

Supplementary Online Content

Osborne NH, Nicholas LH, Ryan AM, Thumma JR, Dimick JB. Association of hospital participation in a quality reporting program with surgical outcomes and expenditures for Medicare beneficiaries. *JAMA*. doi:10.1001/jama.2015.25

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

eAppendix 1. International Classification of Diseases, Ninth Revision (ICD-9), Procedure Codes Used to Identify Cases

General Surgery Procedures	ICD-9 Procedure codes
Esophagectomy	Any esophagectomy 424, 4240, 4241, 4242, 4399
Pancreatic resection	Any pancreaticoduodenectomy 5251, 5253, 526, 527
Colon resection	Any colectomy 457, 4571, 4572, 4573, 4574, 4575, 4576, 4579, 1731 to 1739, 458
Gastrectomy	Any gastric resection 435, 436, 437, 438, 4381, 4389, 439, 4391, 4399
Liver resection	Any hepatic resection 5022, 503
Incisional hernia repair	Repair of hernia 5341, 5342, 5343, 5349, 5351, 5359, 5361, 5362, 5363, 5369
Cholecystectomy	Any cholecystectomy 5122, 5123, 5124
Appendectomy	Any appendectomy 4701, 4709, 4711, 4719
Vascular Surgery procedures	
Abdominal aortic aneurysm repair*	Any AAA repair 3834 3844, 3864, 3925, 3971 and diagnosis of AAA without rupture with ICD-9 diagnosis codes 4414, 4417, 4419
Lower extremity bypass	Vascular bypass 3929, excluding upper extremity with ICD-9 diagnosis code 44421 and all ESRD
Carotid endarterectomy	Carotid endarterectomy 3812

*Excluded aortic dissection with ICD-9 diagnosis code 4410x, rupture with ICD-9 diagnosis codes 4412, 4413, 4415, 4416 or thoracic aneurysm with ICD-9 diagnosis code 4411 or with ICD-9 procedure code 3845

eAppendix 2. International Classification of Diseases, Ninth Revision (ICD-9), Diagnoses and Procedure Codes Used to Determine Complications after Surgery

Complications	ICD-9 Diagnoses (DX)/ Procedure (SX) Codes
Pulmonary failure	DX: Acute respiratory failure 518.81 Other pulmonary insufficiency 518.82 Acute and chronic respiratory failure 518.84 SX: Insertion of endotracheal tube 96.04 Other intubation of respiratory tract 96.05 Other continuous mechanical ventilation 96.7 Continuous invasive mechanical ventilation of unspecified duration 96.70
Pneumonia	DX: Pneumococcal pneumonia 481.xx Other bacterial pneumonia 482.xx Pneumonia due to other specified organism 483.xx Pneumonia in infectious diseases classified elsewhere 484.xx Bronchopneumonia, organism unspecified 485.xx Pneumonitis due to inhalation of food or vomitus 507.0x
Myocardial infarction	DX: Acute myocardial infarction 410.xx
Deep venous thrombosis and pulmonary embolism	DX: Pulmonary embolism and infarction 415.1x Phlebitis and thrombophlebitis of femoral vein 451.11 Other pulmonary embolism and infarction 451.19 Phlebitis and thrombophlebitis of lower extremities 451.2x Phlebitis and thrombophlebitis of iliac vein 451.81 Other venous embolism and thrombosis of other specified veins 453.8x SX: Incision, excision, and occlusion of vessels: abdominal veins 38.7
Acute renal failure	DX: Acute renal failure 584.xx SX: Other operations on vessels: Hemodialysis 39.95
Hemorrhage	DX: Hemorrhage or hematoma or seroma complicating a procedure 998.1x
Surgical site infection	DX: Posttraumatic wound infection, not elsewhere classified 958.3x Disruption of operation wound 998.3x Postoperative infection 998.5x SX: Other operations of abdominal region 54.91
Gastrointestinal hemorrhage	DX: Esophageal hemorrhage 530.82 Gastric ulcer: Acute with hemorrhage 531.0x Gastric ulcer: Acute with perforation 531.1x Gastric ulcer: Acute with hemorrhage and perforation 531.2x Gastric ulcer: Chronic or unspecified with hemorrhage 531.4x Gastric ulcer: Chronic or unspecified with hemorrhage and perforation 531.6x Duodenal ulcer: Acute with hemorrhage 532.0x Duodenal ulcer: Acute with perforation 532.1x Duodenal ulcer: Acute with hemorrhage and perforation 532.2x Duodenal ulcer: Chronic or unspecified with hemorrhage 532.4x Duodenal ulcer: Chronic or unspecified with hemorrhage and perforation 532.6x Peptic ulcer, site unspecified: Acute with hemorrhage 533.0x Peptic ulcer, site unspecified: Acute with perforation 533.1x Peptic ulcer, site unspecified: Acute with hemorrhage and perforation 533.2x Peptic ulcer, site unspecified: Chronic or unspecified with hemorrhage 533.4x Peptic ulcer, site unspecified: Chronic or unspecified with hemorrhage and perforation 533.6x Gastrojejunal ulcer, site unspecified: Acute with hemorrhage 534.0x Gastrojejunal ulcer, site unspecified: Acute with perforation 534.1x Gastrojejunal ulcer, site unspecified: Acute with hemorrhage and perforation 534.2x Gastrojejunal ulcer, site unspecified: Chronic or unspecified with hemorrhage

	<p>534.4x Gastrojejunal ulcer, site unspecified: Chronic or unspecified with hemorrhage and perforation 534.6x Acute gastritis, with hemorrhage 535.01 Atrophic gastritis, with hemorrhage 535.11 Gastric mucosal hypertrophy, with hemorrhage 535.21 Alcoholic gastritis, with hemorrhage 535.31 Other specified gastritis, with hemorrhage 535.41 Unspecified gastritis and gastroduodenitis, with hemorrhage 535.51 Duodenitis, with hemorrhage 535.61 SX: Other repair of bladder 57.89</p>
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eAppendix 3. *International Classification of Diseases, Ninth Revision (ICD-9), Diagnoses and Procedure Codes Used to Determine Reoperations after Surgery*

Reoperations	ICD-9 Procedure Codes
Reopening of surgical site	Reopening of recent laparotomy 5412 Reopening of recent thoracotomy 3402, 3403 Exploratory laparotomy (performed after primary surgery) 5411 Laparoscopy 5421 Reopening sternotomy 3595 Revision of vascular procedure 3949
Reclosure of dehiscence	Reclosure of disrupted abdominal wound 5471
Management of postoperative shock/hemorrhage	Control of hemorrhage 3998, 4995, 5793, 6094, 3941, 3998 Splenectomy 415
Retrieval of Retained Foreign Body	Removal of foreign body from peritoneal cavity 5492 Removal of foreign body, not otherwise specified 9820
Reoperation for management of deep surgical site infection	Drainage abdominal wall or retroperitoneal abscess 540 Laparotomy drainage of abscess/hematoma 5419 Other operations on intestine; revision of anastomosis of large intestine 4694
Repair of an organ injury/laceration	Excision of small intestine 4461 Suture of duodenal, small intestine, large intestine or rectum laceration 4671, 4673, 4675, 4871 Suture of liver laceration 5061 Other repair of intestine, duodenoplasty 4679 Suture of laceration of kidney 5581 Operations to repair ureter, bladder, or urethra 5675, 5682, 5686, 5689, 5781, 5783, 5784, 5841
Management of wound complication	Closure of duodenal fistula 4672 Closure of small intestinal fistula 4674 Closure of large intestinal fistula 4676
Management of stoma complications	Revision of stoma 4640 Revision of small intestinal stoma 4641 Repair of parastomal hernia 4642 Other revision of large intestinal stoma 4643

eAppendix 4: Weighted standardized differences between ACS-NSQIP and Non-ACS-NSQIP hospitals, and Percent bias reduction across hospital characteristics before vs. after propensity score matching.

	Weighted Standardized Difference between NSQIP and Non-NSQIP Hospitals		% Reduction in Bias
	Before Matching	After Matching	
Variables included in the propensity model			
Overall model	0.9529	0.0126	98.4
Annual surgical volume	1.6893	0.0124	99.4
Risk and reliability adjusted mortality			
1 year prior to enrollment year	-0.2767	-0.0488	82.3
2 year prior to enrollment year	-0.2176	-0.0419	80.3
Variables not included in the propensity model			
Teaching hospital	1.4178	0.6083	50.6
Technology hospital	1.3643	0.3149	75.7
Profit status			
For-profit	-0.5018	-0.234	46.7
Non-profit	0.5623	0.122	64.7
Other	-0.2023	0.0638	81.4
Bed size			
<200	-1.7999	-0.422	74.9
200-349	0.3248	-0.1004	43.4
350-499	0.672	0.1588	99.6
≥ 500	0.9095	0.3563	41.9
Geographic region			
Northeast	0.3354	0.2326	25.9
Midwest	0.0425	0.1629	-158.5
South	-0.3419	-0.3823	-10.5
West	0.0233	0.029	-17.9
Other hospital characteristics			
Licensed beds	1.4591	0.5004	61.8
Total admissions	1.7322	0.5882	57.5
Full-Time Equivalent Employees	1.4528	0.6892	42.3
Total Annual Surgical Operations	1.265	0.5417	50.7

eFigure: Distribution of propensity scores of the ACS-NSQIP and non-participating hospitals before and after matching

