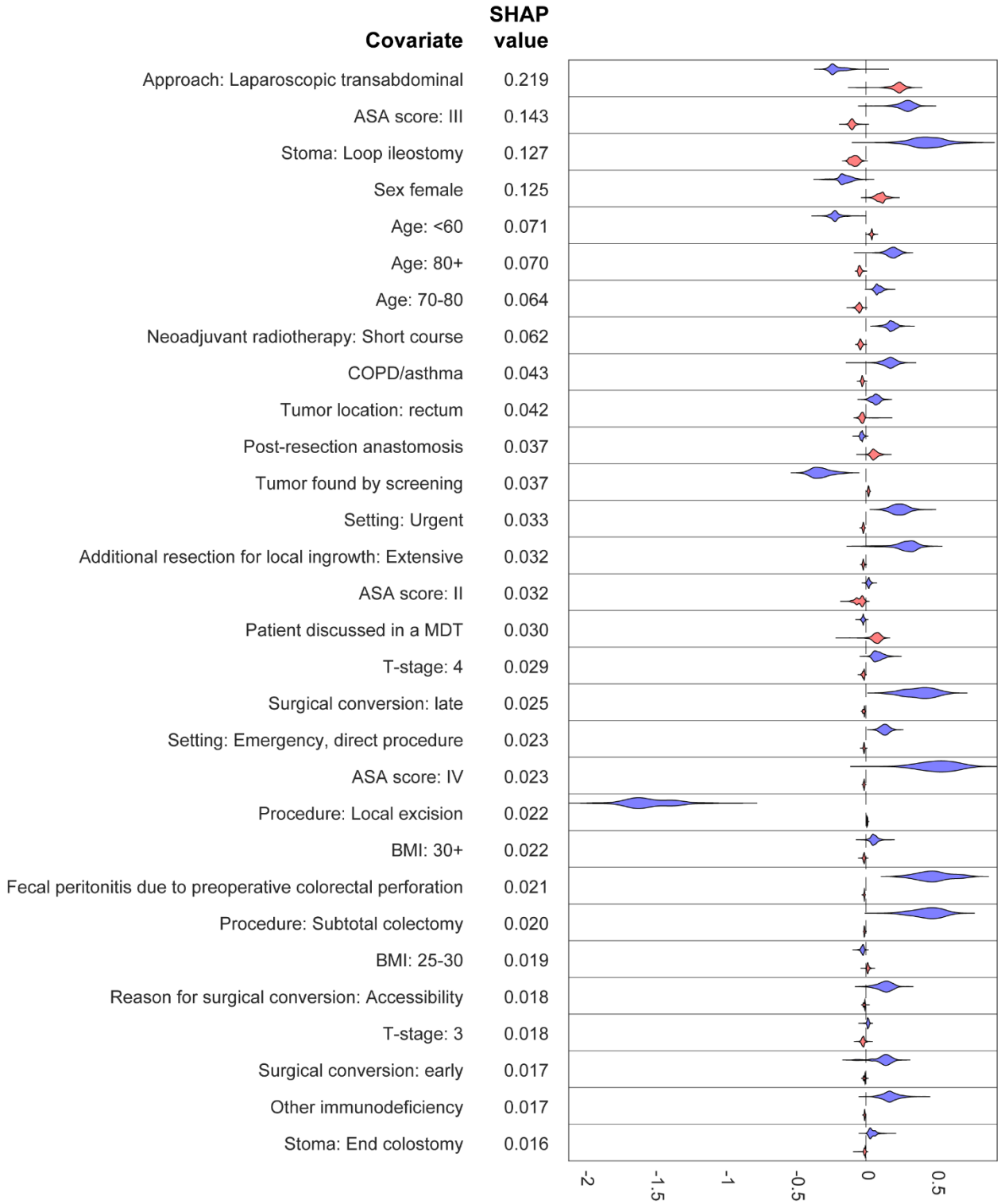
eFigure 7: Top 30 SHAP feature values of the gradient-boosting model for prediction of 30-day mortality. SHAP values were calculated per variable for all patients in the test set. Distributions of SHAP values for patients are shown in blue (patients that are positive for a variable) and red (patients that are negative for a variable). SHAP values were ranked by the mean of the absolute value across all patients in the test set.

eFigure 8. Most Influential Predictor Variables for Hospital Readmission



eFigure 8: Top 30 SHAP feature values of the gradient-boosting model for prediction of readmission. Top 30 SHAP feature values of the gradient-boosting model for prediction of 30-day mortality. SHAP values were calculated per variable for all patients in the test set. Distributions of SHAP values for patients are shown in blue (patients that are positive for a variable) and red (patients that are negative for a variable). SHAP values were ranked by the mean of the absolute value across all patients in the test set.

eFigure 9. Most Influential Predictor Variables for Prolonged Length of Hospital Stay



eFigure 9: Top 30 SHAP feature values of the gradient-boosting model for prediction of prolonged length of hospital stay. Top 30 SHAP feature values of the gradient-boosting model for prediction of 30-day mortality. SHAP values were calculated per variable for all patients in the test set. Distributions of SHAP values for patients are shown in blue (patients that are positive for a variable) and red (patients that are negative for a variable). SHAP values were ranked by the mean of the absolute value across all patients in the test set.