

Supplementary Table 1: ICD-9 Codes for Biliary Procedures

ICD-9	Procedure
Diagnostic ERCP	
51.10	Diagnostic procedures on biliary tract
51.11	Endoscopic retrograde cholangiography
Therapeutic ERCP	
51.14	Endoscopic biopsy of biliary duct or sphincter of Oddi
51.15	Pressure measurement of sphincter of Oddi
51.64	Endoscopic excision or destruction of lesion of biliary duct
51.69	Endoscopic excision of other bile duct
51.84	Endoscopic dilation of ampulla and biliary duct
51.85	Endoscopic sphincterotomy and papillotomy
51.86	Endoscopic insertion of nasobiliary drainage tube
51.87	Endoscopic insertion of stent (tube) into bile duct
51.88	Endoscopic removal of stone(s) from biliary tract
Bile Duct Surgery	
51.32	Anastomosis of gallbladder to intestine
51.36	Choledochoenterostomy
51.41	Common duct exploration for removal of calculus
51.42	Common duct exploration for relief of other obstruction
51.43	Insertion of choledochohepatic tube for decompression
51.49	Incision of other bile ducts for relief of obstruction
51.51	Exploration of common duct
51.59	Other incision of other bile duct
51.71	Simple suture of common bile duct
51.72	Choledochoplasty
51.79	Repair of other bile ducts
Percutaneous Transhepatic Cholangiography	
51.96	Percutaneous extraction of common duct stones
51.98	Other percutaneous procedures on biliary tract

Supplementary Table 2: Age-standardized rate of biliary procedures																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
All biliary interventions																
Rate	119.8	116.2	110.5	115.1	112.6	113.5	105.7	105.0	107.2	101.4	108.5	104.9	106.4	106.5	102.3	100.1
SE	2.6	2.6	2.5	2.5	2.5	2.5	2.3	3.0	2.8	3.1	3.1	2.5	2.7	2.1	1.3	1.3
Diagnostic ERCP																
Rate	36.0	32.5	29.0	26.8	25.1	22.8	20.1	18.2	17.3	14.1	13.6	12.6	11.4	10.0	9.4	8.6
SE	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.7	1.0	0.6	1.0	0.5	0.5	0.5	0.3	0.2
Therapeutic ERCP																
Rate	62.0	64.3	63.9	72.2	71.7	75.9	72.4	74.8	78.8	75.9	83.6	82.2	84.9	87.9	84.8	83.9
SE	1.8	1.8	1.8	1.8	1.8	1.8	1.6	2.6	1.7	2.7	1.9	1.9	2.2	1.0	1.0	0.9
Bile duct surgery																
Rate	16.9	14.2	13.2	11.8	11.3	10.3	9.0	7.8	7.2	6.6	6.9	5.9	5.4	4.6	4.2	3.8
SE	1.4	1.5	1.4	1.5	1.5	1.5	1.5	1.4	2.0	1.4	2.2	1.6	1.5	1.8	0.8	0.8
Percutaneous transhepatic cholangiography																
Rate	5.0	5.2	4.4	4.3	4.5	4.5	4.1	4.2	3.9	4.7	4.5	4.2	4.7	4.1	3.9	3.8
SE	0.4	0.5	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.4	0.3	0.2	0.3	0.3	0.1	0.1

Age-standardized rate of procedures per 100,000 United States residents. *SE*, standard error.

Supplementary Table 3: Age-standardized rate of biliary procedures for select ICD-9 codes																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Interventions for bile duct stones																
51.88	16.7	17.1	17.2	19.4	19.4	20.4	19.4	19.8	20.6	20.5	22.4	22.1	23.0	24.1	22.3	22.1
51.41	5.2	4.2	3.9	3.5	3.3	2.9	2.8	2.3	2.1	1.8	1.8	1.6	1.3	1.1	0.9	0.8
51.96	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1
Therapeutic ERCP codes																
51.85	28.3	29.9	29.6	34.0	34.3	36.0	33.7	35.1	36.4	35.2	39.0	38.6	39.6	40.5	37.3	36.5
51.87	11.5	12.1	12.1	13.6	13.7	15.0	14.7	15.6	17.2	16.0	18.3	17.5	17.9	18.8	17.4	17.4
51.88	16.7	17.1	17.2	19.4	19.4	20.4	19.4	19.8	20.6	20.5	22.4	22.1	23.0	24.1	22.3	22.1
Bile duct surgery																
51.3x	4.0	3.4	3.1	2.8	2.5	2.3	2.1	1.8	1.5	1.5	1.5	1.2	1.2	0.9	0.8	0.8
51.4x	7.0	5.7	5.4	4.7	4.5	4.0	3.8	3.2	3.1	2.7	2.6	2.4	2.0	1.8	1.6	1.4
51.5x	5.1	4.2	4.1	3.6	3.5	3.2	2.5	2.3	2.0	1.8	2.2	1.7	1.6	1.3	1.3	1.1
51.7x	0.8	0.8	0.7	0.7	0.8	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.5	0.5

Age-standardized rate of procedures per 100,000 United States residents by ICD-9-CM code or code family. See **Supplementary Table 1** for description of each code.

Supplementary Table 4: Trends in case fatality for biliary procedures																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP	1.8	1.6	1.5	1.4	1.5	1.4	1.4	1.4	1.1	1.1	1.0	1.0	0.9	0.8	0.8	1.0
Bile duct surgery	5.5	4.1	4.8	4.7	4.5	3.2	4.5	4.3	3.2	3.1	3.2	4.1	2.5	3.4	2.7	3.0
Percutaneous transhepatic cholangiography	6.4	3.9	6.2	7.5	6.2	4.9	4.3	4.4	4.5	5.3	3.8	3.1	4.7	3.7	3.3	4.1

Case fatality calculated as in-hospital deaths per 100 discharges for principal procedures.

Supplementary Table 5: Trends in hospital length of stay for biliary procedures																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP	5.5	5.3	5.4	5.4	5.5	5.4	5.6	5.5	5.4	5.5	5.3	5.3	5.3	4.9	5.0	5.2
Bile duct surgery	12.0	11.0	11.7	11.6	11.5	11.0	10.4	11.5	11.1	10.4	11.1	10.2	10.1	10.3	9.9	9.5
Percutaneous transhepatic cholangiography	7.9	6.8	7.9	8.0	7.8	7.5	8.0	7.2	7.5	7.8	7.3	7.5	7.4	7.4	7.2	7.7

Length of stay (in days) for principal procedures.

Supplementary Table 6: Trends in biliary procedures by age

Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP																
≤ 44	12.0	13.1	13.6	15.1	16.2	17.5	17.3	17.0	19.3	18.4	21.0	21.2	21.8	22.8	21.7	21.4
45 - 64	12.9	14.1	14.5	14.4	16.6	18.2	17.6	18.8	20.3	19.6	22.7	22.8	24.6	25.6	25.2	25.4
≥ 65	27.5	27.8	27.3	31.6	30.8	32.6	31.1	33.4	34.2	34.3	37.2	36.9	38.4	40.7	40.8	41.4
Bile duct surgery																
≤ 44	2.9	2.6	2.5	2.2	2.2	2.1	1.9	1.5	1.6	1.3	1.5	1.3	1.2	0.9	0.9	0.9
45 - 64	3.4	3.1	3.0	2.7	2.6	2.5	2.4	2.2	1.9	1.9	2.2	1.9	1.9	1.6	1.4	1.4
≥ 65	7.7	6.3	5.9	5.3	5.1	4.6	4.0	3.5	3.2	2.9	3.0	2.6	2.3	2.2	2.0	2.0
Percutaneous transhepatic cholangiography																
≤ 44	0.5	0.6	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.6	0.4	0.5	0.4
45 - 64	1.1	1.3	1.1	1.1	1.1	1.2	1.2	1.3	1.2	1.5	1.5	1.4	1.6	1.5	1.5	1.4
≥ 65	2.6	2.4	2.1	2.2	2.4	2.2	2.0	2.1	2.0	2.5	2.2	2.3	2.4	2.3	2.1	2.3

Rate of procedures per 100,000 United States residents by age.

Supplementary Table 7: Trends in biliary procedures by gender.

Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP																
Male	23.0	23.7	23.4	26.4	26.2	28.2	27.0	28.1	29.2	28.8	31.4	31.4	33.2	34.8	34.0	34.0
Female	39.0	40.7	40.5	45.7	45.5	47.6	45.3	46.5	49.6	46.7	52.1	50.8	51.7	53.1	50.7	49.8
Bile duct surgery																
Male	6.9	5.5	5.3	4.6	4.5	4.2	3.7	3.3	2.8	2.9	2.9	2.5	2.3	2.0	1.8	1.6
Female	10.0	8.6	8.0	7.2	6.7	6.1	5.3	4.6	4.3	3.7	4.0	3.4	3.0	2.6	2.4	2.2
Percutaneous transhepatic cholangiography																
Male	2.3	2.6	2.1	2.1	2.3	2.1	2.0	2.0	1.8	2.3	2.3	2.1	2.3	2.0	2.0	1.9
Female	2.7	2.6	2.2	2.2	2.3	2.3	2.1	2.2	2.1	2.4	2.2	2.1	2.4	2.1	1.9	1.9

Age-standardized rate of procedures per 100,000 United States residents by gender.

Supplemental Table 8: Trends in biliary procedures by payer																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP																
Medicare	30.5	30.6	30.1	33.8	33.7	35.4	33.3	35.5	36.3	35.4	37.3	36.7	37.9	40.1	40.1	39.6
Medicaid	4.9	5.4	5.3	6.7	6.7	8.5	7.5	8.0	8.1	8.3	8.7	9.7	10.9	10.9	10.6	10.1
Private Insurance	22.3	23.9	24.1	26.5	25.8	26.0	25.3	24.6	26.6	25.0	29.2	27.0	26.7	27.4	24.8	24.4
Uninsured	2.6	2.7	2.8	3.1	3.6	3.8	4.5	4.7	5.0	4.9	5.6	6.0	6.5	6.7	6.4	6.8
Other	1.5	1.4	1.4	1.8	2.0	2.0	1.7	1.8	2.6	2.1	2.7	2.5	2.7	2.6	2.8	2.7
Bile duct surgery																
Medicare	8.6	6.9	6.5	5.7	5.5	5.1	4.3	3.8	3.4	3.1	3.1	2.5	2.3	2.2	2.0	1.8
Medicaid	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.7	0.7	0.7	0.6	0.5	0.5	0.5
Private Insurance	5.6	4.9	4.4	4.1	3.8	3.4	3.0	2.5	2.3	2.1	2.4	2.0	1.7	1.4	1.3	1.2
Uninsured	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.3	0.3	0.3
Other	0.5	0.4	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.1
Percutaneous transhepatic cholangiography																
Medicare	2.8	2.7	2.3	2.4	2.5	2.5	2.3	2.3	2.1	2.5	2.3	2.2	2.4	2.2	2.1	2.1
Medicaid	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.4	0.4	0.3	0.5	0.4	0.4	0.4
Private Insurance	1.6	2.0	1.5	1.4	1.4	1.4	1.3	1.3	1.2	1.5	1.5	1.4	1.5	1.2	1.1	1.1
Uninsured	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Other	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Age-standardized rate of procedures per 100,000 United States residents by payer.

Supplemental Table 9: Trends in biliary procedures by hospital size																
Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP																
Small	5.6	6.4	5.1	5.2	5.9	6.0	6.0	5.5	9.6	6.7	8.7	7.0	7.2	6.9	8.5	8.0
Medium	16.5	16.6	17.5	18.0	18.5	20.7	19.3	18.7	19.4	19.1	19.1	19.0	18.2	20.9	21.1	21.3
Large	39.7	41.4	41.2	48.9	47.3	49.1	47.1	50.6	49.7	50.0	55.6	55.3	58.6	59.0	55.1	54.4
Bile duct surgery																
Small	2.3	1.7	1.4	1.2	1.3	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.4
Medium	4.5	3.9	3.4	3.2	2.8	2.6	2.3	2.1	1.8	1.7	1.5	1.3	1.1	1.0	1.1	1.0
Large	10.1	8.5	8.4	7.4	7.2	6.7	5.8	5.0	4.6	4.2	4.8	3.8	3.7	3.1	2.7	2.4
Percutaneous transhepatic cholangiography																
Small	0.5	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.4	0.5	0.3	0.4	0.3
Medium	1.1	1.2	0.8	0.8	1.0	0.9	0.8	1.1	0.8	0.8	0.8	0.8	0.7	0.8	0.9	0.8
Large	3.4	3.7	3.3	3.1	3.1	3.2	3.0	2.8	2.8	3.6	3.5	2.9	3.5	2.9	2.7	2.7

Age-standardized rate of procedures per 100,000 United States residents by hospital size. See text for description of classifications of hospital characteristics.

Supplemental Table 10: Trends in biliary procedures by metropolitan status

Year	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Therapeutic ERCP																
Non-metro	5.6	6.1	5.1	6.7	6.8	7.4	4.8	4.4	3.7	5.5	4.6	4.3	5.3	3.7	4.6	4.5
Metro	56.2	58.3	58.7	65.4	64.9	68.5	67.6	70.3	74.9	70.3	78.9	76.9	78.8	83.2	80.1	79.3
Bile duct surgery																
Non-metro	3.0	2.3	2.5	2.0	1.9	1.7	1.3	1.0	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.3
Metro	13.9	11.9	10.8	9.8	9.4	8.6	7.7	6.9	6.3	5.8	6.2	5.2	4.8	4.1	3.8	3.5
Percutaneous transhepatic cholangiography																
Non-metro	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Metro	4.8	5.0	4.1	4.1	4.4	4.2	4.0	4.1	3.8	4.6	4.4	4.0	4.5	3.9	3.8	3.7

Age-standardized rate of procedures per 100,000 United States residents by hospital size. See text for description of classifications of hospital characteristics. *Metro*, metropolitan-located hospital; *Non-metro*, non-metropolitan-located hospital.