

Incidence and Risk Factors for New Onset Diabetes Mellitus Following Surgical Resection of Pancreatic Cystic Lesions *A MarketScan Study*

SUPPLEMENTAL TABLE 1. Variables and Corresponding ICD and CPT Coding			
	ICD-9-CM/PCS Code	ICD-10-CM/PCS Code	CPT Code
Inclusion			
Pancreatic cystic lesion	577.2	K86.2, K86.3	
Pancreatectomy, distal	52.52	0FBG*, 0FTG*	48140, 48145, 48146
Pancreatectomy, proximal (Whipple-type procedure)	52.51, 52.7	0FBG* or 0FTG* + 0DT9* or 0DB9*	48150, 48152, 48153, 48154
Pancreatectomy, unknown proximal or distal	52.5, 52.53, 52.59		
Excision of lesion of pancreas			48120
Exclusion			
Any prior DM or use of DM medications	249*, 250*	E08*, E09*, E10*, E11*, E13*	
Pregnancy	63*, 64*, 65*, 66*, 670*, 671*, 672*, 673*, 674*, 675*, 676*, 677*, V22*, V23*, V24*, V27*, V28.0*, V28.1*, V28.2*, V28.6*, V61.5, V61.6, V61.7, 792.3, 796.5, V65.11, V72.42, 72.*, 73.*, 74.*, 75.0*, 75.1*, 75.2*, 75.4*, 75.5*, 75.3, 75.30, 75.31, 75.32, 75.33, 75.34, 75.35, 75.36, 75.37	O0*, O1*, O2*, O3*, O4*, O6*, O7*, O8*, O9* Z76.81, Z64.0, Z64.1, Z32.01, Z33*, Z34*, Z36*, Z37*, Z39*, Z3A*, 10*	
Total pancreatectomy	V88.11	Z90.410	48155
Prior partial pancreatectomy	V88.12	Z90.411	
Prior other pancreatic surgery†			48000, 48001, 48020, 48510, 48545, 48547, 48548, 48550, 48551, 48552, 48554, 48556, 48999
Islet cell transplantation			48160
Necrosectomy following acute pancreatitis			48105
Acute pancreatitis	577.0	K85*	
Chronic pancreatitis	577.1	K86.0, K86.1	
Cystic Fibrosis	277.0*	E84*	
Hemochromatosis	275.01, 275.02, 275.03	E83.11*	
Pancreatic cancer	157*	C25*	
Outcome			
Diabetes mellitus	249*, 250*	E08*, E09*, E10*, E11*, E13*	
Post-surgical hypoinsulinemia	251.3	E89.1	
Other variables			
Open surgery	54.21 not present	0FBG0*, 0FTG0*	48999 not present
Laparoscopic or robotic surgery	54.21 present	0FBG4*, 0FTG4*	48999 present
Splenectomy during pancreas resection	41.43, 41.5	07TP*, 07BP*	38100, 38101, 38102, 38120

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SUPPLEMENTAL TABLE 1. (Continued)

	ICD-9-CM/PCS Code	ICD-10-CM/PCS Code	CPT Code
Comorbidities			
Essential hypertension	401*	I10*	
Hyperlipidemia	272.0, 272.1, 272.2, 272.3, 272.4, 272.8, 272.9	E78.0, E78.1, E78.2, E78.3, E78.4*, E78.5, E78.8*, E78.9	
Obesity	278.00, 278.01, 278.02, V85.3*, V85.4*	E66.0*, E66.1, E66.2, E66.8, E66.9, Z68.3*, Z68.4*	
Tobacco use	305.1, V15.82	F17.20*, F17.21*, F19.9*, Z87.891	
Alcohol abuse/dependence	303*, 305.0*	F10*	
Pancreatic anomalies	751.7	Q45.0, Q45.1, Q45.3	
Cardiovascular disease/heart failure	410*, 411*, 412*, 413*, 414*, 428*, 440*, 441*, 443.2*, 443.81, 443.9, 444*, 445*	I21*, I22*, I23*, I24*, I25*, I50*, I70*, I71*, I73.89, I73.9, I77.7*, I74*, I75*	
Cerebrovascular disease	430*, 431*, 432*, 433*, 434*, 435*, 436*, 437*, 438*	I60*, I61*, I62*, I63*, I65*, I66*, I67*, I68*, I69*	
Chronic kidney disease	403*, 404*, 582*, 583*, 585*, 586*, 588*, V42.0, V45.1*, V56*	I12*, I13*, N03*, N05*, N18*, N19*, N25*, Z94.0, Z99.2, Z49*	
Alcoholic liver disease	571.0, 571.1, 571.2, 571.3	K70*	
Chronic hepatitis B	070.22, 070.23, 070.32, 070.33	B18.0, B18.1	
Chronic hepatitis C	070.44, 070.54, 070.7*	B18.2	
COPD	490*, 491*, 492*, 493*, 494*, 495*, 496*	J40*, J41*, J42*, J43*, J44*, J45*, J47*	
Depression	296.2*, 296.3*, 300.4, 311	F32*, F33*, F34.1	
Charlson comorbidity index	—	—	

*Denotes inclusion of all subsequent codes with the preceding numerals.

†Not including codes related to pancreatic cysts; biopsy of pancreas (48100, 48102), injection procedure of pancreas (48400), internal anastomosis of pancreatic cyst to gastrointestinal tract (48520, 48540), marsupialization of pancreatic cyst (48500).

ICD-9-CM indicates *International Classification of Diseases*, ninth edition clinical modification; PCS, procedural coding system; CPT, current procedural terminology; DM, diabetes mellitus; COPD, chronic obstructive pulmonary disease.

SUPPLEMENTAL TABLE 2. Stepwise Exclusions Applied to Achieve Final Study Cohort

MarketScan 2012–2018	No. Subjects
Partial pancreatectomy	14,396
PCLs	2006
Exclusions	
No enrollment information	73
<18 years old	165
<3 months prior enrollment	1481
<1 month post-surgery enrollment	576
Total pancreatectomy	821
Pregnancy	146
Islet auto-transplantation	9
Cystic fibrosis	18
Hemochromatosis	45
Necrosectomy	275
No data/encounters prior to surgery	30
DM or DM meds within 12 months prior	3675
Prior pancreatic enzymes	188
AP within 6 months prior	1809
Prior CP	522
Prior other pancreas surgery	485
Prior pancreatectomy	1
Total exclusions	10,319
Remaining	4077
PCLs	390
Non-PCLs	3687
Further exclusions for cysts	
Prior pancreatic cancer (not including surgery date)	79
Final inclusion	311

PCL indicates pancreatic cystic lesion; AP, acute pancreatitis; CP, chronic pancreatitis.

SUPPLEMENTAL TABLE 3. Diabetic Medications Searched for in the MarketScan Database to Denote the Presence of Diabetes Mellitus

Medication Class	Single (Generic)	Combination (Generic)	Brand Name	
α-glucosidase inhibitors	Acarbose		Precose	
	Miglitol		Glyset	
Biguanides	Metformin		Glucophage, Metformin Hydrochloride ER, Glumetza, Riomet, Fortamet	
		metformin-alogliptin	Kazano	
		metformin-canagliflozin	Invokamet	
		metformin-dapagliflozin	Xigduo XR	
		metformin-empagliflozin	Synjardy	
		metformin-glipizide		
		metformin-glyburide	Glucovance	
		metformin-linagliptin	Jentaduetto	
		metformin-pioglitazone	Actoplus	
		metformin-repaglinide	PrandiMet	
		metformin-rosiglitazone	Avandamet	
		metformin-saxagliptin	Kombiglyze XR	
		metformin-sitagliptin	Janumet	
		DPP-4 inhibitors	Alogliptin	
Alogliptin-metformin	Kazano			
linagliptin	Alogliptin-pioglitazone		Oseni	
	linagliptin-empagliflozin		Tradjenta	
saxagliptin	linagliptin-metformin		Glyxambi	
	saxagliptin-metformin		Jentaduetto	
sitagliptin			Onglyza	
	sitagliptin-metformin		Kombiglyze XR	
GLP-1 receptor agonists	albiglutide dulaglutide exenatide exenatide extended-release liraglutide semaglutide lixisenatide <i>Meglitinides</i> nateglinide repaglinide			Januvia
			Sitagliptin-simvastatin	Janumet, Janumet XR
			Juvisync	
			Tanzeum	
			Trulicity	
			Byetta	
			Bydureon	
			Victoza	
			Ozempic	
			Adlyxin	
SGLT-2 inhibitors	dapagliflozin	repaglinide-metformin	Prandimet	
		dapagliflozin-metformin	Farxiga	
	canagliflozin		Xigduo XR	
		canagliflozin-metformin	Invokana	
	empagliflozin		Invokamet	
		empagliflozin-linagliptin	Jardiance	
ertugliflozin	empagliflozin-metformin	Glyxambi		
		Synjardy		
Sulfonylureas	glimepiride		Steglatro	
		glimepiride-pioglitazone	Amaryl	
	gliclazide glipizide	glimepiride-rosiglitazone	Duetact	
			Avandaryl	
		Glucotrol, Glucotrol XL		

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SUPPLEMENTAL TABLE 3. *(Continued)*

Medication Class	Single (Generic)	Combination (Generic)	Brand Name	
Thiazolidinediones	glyburide	glipizide-metformin	Metaglip DiaBeta, Glynase, Micronase, Glycron	
		glyburide-metformin	Glucovance	
	chlorpropamide tolazamide tolbutamide			Diabinese Tolinase Orinase, Tol-Tab
			rosiglitazone	Avandia
			rosiglitazone-glimepiride	Avandaryl
	pioglitazone		rosiglitazone-metformin	Amaryl M Actos
			pioglitazone-alogliptin	Oseni
			pioglitazone-glimepiride	Duetact
			pioglitazone-metformin	Actoplus Met, Actoplus Met XR
Insulin	Aspart Glulisine Lispro Regular		Novolog, Fiasp Apidra Humalog, Admelog	
			Humulin R, Novolin R, Velosulin R	
			Humulin N, Novolin N, ReliOn	
	NPH Detemir Glargine Degludec		Levemir Basaglar, Lantus, Toujeo Tresiba	
			Novolog mix 70/30	
			Humalog mix 75/25 and 50/50	
		Aspart protamine and aspart mixture Lispro protamine and lispro mixture NPH and regular mixture	Humulin mix 70/30, Novolin mix 70/30	
		Humulin R U-500		

DPP-4 indicates dipeptidyl peptidase-4; GLP-1, glucagon-like peptide-1; SGLT-2, sodium-glucose cotransporter-2.

SUPPLEMENTAL TABLE 4. Kaplan-Meier Estimates for Time to NODM at Select Time Points for Subjects Undergoing Distal Compared to Proximal Pancreatectomy for PCLs: Analysis of the IBM MarketScan Research Database®, 2012-2018

Time Post-Surgery, mo	Distal (95% CI), %	Proximal (95% CI), %
3	7.0 (4.3–11.3)	7.4 (3.2–16.9)
6	9.6 (6.3–14.5)	9.2 (4.2–19.4)
12	17.5 (12.6–24.0)	11.3 (5.5–22.5)
18	20.3 (14.8–27.5)	11.3 (5.5–22.5)
24	24.4 (18.1–32.5)	11.3 (5.5–22.5)
36	27.7 (20.5–36.9)	11.3 (5.5–22.5)
48	35.7 (25.7–48.2)	26.1 (8.5–64.1)

NODM indicates new-onset diabetes mellitus; PCL, pancreatic cystic lesion; CI, confidence interval.