

Supplemental Table S1. Algorithm to Determine Primary Care Visit and Primary Care Provider

Measure	Algorithm
Primary care visit	CPT code: 99201-99215, 99304-99350, 99363-99449, 99487-99490, 99495-99498, 98966-98969, G0463, G0438, G0439
Primary care physician	CMS provider specialty codes: general practice (01), family practice (08), internal medicine (11), geriatric medicine (38)
Primary care nurse practitioner	CMS provider specialty codes as nurse practitioner (50), and taxonomy code as primary care nurse practitioner (363L00000X, 363LA2200X, 363LF0000X, 363LG0600X, 363LP2300X, 363LW0102X)
Primary care physician assistant	CMS provider specialty codes as physician assistant (97) and taxonomy code as physician assistant (363A00000X, 363AM0700X).

Abbreviations: CMS, Centers for Medicare & Medicaid Services; CPT, Current Procedural Terminology

Supplemental Table S2. Flowchart of Study Cohort

Criteria	PCSA, No.	Practice, No.	Provider, No.	Patients, No.
First Step: Build up practice within PCSA				
20% Randomly selected PCSAs	1 400	NA	NA	NA
PCSA with providers who had at least 1 primary care E&M bill	1 286	NA	NA	NA
PCSA with provider pairs that shared at least 30 patients	982	NA	NA	NA
PCSA with a modularity ≥ 0.4	559	NA	NA	NA
Practices in PCSAs with a modularity ≥ 0.4	559	5 284	19 946	NA
Exclude practices with only 1 provider	559	5 273	19 935	NA
Select 4 types of practices: MD Only, MD-NP, MD-NP-PA, or MD-PA	557	4 776	18 615	NA
Exclude practices with providers working in multiple practices	557	4 648	17 902	NA
Second Step: Select Medicare beneficiaries getting care from practice				
Select patients with diabetes, CHF, or COPD who had at least 2 office visits to any of the 4648 practices identified through SNA ^a	NA	4 479	NA	1 004 506
Exclude those cared for by multiple practices	NA	4 477	NA	951 757
Select patients with complete parts A, B, and D enrollment without Medicare Advantage enrollment in 2014 and 2015.	NA	4 470	NA	614 291
Select patients alive on 12/31/2015.	NA	4 470	NA	610 572
Select patients aged 66 ^b or above	NA	4 461	NA	492 738
Remove residents in long-term-care nursing facilities	NA	4 453	NA	449 725
Remove those with unknown rural/urban residential information	556	4 453	17 185	449 460

Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; E&M: evaluation and management; MD, primary care physician; NA, not applicable; NP, nurse practitioner; PA, physician assistant; PCSA, primary care service area; SNA, social network analysis

^a Chronic condition was based on end-of-year flag in 2015 Master Beneficiary Summary File (MBSF): Chronic Conditions Segment

^b The age as of January 1st, 2015

Supplement Table S3. Baseline Characteristics for All Eligible Beneficiaries and Stratified by Type of Practice

Variable	All	Type of Practice			
		MD Only	MD/NP	MD/NP/PA	MD/PA
Number of subject	449460	155565	144300	88600	60995
Age, years					
Mean (SD)	75.8 (7.1)	75.8 (7.1)	75.8 (7.1)	75.8 (7.0)	75.8 (7.1)
65-70	123 964 (27.6)	43 116 (27.7)	39 877 (27.6)	24 161 (27.3)	16 810 (27.6)
71-75	120 111 (26.7)	41 641 (26.8)	38 093 (26.4)	23 919 (27.0)	16 458 (27.0)
76-80	91 632 (20.4)	31 463 (20.2)	29 388 (20.4)	18 294 (20.6)	12 487 (20.5)
>80	113 753 (25.3)	39 345 (25.3)	36 942 (25.6)	22 226 (25.1)	15 240 (25.0)
Gender, %					
Male	193 597 (43.1)	65 822 (42.3)	61 785 (42.8)	39 250 (44.3)	26 740 (43.8)
Female	255 863 (56.9)	89 743 (57.7)	82 515 (57.2)	49 350 (55.7)	34 255 (56.2)
Race/ethnicity, %					
Non-Hispanic white	371 876 (82.7)	119 499 (76.8)	122 584 (85.0)	77 808 (87.8)	51 985 (85.2)
Black	35 219 (7.8)	14 491 (9.3)	11 805 (8.2)	5 141 (5.8)	3 782 (6.2)
Hispanic	24 500 (5.5)	12 218 (7.9)	5 554 (3.8)	3 516 (4.0)	3 212 (5.3)
Other	17 865 (4.0)	9 357 (6.0)	4 357 (3.0)	2 135 (2.4)	2 016 (3.3)
Dual eligible, %	86 003 (19.1)	34 219 (22.0)	25 979 (18.0)	15 655 (17.7)	10 150 (16.6)
Original Entitlement					
Aged	387 720 (86.3)	134 760 (86.6)	123 714 (85.7)	76 200 (86.0)	53 046 (87.0)
ESRD/Disability	61 740 (13.7)	20 805 (13.4)	20 586 (14.3)	12 400 (14.0)	7 949 (13.0)
Cohort condition					
COPD, %	128 620 (28.6)	42 502 (27.3)	42 432 (29.4)	26 586 (30.0)	17 100 (28.0)
CHF, %	139 206 (31.0)	48 327 (31.1)	45 487 (31.5)	27 263 (30.8)	18 129 (29.7)
Diabetes, %	316 514 (70.4)	111 566 (71.7)	100 142 (69.4)	61 578 (69.5)	43 228 (70.9)
Chronic condition, %					
Hypertension, %	381 791 (84.9)	132 637 (85.3)	123 317 (85.5)	74 566 (84.2)	51 271 (84.1)
Ischemic heart disease, %	205 586 (45.7)	71 222 (45.8)	66 141 (45.8)	40 558 (45.8)	27 665 (45.4)
Atrial fibrillation, %	73 071 (16.3)	24 322 (15.6)	23 652 (16.4)	15 387 (17.4)	9 710 (15.9)
Hyperlipidemia, %	325 887 (72.5)	113 004 (72.6)	104 528 (72.4)	63 816 (72.0)	44 539 (73.0)
Stroke, %	22 896 (5.1)	8 104 (5.2)	7 370 (5.1)	4 343 (4.9)	3 079 (5.0)
Arthritis, %	190 296 (42.3)	66 347 (42.6)	62 145 (43.1)	36 253 (40.9)	25 551 (41.9)
Asthma, %	38 003 (8.5)	13 617 (8.8)	12 068 (8.4)	7 180 (8.1)	5 138 (8.4)
Cancer, %	53 530 (11.9)	18 354 (11.8)	17 476 (12.1)	10 263 (11.6)	7 437 (12.2)
Chronic kidney disease, %	148 343 (33.0)	51 679 (33.2)	47 473 (32.9)	29 440 (33.2)	19 751 (32.4)
ADRD, %	46 127 (10.3)	16 393 (10.5)	15 258 (10.6)	8 689 (9.8)	5 787 (9.5)
Depression, %	83 255 (18.5)	27 760 (17.8)	27 819 (19.3)	16 605 (18.7)	11 071 (18.2)
Osteoporosis, %	35 714 (7.9)	12 589 (8.1)	11 340 (7.9)	6 866 (7.7)	4 919 (8.1)
Residence location, %					
Metropolitan	361 622 (80.5)	134 949 (86.7)	111 515 (77.3)	66 183 (74.7)	48 975 (80.3)
Urban	80 642 (17.9)	18 845 (12.1)	30 184 (20.9)	20 464 (23.1)	11 149 (18.3)
Rural	7 196 (1.6)	1 771 (1.1)	2 601 (1.8)	1 953 (2.2)	871 (1.4)

Abbreviations: ADRD: Alzheimer's disease/dementia; CHF: congestive heart failure; COPD: chronic obstructive pulmonary disease; ESRD, end-stage renal disease; MD, primary care physician; NP, nurse practitioner; PA, physician assistant; SD: standard deviation

Supplemental Table S4. Impact of Baseline Characteristics on Health Outcome (N=449460)^a

Variable	Hospitalization	ER Admission	High-Risk Medication	Total Spending [§]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	CR (SE)
Age, years	Reference: 65-70			
71-75	0.92 (0.90,0.94) ^b	0.98 (0.96,1.01)	0.87 (0.86,0.89) ^b	0.97 (0.004) ^b
76-80	0.86 (0.84,0.89) ^b	0.99 (0.96,1.02)	0.78 (0.76,0.80) ^b	0.92 (0.005) ^b
>80	0.85 (0.83,0.87) ^b	1.12 (1.09,1.15) ^b	0.61 (0.60,0.63) ^b	0.80 (0.005) ^b
Female	0.93 (0.91,0.94) ^b	0.99 (0.97,1.01)	1.39 (1.36,1.41) ^b	0.96 (0.003) ^b
Race/ethnicity				
Black	0.98 (0.95,1.02)	1.12 (1.08,1.16) ^b	0.84 (0.81,0.87) ^b	0.93 (0.007) ^b
Hispanic	1.00 (0.96,1.04)	1.08 (1.04,1.13) ^b	0.84 (0.80,0.87) ^b	0.98 (0.008) ^b
Other	0.98 (0.93,1.03)	1.02 (0.96,1.07)	0.79 (0.75,0.83) ^b	0.92 (0.009) ^b
Dual eligible	1.05 (1.02,1.07) ^b	1.18 (1.15,1.20) ^b	0.98 (0.96,1.01)	0.93 (0.005) ^b
Entitlement as ESRD/Disability	1.01 (0.99,1.04)	1.10 (1.07,1.13) ^b	1.33 (1.30,1.36) ^b	1.06 (0.005) ^b
No. of visit from practice				
3 times	1.02 (0.99,1.05)	1.03 (1.00,1.06)	1.05 (1.02,1.08) ^b	1.10 (0.005) ^b
More than 3	1.31 (1.28,1.33) ^b	1.31 (1.28,1.35) ^b	1.27 (1.24,1.30) ^b	1.45 (0.004) ^b
Resident area				
Rural/Urban	1.08 (1.05,1.11) ^b	0.83 (0.81,0.86) ^b	1.00 (0.97,1.02)	1.01 (0.006)
Cohort condition				
COPD	2.39 (2.35,2.44) ^b	2.48 (2.43,2.54) ^b	1.11 (1.09,1.13) ^b	1.47 (0.004) ^b
CHF	1.97 (1.93,2.01) ^b	2.10 (2.06,2.15) ^b	1.06 (1.04,1.08) ^b	1.47 (0.004) ^b
Diabetes	0.92 (0.90,0.94) ^b	0.94 (0.92,0.96) ^b	1.13 (1.11,1.16) ^b	1.02 (0.004) ^b
Chronic condition				
Hypertension	2.20 (2.14,2.27) ^b	2.15 (2.07,2.22) ^b	1.04 (1.02,1.07) ^b	1.30 (0.005) ^b
Ischemic heart disease	1.44 (1.42,1.47) ^b	1.40 (1.37,1.43) ^b	1.05 (1.03,1.07) ^b	1.40 (0.004) ^b
Atrial fibrillation	1.86 (1.83,1.90) ^b	1.85 (1.81,1.89) ^b	1.20 (1.18,1.23) ^b	1.43 (0.005) ^b
Hyperlipidemia	1.60 (1.57,1.63) ^b	1.51 (1.48,1.54) ^b	0.96 (0.94,0.98) ^b	1.24 (0.004) ^b
Stroke	2.81 (2.73,2.90) ^b	2.97 (2.88,3.06) ^b	1.03 (0.99,1.06)	1.67 (0.007) ^b
Arthritis	1.45 (1.42,1.47) ^b	1.12 (1.10,1.14) ^b	1.45 (1.42,1.47) ^b	1.53 (0.003) ^b
Asthma	1.91 (1.86,1.96) ^b	1.83 (1.78,1.88) ^b	1.15 (1.12,1.18) ^b	1.44 (0.006) ^b
Cancer	1.93 (1.88,1.97) ^b	1.67 (1.63,1.71) ^b	1.04 (1.01,1.06) ^b	1.81 (0.005) ^b
Chronic kidney disease	2.17 (2.13,2.21) ^b	2.33 (2.29,2.37) ^b	1.01 (1.00,1.03)	1.50 (0.004) ^b
ADRD	1.43 (1.39,1.47) ^b	1.61 (1.57,1.65) ^b	1.00 (0.97,1.03)	1.12 (0.005) ^b
Depression	1.66 (1.62,1.69) ^b	1.69 (1.66,1.73) ^b	1.50 (1.47,1.53) ^b	1.40 (0.004) ^b
Osteoporosis	1.66 (1.61,1.70) ^b	1.63 (1.58,1.68) ^b	1.02 (0.99,1.05)	1.41 (0.006) ^b

Abbreviations: ADRD: Alzheimer's disease/dementia; CHF: congestive heart failure; CI, confident interval; COPD: chronic obstructive pulmonary disease; CR, cost ratio; ESRD, end-stage renal disease; OR, odds ratio; SE, standard error

^a Full model with random intercept on practice

^b Statistical significant on odds ratio and cost ratio estimation