

Supplementary Table 1 Study definitions and corresponding International Classification of Diseases version 9 codes

	ICD-9-CM Code
Inclusion Criteria	
Cholecystectomy	
Laparoscopic	51.23
Open	51.22
Laparoscopic Converted to Open (Categorized as Open)	V64.44, V64.41
Exclusion Criteria	
Partial Cholecystectomy	51.24, 51.21
Cirrhosis	571.2, 571.5, 571.6
Pregnancy	63x.xx, 64x.xx, 65x.xx, 66x.xx, 670.xx, 671.xx, 672.xx, 673.xx, 674.xx, 675.xx, 676.xx, 677.xx, V22.xx, V23.xx, V24.xx, V27.xx, V28.0x, V28.1x, V28.2x, V28.6x, V61.6x, V61.7x, 792.3, 796.5, V65.11, V72.42 72.xx, 73.xx, 74.xx, 75.0x, 75.1x, 75.2x, 75.4x, 75.5x, 75.3, 75.30, 75.31, 75.32, 75.33, 75.34, 75.35, 75.36, 75.37
Indication for Cholecystectomy	
Acute Cholecystitis	574.0, 574.00, 574.01, 574.1, 574.10, 575.0, 575.12, 575.10, 574.11, 574.10
Chronic Cholecystitis	575.11
Gallstone Disease without Cholecystitis	574.2, 574.20
Choledocholithiasis	574.3, 574.4, 574.5, 574.6x, 574.7x, 574.8x, 574.9x, 574.5x, 576.xx
Gallstone Pancreatitis	AP (577.0) plus ICD9 574.xx

Biliary Dyskinesia	575.8
Post-operative Outcomes	
Pulmonary Complications	507.0, 415.1, 451.11, 451.19, 451.2, 451.81, 453.8, 415.11, 453.4, 453.40, 453.41, 453.42, 514, 518.4, 518.5, 518.81, 518.82 96.70, 96.71, 96.72, 93.90
Surgical Complications	008.45, 320.xx, 510.0, 510.9, 513.1, 519.2, 590.10, 590.11, 590.80, 683, 410.xx, 415.1, 451.11, 451.19, 451.2, 451.81, 453.8, 415.11, 453.4, 453.40, 453.41, 453.42, 530.4, 569.83, 575.4, 01.23, 03.02, 06.02, 34.03, 35.95, 39.49, 54.12, 54.61, 29.51, 31.61, 33.41, 33.43, 42.82, 44.61, 46.71, 46.75, 48.71, 50.61, 51.91, 55.81, 56.82, 57.81, 58.41, 69.41
Secondary Diagnoses	
Cystic Fibrosis	277.0x
Chronic Respiratory Failure	518.83, 518.84

Supplementary Table 2 Summary of missing data among demographics and outcomes in the Nationwide Inpatient Sample 2002-2014

	Percentage of missing data (%)
Gender	0.22
Race	17.18
Income Quartile	10.12
Primary Payer	0.19
Elective Admission	0.28
Hospital Bed Size	0.35
Hospital Location/Teaching Status	0.35
Mortality	0.05
Length of Stay	<0.01
Cost	7.48

Supplementary Table 3 Univariate comparison of outcomes between subjects with and without cystic fibrosis who underwent cholecystectomy from 2002 to 2014

	Without Cystic Fibrosis (n=5,974,985)		With Cystic Fibrosis (n=1,239)		<i>p-value</i>
	<i>n</i>	%	<i>n</i>	%	
Mortality	59,275	0.99	≤10	≤0.81	0.719
Length of Stay (mean, SE)	5.35	0.02	10.13	0.71	<0.001
Cost (mean, SE)	14,059	63	27,561	2,741	<0.001
Pulmonary Complications	304,613	5.10	95	7.70	0.051
Surgical Complications	208,891	3.50	80	6.42	0.007

Supplementary Table 4 Standardized differences between subjects with and without cystic fibrosis for each of the covariates after applying propensity weighting in the Nationwide Inpatient Sample 2003-2015

	Propensity Score Weighting		
	No CF n=722	CF n=731	Standardized Difference
Patient and Hospital Characteristics			
Age (mean, SE)	31.11	31.00	0.61
Female	68.79	69.26	-0.65
Race			
White	90.66	90.82	-0.35
Black	1.43	1.40	0.11
Hispanic	4.01	3.95	0.22
Other	3.90	3.83	0.23
Income Quartile			
First	24.38	24.13	0.37
Second	23.76	23.66	0.15
Third	29.48	28.93	0.78
Fourth	22.38	23.27	-1.36
Primary Payer			
Medicare	24.13	24.45	-0.47
Medicaid	18.18	18.28	-0.17
Private Insurance	48.82	48.54	0.36
Other	8.86	8.73	0.31
Elective Admission	30.03	30.06	-0.04
Chronic Respiratory Failure	2.11	2.63	-2.09
Hospital Bed Size			
Small	9.08	8.98	0.23
Medium	20.12	20.28	-0.24

Large	70.80	70.75	0.07
Hospital Location/Teaching Status			
Rural	5.41	5.32	0.26
Urban Non-Teaching	19.93	19.69	0.39
Urban Teaching	74.66	74.99	-0.49
Hospital Region			
Northeast	20.41	20.93	-0.83
Midwest	20.08	19.85	0.38
South	37.32	37.97	-0.86
West	22.19	21.25	1.49
Indication for Cholecystectomy			
Acute Cholecystitis	52.24	52.61	-0.47
Chronic Cholecystitis	8.25	8.15	0.23
Gallstone Disease without Cholecystitis	17.34	17.51	-0.28
Choledocholithiasis	16.95	17.09	-0.23
Biliary Dyskinesia	13.30	13.00	0.57
Elixhauser Comorbidities			
Alcohol abuse	0.65	0.68	-0.26
Deficiency Anemias	13.29	12.61	1.32
Chronic Pulmonary Disease	29.26	29.11	0.21
Depression	15.44	15.39	0.09
Diabetes	29.32	29.94	-0.87
Diabetes with Complications	5.29	5.32	-0.10
Drug Abuse	2.62	2.57	0.20
Hypertension	15.98	15.71	0.48
Hypothyroidism	2.75	2.74	0.07
Liver Disease	2.14	2.09	0.20
Fluid and Electrolyte Disorders	17.60	16.98	1.07

Metastatic Cancer	0.69	0.68	0.02
Other Neurological Disorders	2.76	2.68	0.31
Obesity	4.02	3.92	0.32
Peripheral Vascular Disorders	0.77	0.74	0.17
Psychoses	4.48	4.49	-0.03
Pulmonary Circulation Disorders	1.48	1.86	-1.83
Renal Failure	3.18	3.24	-0.20
Solid Tumor without Metastasis	0.72	0.68	0.28
Peptic Ulcer Disease	0.58	0.52	0.57
Weight Loss	11.57	11.95	-0.74

Supplementary Table 5 Univariate comparison of post-operative outcomes between subjects with cystic fibrosis who underwent open compared to laparoscopic cholecystectomy from 2002 to 2014

	Laparoscopic CCY (n=973)		Open CCY (n=266)		<i>p-value</i>
	<i>n</i>	%	<i>n</i>	%	
Mortality ¹	≤10	≤1.03	≤10	≤3.76	0.286
Length of Stay (mean, SE)	8.94	0.71	14.46	2.00	0.009
Cost (\$) (mean, SE)	23,288	2,969	43,024	6,468	0.005
Pulmonary Complications	59	6.02	37	13.86	0.054
Surgical Complications	47	4.84	32	12.21	0.048

¹Where n≤10, the exact value is censored to protect patient privacy, per Nationwide Inpatient Sample regulation.