

eTable 1: Collection of 227 operations identified in the NIS as high risk for patients age 65 and older

Modified CCS description	Name of procedure	ICD9	Mortality (%)	C.I. (%)	p value
Incision and excision of CNS	other craniotomy	1.24	14.0	(12.7-15.3)	0.0000
	other craniectomy	1.25	12.1	(9.1-15)	0.0000
	incise cerebral meninges	1.31	13.4	(12.8-14)	0.0000
	other brain incision	1.39	24.6	(22.8-26.4)	0.0000
	ex cereb meningeal les	1.51	2.9	(2.3-3.5)	0.0000
	brain lobectomy	1.53	11.5	(6.6-16.3)	0.0000
	other brain excision	1.59	3.9	(3.5-4.3)	0.0000
Pineal & pituitary	exc pituit les-transfron	7.61	8.3	(3.7-13)	0.0000
Thymus	oth part excision thymus	7.81	3.2	(0.4-6)	0.0045
Lobectomy or pneumonectomy	partial lobectomy of lung	32.21	11.5	(6.6-16.5)	0.0000
	lobectomy of lung#	32.22	9.9	(4.8-15)	0.0000
	complete pneumonectomy#	32.30	3.2	(2.6-3.8)	0.0000
	other excision of lung	32.40	3.5	(3.2-3.7)	0.0000
	emphysema bleb plication	32.50	10.0	(8.6-11.3)	0.0000
	lung vol reduction surg	32.90	9.2	(1.8-16.6)	0.0000
Major Larynx procedures	complete laryngectomy	30.30	2.1	(1.1-3.1)	0.0020
Major Tracheal/bronchial	thoracoplasty	33.34	9.4	(2.9-15.8)	0.0000
	bronchial fistula clos	33.42	7.9	(0-22.9)	0.0199
	bronchial repair nec	33.48	10.1	(0-23.5)	0.0007
	bronchial operation nec	33.98	17.0	(0-36.4)	0.0000
Extrapulmonary procedure	decortication of lung	34.51	10.0	(9.3-10.8)	0.0000
	other pleural excision	34.59	7.8	(5.6-10.1)	0.0000
	clos thoracic fistul nec	34.73	16.3	(10.8-21.8)	0.0000
	other chest wall repair	34.79	3.4	(2.1-4.8)	0.0000
	repair of pleura	34.93	18.3	(0-36.9)	0.0000
Mediastinal procedure	incision of mediastinum	34.10	13.3	(9.8-16.7)	0.0000
	destruct mediastin les	34.30	2.2	(1-3.5)	0.0025
Heart valve procedures	opn aortic valvuloplasty	35.11	9.4	(6.7-12)	0.0000
	opn mitral valvuloplasty	35.12	6.1	(5.4-6.7)	0.0000
	opn tricus valvuloplasty	35.14	13.5	(8.5-18.4)	0.0000
	replace aort valv-tissue	35.21	5.5	(5.2-5.9)	0.0000
	replace aortic valve nec	35.22	6.3	(5.9-6.7)	0.0000
	replace mitr valv-tissue	35.23	10.3	(9.4-11.2)	0.0000
	replace mitral valve nec	35.24	9.5	(8.7-10.3)	0.0000
	replace tric valv-tissue	35.27	11.1	(4.9-17.3)	0.0000
	replace tricus valv nec	35.28	23.3	(11.4-35.3)	0.0000
	other heart valve ops	35.99	8.4	(0-20)	0.0020
Coronary artery bypass graft (CABG)	aortocor bypas-1 cor art	36.11	3.5	(3.2-3.8)	0.0000
	aortocor bypas-2 cor art	36.12	3.0	(2.8-3.2)	0.0000
	aortocor bypas-3 cor art	36.13	3.2	(3-3.4)	0.0000
	aortocor bypas-4+ cor art	36.14	3.5	(3.3-3.8)	0.0000
	1 int mam-cor art bypass	36.15	2.6	(2.4-2.8)	0.0000
	2 int mam-cor art bypass	36.16	2.7	(1.7-3.6)	0.0000
	open chest trans revasc	36.31	4.7	(3.7-5.8)	0.0000
	oth transmyo revascular	36.32	4.9	(0-10.3)	0.0026

Modified CCS description	Name of procedure	ICD9	Mortality (%)	C.I. (%)	p value
Pericardial/Ex tracardiac	heart & pericard repair#	37.12	10.6	(9.8-11.4)	0.0000
	pericardiotomy	37.31	11.1	(8.4-13.7)	0.0000
	pericardiectomy	37.40	26.0	(18.3-33.6)	0.0000
	heart/pericard repr nec	37.49	18.2	(7.3-29.2)	0.0000
	other heart/pericard ops	37.99	4.0	(3.1-4.9)	0.0000
Intracardiac	annuloplasty	35.33	7.6	(6.5-8.7)	0.0000
	tiss adj to valv ops nec	35.39	12.3	(0-25)	0.0000
	pros rep atrial def-opn	35.51	6.5	(0-13.7)	0.0007
	pros rep ventric def-opn	35.53	42.7	(33.3-52.1)	0.0000
	pros rep endocar cushion	35.54	50.4	(1.2-99.7)	0.0000
	graft repair ventric def	35.62	51.2	(40.8-61.7)	0.0000
	grft rep endocar cushion	35.63	26.4	(0-70.5)	0.0010
	ventr septa def rep nec	35.72	43.4	(35.3-51.6)	0.0000
	conduit left ventr-aorta	35.93	28.8	(6.5-51)	0.0000
	incision of heart nos	37.10	6.1	(3.2-9)	0.0000
	cardiotomy	37.11	9.0	(4.9-13.1)	0.0000
	heart aneurysm excision	37.32	5.9	(4.2-7.7)	0.0000
	exc/dest hrt lesion open	37.33	4.5	(3.7-5.3)	0.0000
	partial ventriculectomy	37.35	15.5	(4.3-26.6)	0.0000
Other Coronary Artery procedure	open coronry angioplasty	36.03	7.8	(2.8-12.9)	0.0000
	rem of cor art obstr nec	36.09	3.6	(0-7.2)	0.0063
	coron vess aneurysm rep	36.91	4.4	(0.1-8.6)	0.0017
	heart vessel op nec	36.99	17.4	(13-21.8)	0.0000
Artificial heart/Assist devices	insrt non-impl circ dev	37.62	35.5	(25.3-45.8)	0.0000
	repair heart assist sys	37.63	22.1	(12.2-32)	0.0000
	imp vent ext hrt ast sys	37.65	67.9	(56.8-79.1)	0.0000
	implantable hrt assist	37.66	51.0	(38.4-63.6)	0.0000
Aortic resection; replacement of anastomosis	aorta resection & anast	38.34	14.8	(12.2-17.4)	0.0000
	resect abdm aorta w repl	38.44	12.3	(11.7-12.9)	0.0000
	excision of aorta	38.64	29.7	(20.6-38.7)	0.0000
	endo impl grft abd aorta	39.71	2.1	(1.9-2.3)	0.0000
	endo imp grft thor aorta	39.73	5.8	(3.9-7.8)	0.0000
Peripheral Vascular Bypass	leg artery resec w repla	38.48	2.4	(1.7-3.1)	0.0000
	aorta-iliac-femor bypass	39.25	6.6	(6-7.1)	0.0000
	vasc shunt & bypass nec	39.29	2.3	(2.2-2.5)	0.0000
Vascular bypass and shunt, not heart	aorta-renal bypass	39.24	6.3	(2.4-10.1)	0.0000
	intra-abdomin shunt nec	39.26	15.2	(12.2-18.1)	0.0000
	extracran-intracr bypass	39.28	7.2	(1.7-12.6)	0.0000
Neuro Vascular	intracran vessel incis	38.01	29.7	(16.9-42.5)	0.0000
	head/neck ves incis nec	38.02	5.0	(2.8-7.3)	0.0000
	intracran ves resec-repl	38.41	18.5	(0-51.5)	0.0027
	head/neck ves resec-repl	38.42	2.6	(0.7-4.5)	0.0067
	occlus intracran ves nec	38.81	11.9	(6.1-17.7)	0.0000
	occlus head/neck ves nec	38.82	4.8	(2.5-7)	0.0000
Embolectomy and endarterectomy of lower limbs	lower limb endarterect				
		38.18	3.3	(2.8-3.7)	0.0000
Embolectomy	endarterectomy of aorta	38.14	13.9	(9.3-18.5)	0.0000

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of Central Vessels	thoracic endarterectomy	38.15	14.3	(3.5-25)	0.0000
	abdominal endarterectomy	38.16	4.2	(3.1-5.2)	0.0000
Embolectomy of upper limbs	upper limb endarterectom	38.13	5.9	(2.7-9)	0.0000
Other Major Vasc Repair/Intervention	incision of aorta	38.04	42.4	(34.5-50.4)	0.0000
	thoracic vessel inc nec	38.05	16.1	(11.7-20.6)	0.0000
	abdomen artery incision	38.06	24.2	(21.2-27.2)	0.0000
	abdominal vein incision	38.07	9.2	(2.7-15.7)	0.0000
	lower limb vein incision	38.09	6.0	(2.8-9.2)	0.0000
	arm vessel resect/anast	38.33	3.8	(0.1-7.4)	0.0038
	thor vessel resect/anast	38.35	36.7	(0-77.1)	0.0000
	abd vessel resect/anast	38.36	13.8	(7.7-19.8)	0.0000
	leg artery resect/anast	38.38	2.1	(0.3-4)	0.0457
	resect thorac ves w repl	38.45	17.5	(15.6-19.5)	0.0000
	abd artery resec w repla	38.46	10.8	(8.5-13.1)	0.0000
	thoracic vessel excision	38.65	13.0	(0-26.9)	0.0000
	abdominal artery excis	38.66	7.4	(3.6-11.3)	0.0000
	abdominal vein excision	38.67	34.2	(6-62.5)	0.0000
	leg artery excision	38.68	2.2	(1-3.5)	0.0029
	vasc proc revision nec	39.49	3.7	(3.4-4)	0.0000
	aneurysm repair nec	39.52	9.3	(8.5-10.1)	0.0000
	repair vess w tis patch	39.56	5.9	(3.6-8.2)	0.0000
	rep vess w synth patch	39.57	8.2	(6.2-10.2)	0.0000
	repair vess w patch nos	39.58	3.0	(0.6-5.4)	0.0041
repair of vessel nec	39.59	10.2	(7.6-12.8)	0.0000	
vessel operation nec	39.99	5.6	(1.2-10)	0.0000	
Ligation of Vessel	occlude aorta nec	38.84	66.4	(54.3-78.4)	0.0000
	occlude thoracic ves nec	38.85	13.7	(8.3-19.1)	0.0000
Procedures on spleen	total splenectomy	41.43	5.8	(0-15.4)	0.0238
	partial splenectomy	41.50	9.8	(8.8-10.7)	0.0000
	repair of spleen	41.95	7.7	(0-17.9)	0.0021
Gastrectomy	proximal gastrectomy	43.50	8.5	(6.4-10.7)	0.0000
	partial gastrectomy nec	43.60	7.2	(5.6-8.7)	0.0000
	distal gastrectomy	43.70	12.1	(11.2-13.1)	0.0000
	part gastrec w jej anast	43.89	8.9	(7.7-10.1)	0.0000
	total gastrectomy nec	43.99	11.6	(10.2-12.9)	0.0000
Small bowel procedure	duodenal incision	45.01	11.2	(6.2-16.2)	0.0000
	small bowel incision nec	45.02	8.3	(6-10.5)	0.0000
	oth excise duodenum les	45.31	5.4	(3.3-7.5)	0.0000
	local excis sm bowel nec	45.33	4.3	(2.4-6.2)	0.0000
	mult seg sm bowel excis	45.61	16.0	(14.2-17.8)	0.0000
	part sm bowel resect nec	45.62	11.8	(11.4-12.2)	0.0000
	total removal sm bowel	45.63	22.7	(16.5-28.8)	0.0000
	intestinal anastom nos	45.90	7.7	(2.1-13.3)	0.0000
	sm-to-sm bowel anastom	45.91	10.0	(8.2-11.8)	0.0000
	sm bowel-rect stump anas	45.92	3.9	(0-9.2)	0.0274
	small-to-large bowel nec	45.93	9.4	(7.8-10.9)	0.0000
	anal anastomosis	45.95	3.0	(0.8-5.3)	0.0015
	duodenal lacerat suture	46.71	22.3	(16.9-27.7)	0.0000

Modified CCS description	Name of procedure	ICD9	Mortality (%)	C.I. (%)	p value
	duodenal fistula closure	46.72	15.9	(7.4-24.4)	0.0000
	close sm bowel fist nec	46.74	6.4	(4.7-8)	0.0000
	repair of intestine nec	46.79	14.4	(12.2-16.6)	0.0000
Colorectal procedure	large bowel incision	45.03	9.2	(6.1-12.2)	0.0000
	opn mul seg lg intes nec	45.71	10.1	(8.2-12.1)	0.0000
	open cecectomy nec	45.72	7.4	(6.7-8.2)	0.0000
	opn rt hemicolectomy nec	45.73	5.1	(4.9-5.3)	0.0000
	opn transv colon res nec	45.74	6.6	(5.9-7.2)	0.0000
	opn lft hemicolectmy nec	45.75	8.1	(7.7-8.6)	0.0000
	open sigmoidectomy nec	45.76	6.1	(5.9-6.4)	0.0000
	prt lg intes exc nec/nos	45.79	9.7	(9.1-10.3)	0.0000
	tot intra-abd colectomy#	45.80	21.0	(19.8-22.2)	0.0000
	lg-to-lg bowel anastom	45.94	3.3	(2.3-4.2)	0.0000
	large bowel fixation nec	46.64	4.3	(0-10.3)	0.0188
	suture lg bowel lacerat	46.75	6.2	(5-7.4)	0.0000
	close lg bowel fistula	46.76	3.5	(1.2-5.9)	0.0001
	revise lg bowel anastom	46.94	6.3	(2.7-9.8)	0.0000
	abd-perineal rect resect#	48.50	2.9	(2.4-3.3)	0.0000
	ant rect resect w colost	48.62	5.3	(4.3-6.3)	0.0000
	anterior rect resect nec	48.63	2.0	(1.7-2.3)	0.0000
rectal resection nec	48.69	2.5	(1.9-3.2)	0.0000	
Hernia repair (other than inguinal and femoral)	pericolost hernia repair	46.42	2.8	(1.9-3.7)	0.0000
	abd repair-diaphr hernia#	53.70	4.7	(3.9-5.4)	0.0000
	thor rep-diaph hern nos	53.80	5.1	(3.1-7.1)	0.0000
Therapeutic esophageal procedures	thorac esophagogastrost	42.09	10.4	(1.7-19.1)	0.0000
	esophagomyotomy	42.11	18.8	(5.7-31.8)	0.0000
	suture esophageal lacer	42.32	4.9	(0-10.4)	0.0034
	esophag stricture repair	42.40	13.8	(5.4-22.2)	0.0000
	esophageal repair nec	42.41	8.0	(6.4-9.7)	0.0000
	endosc destr stomach les	42.42	10.2	(6.7-13.6)	0.0000
	esophageal incision nec	42.52	13.2	(4.4-22)	0.0000
	cervical esophagostomy	42.70	1.7	(0.7-2.8)	0.0423
	local excis esophag nec	42.82	17.0	(12.6-21.3)	0.0000
	esophagectomy nos	42.85	10.3	(2.5-18.1)	0.0000
	partial esophagectomy	42.89	10.7	(7.1-14.3)	0.0000
	total esophagectomy	43.41	1.2	(0.9-1.5)	0.0423
Therapeutic gastric procedure	gastroenterostomy nec	44.38	2.4	(1-3.7)	0.0015
	suture peptic ulcer nos	44.39	11.8	(10.7-13)	0.0000
	sut gastric ulcer site	44.40	20.5	(4.2-36.8)	0.0000
	suture duoden ulcer site	44.41	20.7	(19-22.4)	0.0000
	lap gastroenterostomy	44.42	19.4	(18.3-20.5)	0.0000
	suture gastric lacerat	44.61	27.0	(22.6-31.5)	0.0000
	close gastric fistul nec	44.63	9.9	(7-12.7)	0.0000
	esophagogastroplasty	44.65	4.0	(0.1-7.9)	0.0033
	creat esophagastr sphinc	44.66	1.4	(1.1-1.7)	0.0040
	gastric repair nec	44.69	17.5	(14.4-20.6)	0.0000
ligate gastric varices	44.91	30.8	(10.1-51.5)	0.0000	
Major anorectal	abdominal proctopexy	48.75	2.0	(0.8-3.3)	0.0129

Modified CCS description	Name of procedure	ICD9	Mortality (%)	C.I. (%)	p value
procedure					
Biliary major	gb-to-intestine anastom	51.32	8.0	(5.8-10.2)	0.0000
	choledochoenterostomy	51.36	5.3	(4.2-6.4)	0.0000
	hepatic duct-gi anastom	51.37	4.9	(3.2-6.7)	0.0000
	choledochoplasty	51.72	9.9	(0.7-19.2)	0.0000
	bile duct repair nec	51.79	6.3	(2.7-9.9)	0.0000
Pancreatic procedure	pancreatotomy nec	52.40	4.2	(0.9-7.5)	0.0003
	pancreat cyst marsupiali	51.82	3.2	(0.7-5.7)	0.0024
	pancreat sphincterotom	52.09	13.6	(8.4-18.7)	0.0000
	other destru pancrea les	52.22	18.4	(14-22.8)	0.0000
	int drain pancreat cyst	52.30	4.7	(0-11.2)	0.0143
	distal pancreatectomy	52.52	3.4	(2.3-4.4)	0.0000
	rad subtot pancreatectom	52.53	10.7	(2.7-18.7)	0.0000
	partial pancreatect nec	52.59	5.8	(2.6-9)	0.0000
	total pancreatectomy	52.60	9.9	(5.6-14.2)	0.0000
	rad pancreaticoduodenect	52.70	7.7	(6.6-8.7)	0.0000
	pancreatic anastomosis	52.96	3.1	(0.5-5.8)	0.0046
	Liver major	partial hepatectomy	50.22	4.0	(3.1-5)
hepatic lobectomy		50.30	7.7	(6.3-9.1)	0.0000
Nephrectomy	nephroureterectomy	55.51	1.8	(1.6-2)	0.0000
	rejected kidney nephrect	55.53	8.3	(2.3-14.3)	0.0000
	bilateral nephrectomy	55.54	23.4	(13.3-33.5)	0.0000
Kidney trans	kidney transplant nec	55.69	1.9	(1.2-2.7)	0.0004
Major therapeutic procedures of urinary tract	form cutan ileoureterost	56.51	3.7	(2.6-4.8)	0.0000
	cystotomy nec	57.19	2.5	(1.6-3.4)	0.0000
	partial cystectomy	57.60	1.9	(1.1-2.7)	0.0026
	radical cystectomy	57.71	2.9	(2.5-3.4)	0.0000
	total cystectomy nec	57.79	3.6	(1.7-5.4)	0.0000
	suture bladder lacerat	57.81	9.1	(6.1-12.2)	0.0000
	enterovesico fist repair	57.83	4.5	(3.1-5.8)	0.0000
	bladder repair nec	57.89	5.8	(3.2-8.4)	0.0000
	perivesical incision nec	59.19	15.2	(1.2-29.1)	0.0000
Major theraptueic procedures; female organs	pelvic evisceration	68.80	4.6	(2.8-6.5)	0.0000
	repair colovagin fistula	70.72	2.1	(0.5-3.8)	0.0304
	rep vaginoent fistul nec	70.74	7.8	(1.2-14.5)	0.0000
Amputation of lower extremity	disarticulation of hip	84.18	15.9	(10.3-21.5)	0.0000
Ot orgn tran	heart transplantation#	33.51	3.1	(0-7)	0.0422
	unilat lung transplant	33.52	6.3	(0-15)	0.0054
	bilat lung transplant	37.50	11.3	(4-18.5)	0.0000
	liver transplant nec	37.51	11.0	(5.7-16.3)	0.0000
	heart transplantation	50.59	8.0	(5.4-10.6)	0.0000