

eAppendix methods

eAppendix Table 1. Diagnosis Codes for Identification of Patients with Cardiovascular, Heart Failure or Renal Related Hospitalizations

Diagnosis Codes for Identification of Cardiovascular Related Hospitalizations

Cardiovascular, Cerebrovascular and Peripheral Vascular Disease	ICD-9 Diagnosis Code
Cardiovascular Disease	
Aortic and other aneurysms	441, 442
Hypotension	458
Angina	413
Conduction disorders and cardiac dysrhythmias	426–427
Arteriosclerotic cardiovascular disease	429.2
Cardiomegaly	429.3
Cardiomyopathy	425
Other acute and subacute forms of ischemic heart disease	411
Diabetes with peripheral circulatory disorders	250.7
Myocardial degeneration	429.1
Myocardial infarction	410, 412
Other chronic ischemic heart disease	414
Hypertension	401–405
Peripheral Vascular Disease	
Atherosclerosis	440
Embolism and thrombosis, structure of artery	444, 447.1
Other peripheral vascular disease	443
Other disorders of circulatory system	459
Phlebitis and thrombophlebitis, portal vein thrombosis, thrombolism, and venous thrombolism	451, 452
Other venous embolism and thrombolism	453
Varicose veins of lower extremities	454
Gangrene and amputations	785.4, 885–887, 895–897
Chronic ulcer of skin	707
Cerebrovascular Disease	
Occlusion of cerebral arteries	434
Hemorrhagic stroke	430–432
Late effects of cerebrovascular disease	438
Occlusion of stenosis of precerebral arteries	433
Other and ill-defined cerebrovascular disease	437
Acute, but ill-defined, cerebrovascular disease	436
Transient ischemic attacks	435

Reference: American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. Diabetes Care. 2013 Apr;36(4):1033-46.

Diagnosis Codes for Identification of Heart Failure Related Hospitalizations

Heart Failure	ICD-9 Diagnosis Code
Heart Failure	428

Reference: American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. Diabetes Care. 2013 Apr;36(4):1033-46.

Diagnosis Codes for Identification of Renal Related Hospitalizations

Renal Complications	ICD-9 Diagnosis Code
Infections of kidney	590
Other disorders of bladder	596
Cystitis	595
Renal sclerosis, unspecified	587
Glomerulonephritis, nephrotic syndrome, nephritis, and nephropathy	580-583
Proteinuria	791.0
Renal failure and its sequelae	584, 586, 588
Other disorders of kidney and ureter	593
Urinary tract infection	599.0
Diabetes and renal complications	250.4
Chronic renal failure (ESRD)	585

Reference: American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. Diabetes Care. 2013 Apr;36(4):1033-46.

eAppendix Table 2. GPI codes for Insulin and non-insulin glucose-lowering medications

Antidiabetic Class	Drugs in class	GPI code
Oral Antidiabetic Medications		
Biguanides *	metformin	2725
Sulfonylureas	chlorpropamide, glimepiride, glipizide, glyburide, tolazamide, tolbutamide	2720
Thiazolidinediones (TZDs)	Actos (pioglitazone), Avandia (rosiglitazone)	2760
Amylin agonists	Synlin (pramlintide)	2715
Meglitinides	Prandin (repaglinide), Starlix (nateglinide)	2723, 2728
Alpha-glucosidase inhibitors	Precose (acarbose), Glyset (miglitol)	2750
Dipeptidyl peptidase-4 (DPP-4) inhibitors	Januvia (sitagliptin), Onglyza (saxagliptin), Tradjenta (linagliptin), Nesina (alogliptin)	2755
SGLT-2 Inhibitors	Invokana (canagliflozin), Farxiga (dapagliflozin), Jardiance (empagliflozin)	2770
Bile acid sequestrants	Welchol (colesevelam)	3910001610
Dopamine-2 agonists	Cycloset (bromocriptine)	2757
Glucagon		2730001010, 2730001015
Oral fixed dose combinations	All combinations	2799
Glucagon-like peptide-1 (GLP-1) receptor agonists	Byetta (exenatide), Victoza (liraglutide), Bydureon (exenatide), Tanzeum (albiglutide), Trulicity (dulaglutide)	2717
Insulin	All insulins	2710

eAppendix Table 3. GPI Codes for Cardiovascular Medications

GPI-2 Code	Cardiovascular Medication Class
31*	Cardiotonics
32*	Antianginal Agents
33*	Beta Blockers
34*	Calcium Channel Blockers
35*	Antiarrhythmics
36*	Antihypertensives
37*	Diuretics
38*	Vasopressors
39*	Antihyperlipidemics
40*	Cardiovascular Agents-Misc.

Reference: Feldman SR, Zhao Y, Shi L, Tran MH. Economic and Comorbidity Burden Among Patients with Moderate-to-Severe Psoriasis. *J Manag Care Spec Pharm.* 2015 Oct;21(10):874-88.

eAppendix Table 4. Diabetes Complications Severity Index Diagnosis Codes

Complication	ICD-9 Diagnosis	ICD9	Weight *
Retinopathy	Diabetic ophthalmologic disease	250.5x	1
Retinopathy	Background retinopathy	362.01	1
Retinopathy	Other retinopathy	362.1	1
Retinopathy	Retinal edema	362.83	1
Retinopathy	Cystoid macular edema/degeneration	362.53	1
Retinopathy	Other retinal disorders	362.81, 362.82	1
Retinopathy	Proliferative retinopathy	362.02	2
Retinopathy	Retinal detachment	361.xx	2
Retinopathy	Blindness	369.xx .00-.99	2
Retinopathy	Vitreous hemorrhage	379.23	2
Nephropathy	Diabetic nephropathy	250.4	1
Nephropathy	Acute glomerulonephritis	580	1
Nephropathy	Nephrotic syndrome	581	1
Nephropathy	Hypertension, nephrosis	581.81	1
Nephropathy	Chronic glomerulonephritis	582	1
Nephropathy	Nephritis/nephropathy	583	1
Nephropathy	Chronic renal failure	585	2
Nephropathy	Renal failure, not otherwise specified	586	2
Nephropathy	Renal insufficiency	593.9	2
	Urine protein >30 mg/g of creatinine, or (+) dipstick protein or serum creatinine >1.5 mg/dL		1
	Serum creatinine >2.0 mg/dL		2
Neuropathy	Diabetic neuropathy	356.9, 250.6	1
Neuropathy	Amyotrophy	358.1	1
Neuropathy	Cranial nerve palsy	951.0, 951.1, 951.3	1
Neuropathy	Mononeuropathy	354.0-355.9	1
Neuropathy	Charcot's arthropathy	713.5	1
Neuropathy	Polyneuropathy	357.2	1
Neuropathy	Neurogenic bladder	596.54	1
Neuropathy	Autonomic neuropathy	337.0, 337.1	1
Neuropathy	Gastroparesis/diarrhea	564.5, 536.3	1
Neuropathy	Orthostatic hypotension	458	1
Cerebrovascular	Transient ischemic attack	435	1
Cerebrovascular	Stroke	431, 433, 434, 436	2

Complication	ICD-9 Diagnosis	ICD9	Weight *
Cardiovascular	Atherosclerosis	440.xx	1
Cardiovascular	Other ischemic heart disease	411	1
Cardiovascular	Angina pectoris	413	1
Cardiovascular	Other chronic IHD	414	1
Cardiovascular	Myocardial infarction	410	2
Cardiovascular	Ventricular fibrillation, arrest	427.1, 427.3	2
Cardiovascular	Atrial fibrillation, arrest	427.4, 427.5	2
Cardiovascular	Other atherosclerotic cardiovascular disease	429.2	1
Cardiovascular	Old myocardial infarction	412	2
Cardiovascular	Heart failure	428	2
Cardiovascular	Atherosclerosis, severe	440.23, 440.24	2
Cardiovascular	Aortic aneurysm/dissection	441	2
PVD	Diabetic peripheral vascular disease	250.7	1
PVD	Other aneurysm	442.3	1
PVD	PVD	443.81, 443.9	1
PVD	Foot wound + complication	892.1	1
PVD	Claudication, intermittent	443.9	1
PVD	Embolism/thrombosis (lower extremity)	444.22	2
PVD	Gangrene	785.4	2
PVD	Gas gangrene	040.0	2
PVD	Ulcer of lower limbs	707.1	2
Metabolic	Ketoacidosis	250.1	2
Metabolic	Hyperosmolar	250.2	2
Metabolic	Other coma	250.3	2

* Bessie Ann Young and Elizabeth Lin et al. Diabetes Complications Severity Index and Risk of Mortality, Hospitalization, and Healthcare Utilization. Am J Manag Care. 2008 January ; 14(1): 15–23.

eAppendix Table 5. Deyo Charlson Comorbidity Categories and Associated Diagnosis Codes and Weights

Enhanced (Quan, 2005) Coding Algorithm for Charlson Comorbidities

Number	Comorbidity	ICD-9-CM Codes	Weight
1	Myocardial Infarction	410.x, 412.x	1
2	Congestive Heart Failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4–425.9, 428.x	1
3	Peripheral Vascular Disease	093.0, 440.x, 441.x, 443.1–443.9, 557.1, 557.9, V43.4	1
4	Cerebrovascular Disease	362.34, 430.x–438.x	1
5	Dementia	290.x, 294.1, 331.2	1
6	Chronic Pulmonary Disease	416.8, 416.9, 490.x–505.x, 506.4, 508.1, 508.8	1
7	Connective Tissue Disease	446.5, 710.0–710.4, 714.0–714.2, 714.8, 725.x	1
8	Peptic Ulcer Disease	531.x–534.x	1
9	Mild Liver Disease	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.6, 070.9, 570.x, 571.x, 573.3, 573.4, 573.8, 573.9, V42.7	1
10	Diabetes without Complications	250.0–250.3, 250.8, 250.9	1
11	Diabetes with Complications	250.4–250.7	2
12	Paraplegia and Hemiplegia	334.1, 342.x, 343.x, 344.0–344.6, 344.9	2
13	Renal Disease	403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 582.x, 583.0–583.7, 585.x, 586.x, 588.0, V42.0, V45.1, V56.x	2
14	Cancer (Including Leukemia and Lymphoma)	140.x–172.x, 174.x–195.8, 200.x–208.x, 238.6	2
15	Moderate or Severe Liver Disease	456.0–456.2, 572.2–572.8	3
16	Metastatic Carcinoma	196.x–199.x	6
17	Acquired Immunodeficiency Syndrome (AIDS)	042.x–044.x	6

*ICD-9-CM Procedural Code

References

- ¹Deyo RA, Cherkin DC, and Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology* 1992; 45: 613-619.
- ²Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi J-C, Saunders LD, Beck CA, Feasby TE, Ghali WA. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Medical Care* 2005;43(11):1130-1139.
- ³Klabunde CN, Potosky AL, Legler JM, and Warren JL. Development of a comorbidity index using physician claims data. *Journal of Clinical Epidemiology*. 2000; 53:1258-1267.

eAppendix Table 6. CPT codes for Identification of HbA1c Testing

Code	Description	Code Type	Code Category
3044F	Most recent hemoglobin A1c (HbA1c) level less than 7.0% (DM)	CPT	HbA1C
3045F	Most recent hemoglobin A1c (HbA1c) level 7.0-9.0% (DM)	CPT	HbA1C
3046F	Most recent hemoglobin A1c level greater than 9.0% (DM)	CPT	HbA1C
83036	Hemoglobin A1c (glycosylated hemoglobin)	CPT	HbA1C
83037	Hemoglobin A1c (glycosylated hemoglobin)	CPT	HbA1C

eAppendix Table 7. ICD Codes for Comorbid Conditions

Comorbid Conditions	ICD 9 CM Codes
Acute heart failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9
Acute myocardial infarction	410.00, 410.01, 410.02, 410.10, 410.11, 410.12, 410.20, 410.21, 410.22, 410.30, 410.31, 410.32, 410.40, 410.41, 410.42, 410.50, 410.51, 410.52, 410.60, 410.61, 410.62, 410.70, 410.71, 410.72, 410.80, 410.81, 410.82, 410.90, 410.91, 410.92
Alcohol use	303.00, 303.01, 303.02, 303.03, 303.90, 303.91, 303.92, 303.93, 305.00, 305.01, 305.02, 305.03
Amputations	895.0, 895.1, 896.0, 896.1, 896.2, 896.3, 897.0, 897.1, 897.2, 897.3, 897.4, 897.5, 897.6, 897.7, V49.71, V49.72, V49.73, V49.74, V49.75, V49.76
Amputations (procedure codes)	84.11, 84.12, 84.13, 84.14, 84.15
Chronic kidney disease	249.40, 249.41, 250.40, 250.41, 250.42, 250.43, 285.21, 403.00, 403.01, 403.10, 403.11, 403.90, 403.91, 404.00, 404.01, 404.02, 404.03, 404.10, 404.11, 404.12, 404.13, 404.90, 404.91, 404.92, 404.93, 405.01, 405.11, 405.91, 458.21, 581.81, 582.0, 582.1, 582.2, 582.4, 582.81, 582.89, 582.9, 583.0, 583.1, 583.2, 583.4, 583.6, 583.7, 583.81, 583.89, 583.9, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 585.9, 587, 588.0, 588.81, 588.89, 588.9, 590.00, 590.01, 590.80, 590.81, 593.71, 593.72, 593.73, 792.5, 996.56, 996.68, 996.73, 996.81, V42.0, V45.11, V45.12, V56.0, V56.1, V56.2, V56.31, V56.32, V56.8
Coronary artery disease	414.01
Erectile dysfunction or male impotence	607.84
Gastrointestinal autonomic dysfunction	536.3, 564.5, 564.81, 564.89

Hyperlipidemia	272.0, 272.1, 272.2, 272.3, 272.4
Hypertension	401.0, 401.1, 401.9
Ischemic heart disease	410.00, 410.01, 410.02, 410.10, 410.11, 410.12, 410.20, 410.21, 410.22, 410.30, 410.31, 410.32, 410.40, 410.41, 410.42, 410.50, 410.51, 410.52, 410.60, 410.61, 410.62, 410.70, 410.71, 410.72, 410.80, 410.81, 410.82, 410.90, 410.91, 410.92, 411.0, 411.1, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07, 414.10, 414.11, 414.12, 414.19, 414.2, 414.3, 414.4, 414.8, 414.9, 429.71, 429.79, V45.81, V45.82
Ischemic stroke or transient ischemic attack	346.60, 346.61, 346.62, 346.63, 362.34, 362.35, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 435.0, 435.1, 435.2, 435.3, 435.8, 435.9, 436
Lower limb abscess or ulcer	454.0, 454.2, 680.6, 680.7, 681.10, 681.9, 682.6, 682.7, 682.9, 707.00, 707.01, 707.02, 707.03, 707.04, 707.05, 707.06, 707.07, 707.09, 707.10, 707.11, 707.12, 707.13, 707.14, 707.15, 707.19, 707.20, 707.21, 707.22, 707.23, 707.24, 707.25, 707.8, 707.9, 730.06, 730.07, 730.08, 730.09, 785.4, 997.60, 997.61, 997.62, 997.69
Neuropathy	249.60, 249.61, 250.60, 250.61, 337.1, 357.2, 357.4, 354.0, 354.1, 354.2, 354.3, 354.4, 354.5, 354.8, 354.9, 355.0, 355.1, 355.2, 355.3, 355.4, 355.5, 355.6, 355.71, 355.79, 355.8, 355.9, 358.1, 536.3, 713.5
Peripheral vascular arterial surgery	250.70, 250.71, 250.72, 250.73, 440.20, 440.21, 440.22, 440.23, 440.24, 440.29, 440.30, 440.31, 440.32, 440.4, 440.8, 440.9, 442.0, 442.2, 442.3, 442.81, 442.82, 442.89, 442.9, 443.22, 443.29, 443.89, 443.9, 444.21, 444.22, 444.81, 444.89, 444.9, 445.01, 445.02, 445.89
Diabetic retinopathy and other eye complications	249.50, 249.51, 250.50, 250.51, 250.52, 250.53, 362.01, 362.02, 362.03, 362.04, 362.05, 362.06, 362.07, 362.10, 362.14, 362.16, 362.30, 362.31, 362.32, 362.33, 362.40, 362.41, 362.42, 362.43, 362.81, 362.82, 362.83, 362.84, 362.85, 362.89, 364.22, 365.00, 365.01, 365.02, 365.03, 365.04, 365.05, 365.06, 365.10, 365.11, 365.12, 365.13, 365.14, 365.15, 365.44, 365.60, 365.63, 365.81, 365.89, 365.9, 366.31, 366.41, 366.8, 366.9, 377.14, 379.23, 369.00, 369.01, 369.02, 369.03, 369.04, 369.05, 369.06, 369.07, 369.08, 369.10, 369.11, 369.12, 369.13, 369.14, 369.15, 369.16, 369.17, 369.18, 369.20, 369.21, 369.22, 369.23, 369.24, 369.25, 369.3, 369.4, 369.60, 369.61, 369.62, 369.63, 369.64, 369.65, 369.66, 369.67, 369.68, 369.69, 369.70, 369.71, 369.72, 369.73, 369.74, 369.75, 369.76, 369.8, 369.9.
Skin complications	681.00, 681.01, 681.02, 681.10, 681.11, 681.9, 682.0, 682.1, 682.2, 682.3, 682.4, 682.5, 682.6, 682.7, 682.8,

	682.9, 707.00, 707.01, 707.02, 707.03, 707.04, 707.05, 707.06, 707.07, 707.09, 707.10, 707.11, 707.12, 707.13, 707.14, 707.15, 707.19, 707.20, 707.21, 707.22, 707.23, 707.24, 707.25, 707.8, 707.9, 785.4
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eAppendix Table 8. Baseline Demographic Characteristics of CV and no CV Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	CV	no CV	P-value	CV	no CV	P-value
n	204,398	184,325		16,831	36,904	
Age, mean (SD)	72.59 (±8.53)	70.30 (±7.97)	<.0001	57.35 (±9.94)	53.65 (±9.85)	<.0001
Gender = female (vs. male), n (%)	96900 (47.4%)	94771 (51.4%)	<.0001	7565 (44.9%)	19004 (51.5%)	<.0001
Race/ethnicity, n (%)						
White	167925 (82.2%)	145007 (78.7%)	<.0001			
Black	27113 (13.3%)	27978 (15.2%)				
Hispanic	3201 (1.6%)	3057 (1.7%)				
Other	4719 (2.3%)	6598 (3.6%)				
Unknown	1440 (0.7%)	1685 (0.9%)				
Geographic region, n (%)						
Northeast	5179 (2.5%)	4794 (2.6%)	<.0001	30 (0.2%)	60 (0.2%)	<.0001
Midwest	49337 (24.1%)	40452 (21.9%)		4914 (29.2%)	9705 (26.3%)	
South	130981 (64.1%)	118721 (64.4%)		11414 (67.8%)	25666 (69.5%)	
West	18901 (9.2%)	20358 (11.0%)		473 (2.8%)	1472 (4.0%)	
Low Income Subsidy recipients, n (%)	24669 (12.1%)	18722 (10.2%)	<.0001			
Population density						
Urban	127448 (62.4%)	113077 (61.3%)	<.0001	12952 (77.0%)	27987 (75.8%)	0.0364
Suburban	51716 (25.3%)	47600 (25.8%)		2867 (17.0%)	6632 (18.0%)	
Rural	23763 (11.6%)	22254 (12.1%)		860 (5.1%)	1925 (5.2%)	
Unknown	1471 (0.7%)	1394 (0.8%)		152 (0.9%)	360 (1.0%)	

SD: standard deviation.

Note: Race/ethnicity and Low Income Subsidy status not available for patients enrolled in commercial health plans.

eAppendix Table 9. Baseline Demographic Characteristics of HF and no HF Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	HF		P-value	HF		P-value
n	65,582	60,656		2,544	7,470	
Age, mean (SD)	73.99 (±8.57)	71.53 (±8.26)	<.0001	60.93 (±10.61)	55.21 (±9.92)	<.0001
Gender = female (vs. male), n (%)	28572 (43.6%)	31056 (51.2%)	<.0001	1004 (39.5%)	3872 (51.8%)	<.0001
Race/ethnicity, n (%)						
White	54485 (83.1%)	48742 (80.4%)	<.0001			
Black	8552 (13.0%)	8754 (14.4%)				
Hispanic	902 (1.4%)	1014 (1.7%)				
Other	1225 (1.9%)	1793 (3.0%)				
Unknown	418 (0.6%)	353 (0.6%)				
Geographic region, n (%)						
Northeast	1676 (2.6%)	1431 (2.4%)	<.0001	5 (0.2%)	17 (0.2%)	<.0001
Midwest	16665 (25.4%)	13327 (22.0%)		878 (34.5%)	1994 (26.7%)	
South	41740 (63.6%)	40086 (66.1%)		1611 (63.3%)	5147 (68.9%)	
West	5501 (8.4%)	5812 (9.6%)		50 (2.0%)	312 (4.2%)	
Low income subsidy recipients, n (%)	9635 (14.7%)	6251 (10.3%)	<.0001			
Population density						
Urban	40321 (61.5%)	38263 (63.1%)	<.0001	1983 (77.9%)	5707 (76.4%)	0.2707
Suburban	17045 (26.0%)	15135 (25.0%)		426 (16.7%)	1312 (17.6%)	
Rural	7782 (11.9%)	6844 (11.3%)		118 (4.6%)	379 (5.1%)	
Unknown	434 (0.7%)	414 (0.7%)		17 (0.7%)	72 (1.0%)	

SD: standard deviation.

Note: Race/ethnicity and Low Income Subsidy status not available for patients enrolled in commercial health plans.

eAppendix Table 10. Baseline Demographic Characteristics of Renal and no Renal Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	Renal	no Renal	P-value	Renal	no Renal	P-value
n	114,136	105,461		5,969	14,644	
Age, mean (SD)	73.82 (±8.49)	70.99 (±8.16)	<.0001	59.25 (±10.96)	54.78 (±9.72)	<.0001
Gender = female (vs. male), n (%)	53706 (47.1%)	53778 (51.0%)	<.0001	2729 (45.7%)	7601 (51.9%)	<.0001
Race/ethnicity, n (%)						
White	93286 (81.7%)	84834 (80.4%)	<.0001			
Black	15956 (14.0%)	15063 (14.3%)				
Hispanic	1727 (1.5%)	1729 (1.6%)				
Other	2471 (2.2%)	3145 (3.0%)				
Unknown	696 (0.6%)	690 (0.7%)				
Geographic region, n (%)						
Northeast	2708 (2.4%)	2542 (2.4%)	<.0001	7 (0.1%)	28 (0.2%)	<.0001
Midwest	28484 (25.0%)	23191 (22.0%)		1872 (31.4%)	3861 (26.4%)	
South	72685 (63.7%)	69331 (65.7%)		3913 (65.6%)	10198 (69.6%)	
West	10259 (9.0%)	10397 (9.9%)		177 (3.0%)	556 (3.8%)	
Low income subsidy recipients, n (%)	15707 (13.8%)	10615 (10.1%)	<.0001			
Population density						
Urban	72563 (63.6%)	65312 (61.9%)	<.0001	4712 (78.9%)	11179 (76.3%)	0.0009
Suburban	28301 (24.8%)	26959 (25.6%)		934 (15.6%)	2564 (17.5%)	
Rural	12452 (10.9%)	12367 (11.7%)		272 (4.6%)	748 (5.1%)	
Unknown	820 (0.7%)	823 (0.8%)		51 (0.9%)	153 (1.0%)	

SD: standard deviation.

Note: Race/ethnicity and Low Income Subsidy status not available for patients enrolled in commercial health plans.

eAppendix Table 11. Baseline Clinical Characteristics of CV and Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	CV		P-value	CV		P-value
n	204398	184325		16831	36904	
Classes of oral antidiabetic medications, mean (SD)	0.92 (±0.87)	1.03 (±0.86)	<.0001	0.97 (±0.92)	1.15 (±0.84)	<.0001
GLP-1 agonists, mean (SD)	0.04 (±0.49)	0.05 (±0.59)	<.0001	0.16 (±1.10)	0.21 (±1.23)	<.0001
Insulins, mean (SD)	0.83 (±2.71)	0.69 (±2.46)	<.0001	0.85 (±2.71)	0.69 (±2.50)	<.0001
Classes of cardiovascular medications, mean (SD)	3.07 (±1.94)	2.67 (±1.70)	<.0001	2.49 (±1.86)	2.00 (±1.56)	<.0001
Diabetes complications severity index, mean (SD)	2.44 (±2.05)	1.54 (±1.69)	<.0001	1.24 (±1.62)	0.58 (±1.05)	<.0001
Deyo Charlson comorbidity index, mean (SD)	2.57 (±2.25)	1.96 (±1.73)	<.0001	1.57 (±1.84)	1.08 (±1.14)	<.0001
Count of HbA1c tests, mean (SD)	1.88 (±1.36)	2.01 (±1.24)	<.0001	1.42 (±1.26)	1.64 (±1.16)	<.0001
Specialty of prescribing physician, n (%)						
Cardiology	417 (0.2%)	257 (0.1%)	<.0001	42 (0.2%)	77 (0.2%)	<.0001
Endocrinology	< 10	< 10		< 10	57 (0.2%)	
Gastroenterology	118 (0.1%)	144 (0.1%)		12 (0.1%)	91 (0.2%)	
Primary care	116585 (57.0%)	119117 (64.6%)		9593 (57.0%)	25910 (70.2%)	
Other	9108 (4.5%)	9082 (4.9%)		878 (5.2%)	2653 (7.2%)	
Unknown	78167 (38.2%)	55719 (30.2%)		6301 (37.4%)	8116 (22.0%)	
Comorbid conditions, n (%)						
Acute heart failure	19323 (9.5%)	5915 (3.2%)	<.0001	640 (3.8%)	287 (0.8%)	<.0001
Acute myocardial infarction	1203 (0.6%)	313 (0.2%)	<.0001	100 (0.6%)	52 (0.1%)	<.0001
Alcohol use	1573 (0.8%)	807 (0.4%)	<.0001	161 (1.0%)	100 (0.3%)	<.0001
Amputations	526 (0.3%)	189 (0.1%)	<.0001	33 (0.2%)	10 (0.0%)	<.0001
Chronic kidney disease	40665 (19.9%)	25014 (13.6%)	<.0001	1386 (8.2%)	1296 (3.5%)	<.0001
Coronary artery disease	24872 (12.2%)	10618 (5.8%)	<.0001	1192 (7.1%)	940 (2.5%)	<.0001
Erectile dysfunction or male impotence	3082 (1.5%)	3204 (1.7%)	<.0001	198 (1.2%)	460 (1.2%)	0.4933
Gastrointestinal autonomic dysfunction	857 (0.4%)	352 (0.2%)	<.0001	76 (0.5%)	58 (0.2%)	<.0001
Hyperlipidemia	110259 (53.9%)	104382 (56.6%)	<.0001	7676 (45.6%)	17562 (47.6%)	<.0001

Hypertension	137358 (67.2%)	114012 (61.9%)	<.0001	9796 (58.2%)	17675 (47.9%)	<.0001
Ischemic heart disease	35440 (17.3%)	16108 (8.7%)	<.0001	1419 (8.4%)	1157 (3.1%)	<.0001
Ischemic stroke or transient ischemic attack	5757 (2.8%)	2401 (1.3%)	<.0001	247 (1.5%)	195 (0.5%)	<.0001
Lower limb abscess or ulcer	9410 (4.6%)	3553 (1.9%)	<.0001	665 (4.0%)	513 (1.4%)	<.0001
Neuropathy	27788 (13.6%)	19822 (10.8%)	<.0001	1097 (6.5%)	1545 (4.2%)	<.0001
Peripheral vascular arterial surgery	24380 (11.9%)	12823 (7.0%)	<.0001	754 (4.5%)	578 (1.6%)	<.0001
Diabetic retinopathy and other eye complications	24215 (11.8%)	22903 (12.4%)	<.0001	990 (5.9%)	1877 (5.1%)	0.0001
Skin complications	2951 (1.4%)	1589 (0.9%)	<.0001	262 (1.6%)	305 (0.8%)	<.0001

SD: standard deviation.

eAppendix Table 12. Baseline Clinical Characteristics of HF and Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	HF		<i>P</i> -value	HF		<i>P</i> -value
n	65582	60656		2544	7470	
Classes of oral antidiabetic medications, mean (SD)	0.84 (±0.86)	1.02 (±0.86)	<.0001	0.89 (±0.92)	1.16 (±0.86)	<.0001
GLP-1 agonists, mean (SD)	0.03 (±0.43)	0.05 (±0.59)	<.0001	0.12 (±0.96)	0.24 (±1.34)	<.0001
Insulins, mean (SD)	1.17 (±3.21)	0.76 (±2.57)	<.0001	1.31 (±3.26)	0.80 (±2.65)	<.0001
Classes of cardiovascular medications, mean (SD)	3.85 (±2.19)	2.90 (±1.76)	<.0001	3.51 (±2.34)	2.25 (±1.61)	<.0001
Diabetes complications severity index, mean (SD)	3.77 (±2.21)	2.10 (±1.97)	<.0001	2.85 (±2.27)	0.88 (±1.36)	<.0001
Deyo Charlson comorbidity index, mean (SD)	3.81 (±2.69)	2.53 (±2.11)	<.0001	3.00 (±2.72)	1.41 (±1.51)	<.0001
Count of HbA1c tests, mean (SD)	1.83 (±1.42)	2.07 (±1.31)	<.0001	1.31 (±1.31)	1.72 (±1.21)	<.0001
Specialty of prescribing physician, n (%)						
Cardiology	160 (0.2%)	108 (0.2%)	<.0001	13 (0.5%)	20 (0.3%)	<.0001
Endocrinology	0	< 10		0	< 10	
Gastroenterology	38 (0.1%)	49 (0.1%)		< 10	18 (0.2%)	
Primary care	34525 (52.6%)	38611 (63.7%)		1301 (51.1%)	5307 (71.0%)	
Other	2901 (4.4%)	3005 (5.0%)		137 (5.4%)	487 (6.5%)	
Unknown	27958 (42.6%)	18881 (31.1%)		1092 (42.9%)	1635 (21.9%)	
Comorbid conditions, n (%)						
Acute heart failure	16203 (24.7%)	2253 (3.7%)	<.0001	476 (18.7%)	76 (1.0%)	<.0001
Acute myocardial infarction	4136 (6.3%)	637 (1.1%)	<.0001	199 (7.8%)	65 (0.9%)	<.0001
Alcohol use	1100 (1.7%)	505 (0.8%)	<.0001	59 (2.3%)	52 (0.7%)	<.0001
Amputations	633 (1.0%)	210 (0.3%)	<.0001	35 (1.4%)	13 (0.2%)	<.0001
Chronic kidney disease	21227 (32.4%)	11544 (19.0%)	<.0001	612 (24.1%)	457 (6.1%)	<.0001
Coronary artery disease	18754 (28.6%)	6752 (11.1%)	<.0001	625 (24.6%)	425 (5.7%)	<.0001
Erectile dysfunction or male impotence	1025 (1.6%)	1267 (2.1%)	<.0001	50 (2.0%)	107 (1.4%)	0.0616
Gastrointestinal autonomic dysfunction	876 (1.3%)	324 (0.5%)	<.0001	44 (1.7%)	24 (0.3%)	<.0001
Hyperlipidemia	38673 (59.0%)	36735 (60.6%)	<.0001	1325 (52.1%)	3896 (52.2%)	0.95

Hypertension	50139 (76.5%)	42016 (69.3%)	<.0001	1765 (69.4%)	4179 (55.9%)	<.0001
Ischemic heart disease	23331 (35.6%)	8829 (14.6%)	<.0001	687 (27.0%)	485 (6.5%)	<.0001
Ischemic stroke or transient ischemic attack	5404 (8.2%)	2272 (3.7%)	<.0001	173 (6.8%)	127 (1.7%)	<.0001
Lower limb abscess or ulcer	6528 (10.0%)	2060 (3.4%)	<.0001	261 (10.3%)	190 (2.5%)	<.0001
Neuropathy	11067 (16.9%)	8844 (14.6%)	<.0001	274 (10.8%)	462 (6.2%)	<.0001
Peripheral vascular arterial surgery	12279 (18.7%)	6488 (10.7%)	<.0001	300 (11.8%)	224 (3.0%)	<.0001
Diabetic retinopathy and other eye complications	8597 (13.1%)	8467 (14.0%)	<.0001	272 (10.7%)	444 (5.9%)	<.0001
Skin complications	2065 (3.1%)	995 (1.6%)	<.0001	91 (3.6%)	96 (1.3%)	<.0001

SD: standard deviation.

eAppendix Table 13. Baseline Clinical Characteristics of Renal and no Renal Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	Renal	no Renal	<i>P</i> -value	Renal	no Renal	<i>P</i> -value
n	114136	105461		5969	14644	
Classes of oral antidiabetic medications, mean (SD)	0.88 (±0.87)	1.03 (±0.86)	<.0001	0.96 (±0.93)	1.17 (±0.87)	<.0001
GLP-1 agonists, mean (SD)	0.03 (±0.46)	0.05 (±0.59)	<.0001	0.15 (±1.07)	0.22 (±1.27)	0.0002
Insulins, mean (SD)	1.05 (±3.04)	0.71 (±2.48)	<.0001	1.21 (±3.22)	0.81 (±2.71)	<.0001
Classes of cardiovascular medications, mean (SD)	3.43 (±2.10)	2.89 (±1.77)	<.0001	2.89 (±2.11)	2.21 (±1.62)	<.0001
Diabetes complications severity index, mean (SD)	3.18 (±2.20)	1.91 (±1.84)	<.0001	2.01 (±2.03)	0.77 (±1.22)	<.0001
Deyo Charlson comorbidity index, mean (SD)	3.40 (±2.59)	2.30 (±1.94)	<.0001	2.49 (±2.46)	1.28 (±1.32)	<.0001
Count of HbA1c tests, mean (SD)	1.88 (±1.41)	2.06 (±1.28)	<.0001	1.37 (±1.29)	1.70 (±1.17)	<.0001
Specialty of prescribing physician, n (%)						
Cardiology	220 (0.2%)	188 (0.2%)	<.0001	< 10	31 (0.2%)	<.0001
Endocrinology	< 10	< 10		0	20 (0.1%)	
Gastroenterology	70 (0.1%)	84 (0.1%)		< 10	32 (0.2%)	
Primary care	62523 (54.8%)	68152 (64.6%)		3262 (54.6%)	10308 (70.4%)	
Other	5056 (4.4%)	5103 (4.8%)		375 (6.3%)	1020 (7.0%)	
Unknown	46265 (40.5%)	31933 (30.3%)		2318 (38.8%)	3233 (22.1%)	
Comorbid conditions, n (%)						
Acute heart failure	21422 (18.8%)	6390 (6.1%)	<.0001	617 (10.3%)	244 (1.7%)	<.0001
Acute myocardial infarction	3796 (3.3%)	1063 (1.0%)	<.0001	152 (2.5%)	113 (0.8%)	<.0001
Alcohol use	1663 (1.5%)	797 (0.8%)	<.0001	110 (1.8%)	77 (0.5%)	<.0001
Amputations	771 (0.7%)	207 (0.2%)	<.0001	41 (0.7%)	22 (0.2%)	<.0001
Chronic kidney disease	32518 (28.5%)	15120 (14.3%)	<.0001	1080 (18.1%)	578 (3.9%)	<.0001
Coronary artery disease	22784 (20.0%)	11535 (10.9%)	<.0001	718 (12.0%)	697 (4.8%)	<.0001
Erectile dysfunction or male impotence	1777 (1.6%)	1981 (1.9%)	<.0001	97 (1.6%)	185 (1.3%)	0.0426
Gastrointestinal autonomic dysfunction	1078 (0.9%)	389 (0.4%)	<.0001	61 (1.0%)	48 (0.3%)	<.0001
Hyperlipidemia	65684 (57.5%)	63679 (60.4%)	<.0001	2874 (48.1%)	7513 (51.3%)	<.0001

Hypertension	84600 (74.1%)	71850 (68.1%)	<.0001	3943 (66.1%)	8031 (54.8%)	<.0001
Ischemic heart disease	28596 (25.1%)	15545 (14.7%)	<.0001	852 (14.3%)	826 (5.6%)	<.0001
Ischemic stroke or transient ischemic attack	7912 (6.9%)	3096 (2.9%)	<.0001	290 (4.9%)	192 (1.3%)	<.0001
Lower limb abscess or ulcer	8598 (7.5%)	3096 (2.9%)	<.0001	457 (7.7%)	308 (2.1%)	<.0001
Neuropathy	18534 (16.2%)	14074 (13.3%)	<.0001	592 (9.9%)	852 (5.8%)	<.0001
Peripheral vascular arterial surgery	17850 (15.6%)	10216 (9.7%)	<.0001	488 (8.2%)	358 (2.4%)	<.0001
Diabetic retinopathy and other eye complications	14924 (13.1%)	13910 (13.2%)	0.429	520 (8.7%)	864 (5.9%)	<.0001
Skin complications	2699 (2.4%)	1364 (1.3%)	<.0001	193 (3.2%)	193 (1.3%)	<.0001

SD: standard deviation.

eAppendix Table 14. Baseline All-Cause Healthcare Resource Utilization Costs of CV and Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	CV		<i>P</i> -value	CV		<i>P</i> -value
n	204398	184325		16831	36904	
Healthcare resource utilization, n (%)						
Inpatient	38125 (18.7%)	9392 (5.1%)	<.0001	3505 (20.8%)	2100 (5.7%)	<.0001
Outpatient	200606 (98.1%)	182899 (99.2%)	<.0001	16094 (95.6%)	36489 (98.9%)	<.0001
Emergency department	83639 (40.9%)	34740 (18.8%)	<.0001	6314 (37.5%)	6276 (17.0%)	<.0001
Healthcare cost PPPM, mean (SD)	936.70 (±685.20)	548.87 (±322.58)	<.0001	1,460.65 (±1,057.74)	788.90 (±513.76)	<.0001
Medical cost PPPM, mean (SD)	696.31 (±580.04)	343.81 (±268.70)	<.0001	1,134.87 (±1,008.11)	511.01 (±464.52)	<.0001
Inpatient cost PPPM, mean (SD)	171.78 (±407.25)	38.95 (±137.37)	<.0001	317.89 (±647.61)	81.59 (±252.91)	<.0001
Outpatient cost PPPM, mean (SD)	394.58 (±297.56)	244.36 (±181.03)	<.0001	673.74 (±618.60)	363.42 (±323.18)	<.0001
Emergency department cost PPPM, mean (SD)	42.83 (±37.86)	16.54 (±22.67)	<.0001	88.45 (±90.36)	36.99 (±47.81)	<.0001
Pharmacy cost PPPM, mean (SD)	240.39 (±332.73)	205.06 (±152.21)	<.0001	325.78 (±206.01)	277.89 (±168.57)	<.0001

PPPM: per patient per month, SD: standard deviation.

All cost measures were weighted based on the age distribution of BRFS T2DM population.

eAppendix Table 15. Baseline All-Cause Healthcare Resource Utilization Costs of HF and Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	HF		<i>P</i> -value	HF		<i>P</i> -value
n	65582	60656		2544	7470	
Healthcare resource utilization, n (%)						
Inpatient	33430 (51.0%)	12314 (20.3%)	<.0001	1322 (52.0%)	1156 (15.5%)	<.0001
Outpatient	64510 (98.4%)	60403 (99.6%)	<.0001	2419 (95.1%)	7408 (99.2%)	<.0001
Emergency department	39811 (60.7%)	18567 (30.6%)	<.0001	1445 (56.8%)	1726 (23.1%)	<.0001
Healthcare cost PPPM, mean (SD)	2,046.32 (±1,254.47)	948.66 (±603.02)	<.0001	3,522.46 (±2,515.14)	1,324.70 (±993.51)	<.0001
Medical cost PPPM, mean (SD)	1,750.82 (±1,103.34)	714.13 (±560.20)	<.0001	3,110.06 (±2,487.75)	1,001.26 (±955.46)	<.0001
Inpatient cost PPPM, mean (SD)	935.26 (±888.45)	253.45 (±367.17)	<.0001	1,855.16 (±2,052.07)	384.23 (±620.61)	<.0001
Outpatient cost PPPM, mean (SD)	514.64 (±380.67)	335.66 (±260.06)	<.0001	982.31 (±932.33)	512.73 (±536.87)	<.0001
Emergency department cost PPPM, mean (SD)	72.93 (±55.43)	30.53 (±33.37)	<.0001	136.91 (±137.25)	57.76 (±69.58)	<.0001
Pharmacy cost PPPM, mean (SD)	295.50 (±565.74)	234.53 (±174.58)	<.0001	412.40 (±241.00)	323.44 (±219.43)	<.0001

PPPM: per patient per month, SD: standard deviation.

All cost measures were weighted based on the age distribution of BRFSS T2DM population.

eAppendix Table 16. Baseline All-Cause Healthcare Resource Utilization Costs of Renal and no Renal Cohorts

Measure	Medicare Cohorts			Commercial Cohorts		
	Renal	no Renal	<i>P</i> -value	Renal	no Renal	<i>P</i> -value
n	114136	105461		5969	14644	
Healthcare resource utilization, n (%)						
Inpatient	46339 (40.6%)	17337 (16.4%)	<.0001	2416 (40.5%)	1884 (12.9%)	<.0001
Outpatient	112284 (98.4%)	104932 (99.5%)	<.0001	5725 (95.9%)	14507 (99.1%)	<.0001
Emergency department	62557 (54.8%)	28824 (27.3%)	<.0001	2984 (50.0%)	3213 (21.9%)	<.0001
Healthcare cost PPPM, mean (SD)	1,582.14 (±1,012.76)	809.70 (±481.88)	<.0001	2,715.38 (±1,902.03)	1,108.22 (±702.83)	<.0001
Medical cost PPPM, mean (SD)	1,301.36 (±888.14)	586.73 (±433.96)	<.0001	2,321.92 (±1,855.27)	795.85 (±661.74)	<.0001
Inpatient cost PPPM, mean (SD)	588.14 (±680.30)	183.10 (±280.98)	<.0001	1,117.34 (±1,338.66)	248.15 (±410.60)	<.0001
Outpatient cost PPPM, mean (SD)	474.68 (±352.21)	306.65 (±233.63)	<.0001	967.48 (±880.28)	457.53 (±409.20)	<.0001
Emergency department cost PPPM, mean (SD)	63.12 (±49.50)	26.79 (±31.54)	<.0001	128.04 (±130.21)	50.68 (±70.42)	<.0001
Pharmacy cost PPPM, mean (SD)	280.78 (±449.76)	222.97 (±175.74)	<.0001	393.46 (±254.63)	312.37 (±174.82)	<.0001

PPPM: per patient per month, SD: standard deviation.

All cost measures were weighted based on the age distribution of BRFSS T2DM population.