**SUPPLEMENTARY MATERIAL**

**Supplementary Methods**

The 100% Medicare FFS data were accessed by Avalere Health through their parent company Inovalon, which has been designated by the CMS as a Qualified Entity allowing research to be conducted under a HIPAA-compliant, research-focused data use agreement. The use of data in this study abided by the HIPAA requirements for the privacy and security of protected health information.

The claims database contains information about covered healthcare services used by Medicare beneficiaries, including date of service, diagnoses, procedures performed, place of service, provider information, prescription strength and quantity, and CMS and beneficiary paid amounts.

Data from Medicare Part A contain billing information for inpatient care received while in a hospital or post-acute care (PAC) setting (e.g., skilled nursing facility, home health agency services, inpatient rehabilitation facility, or long-term care hospital). The data do not contain all service details while the patient is in an inpatient or PAC setting, such as medication use. Data from Medicare Part B pertain to information for outpatient medical care including physician office visits, lab tests and procedures performed in outpatient clinics, and other services such as durable medical equipment and mental health care. Data from Medicare Part D cover reimbursement for outpatient prescription drugs. Medicare Part D prescription drug coverage is an optional benefit offered to beneficiaries, and they may access the benefits via a Medicare Prescription Drug Plan, but all patients in this study were required to have Part D coverage.

The FFS data are derived from reimbursement information generated through billing processes from healthcare providers, and include Medicare enrollment data from CMS describing coverage dates and demographic characteristics of beneficiaries such as age, sex, dual eligible status for Medicaid, reason for entitlement to Medicare (age 65 or disabled <65), and race/ethnicity.

The data do not include Medicare beneficiaries covered by managed care organizations (i.e., Medicare Advantage). During the study timeframe of January 1, 2009 through December 31, 2017, 67% to 77% of Medicare beneficiaries were enrolled in traditional Medicare FFS, and the remainder received Medicare benefits through a Medicare Advantage plan.38

**Supplementary Table 1. Clinical Codes to Identify CDI-related Claims**

| **Medical Diagnoses, Procedures**  **and Treatments** | **ICD-9-CM**  **Code** | **ICD-9-CM**  **Procedure Code** | **ICD-10 CM**  **Code** | **ICD-10-PCS**  **Code** | **CPT Code** | **HCPCS**  **Code** |
| --- | --- | --- | --- | --- | --- | --- |
| **CDI** | 008.45 |  | A04.7, A04.71,  A04.72 |  |  |  |
| **FMT** |  |  |  |  | 44705, 44799 | G0455 |
| **Subtotal Colectomy** |  | 47.7x, 45.62, | Z90.49 |  | 44139-44147, 44160, 44204 |  |
| **Diverting loop ileostomy** (with colonic lavage) | V55.2 | 46.21 | Z43.2 | 0D1B0z4 | 44141, 44145, 44146, 44157, 44158, 44208, 44385, 44701, 44310, 45113, |  |
| **Sepsis** | 99591, 99592 |  | A021, A227, A267, A327, A400, A401, A403, A408, A409, A4101, A4102, A411, A412, A413, A414, A4150, A4151, A4152, A4153, A4159, A4181, A4189, A419, A427, A5486, B377, R6520, R6521 |  |  |  |
| **Chronic pulmonary disease** | 490.xx-496.99; 500.xx-505.99; 506.4x |  | J40, J41, J42, J43, J44, J45, J46, J47, J60, J61, J62, J63, J64, J65, J66, J67I278, I279, J684, J701, J703 |  |  |  |
| **Anxiety** | 300.00, 300.01, 300.02, 300.09 |  | F41.9, F41.0, F41.1, F41.8, F41.3, F43.22, F43.23, F06.4 |  |  |  |
| **Delirium** | 290.11, 290.41, 290.3, 293.1, 293.0, 291.0  292.81 |  | 780.09, F05, F03.90, F01.51, F02.81, F10.121, F10.221  F10.231, F10.921, F11.121, F11.221, F11.921, F12.121  F12.221, F12.921, F13.121, F13.221, F13.231, F13.921  F13.931, F14.121, F14.221, F14.921, F15.121, F15.221  F15.921, F16.121, F16.221, F16.921, F18.121, F18.221  F18.921, F19.121, F19.221, F19.231, F19.921, F19.931 |  |  |  |
| **Depression** | 296.20, 296.21, 296.22, 296.23, 296.24  296.25, 296.26, 296.30, 296.31, 296.32  296.33, 296.34, 296.36, 296.82, 298.0  311, 309.28, 309.0 |  | F32.0, F32.1, F32.2, F32.3, F32.4, F32.5, F32.89  F32.9, F33.0, F33.1, F33.2, F33.3, F33.40, F33.41  F33.42, F33.8, F33.9, F43.21, F43.23 |  |  |  |
| **Post-traumatic stress disorder** | 309.81 |  | F43.l, F43.10, F 43.11, F43 .12 |  |  |  |
| **Cerebrovascular disease** | 430.xx-438.99 |  | G45, G46, I60, I61, I62, I63, I64, I65, I66, I67, I68, I69, H340 |  |  |  |
| **Diabetes** | 250.0x-250.39, 250.7x, 250.4x-250.69 |  | E100, E101, E106, E108, E109, E110, E111, E116, E118, E119, E120, E121, E126, E128, E129, E130, E131, E136, E138, E139, E140, E141, E146, E148, E149, E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E122, E123, E124, E125, E127, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147 |  |  |  |
| **Congestive Heart Failure** | 428.xx |  | I43, I50, I099, I110, I130, I132, I255, I420, I425, I426, I427, I428, I429, P290 |  |  |  |
| **Peripheral vascular disease** | 441.xx; 443.9x; 785.4x; v43.4x |  | I70, I71, I731, I738, I739, I771, I790, I792, K551, K558, K559, Z958, Z959 |  |  |  |
| **Renal disease** | 582.xx; 583.0x-583.79; 585.xx-586.99; 588.xx |  | N18, N19, N052, N053, N054, N055, N056, N057, N250, I120, I131, N032, N033, N034, N035, N036, N037, Z490, Z491, Z492, Z940, Z992 |  |  |  |
| **GI surgery** |  | 43.xx-54.xx, |  | 0D1\*-0DY\* | 43500-46999 |  |
| **Chemotherapy** | 963.1, V58.0x, V58.1x, V58.65, V58.69, | 99.25, 99.28, 00.10, 00.15, 17.70, | Z51.11, Z51.12, T45.1X1A | 3E00X05, 3E00X0M, 3E01305, 3E0130M, 3E02305, 3E0230M, 3E03002, 3E03003, 3E03005, 3E0300M, 3E0300P, 3E03302, 3E03303, 3E03305, 3E0330M, 3E0330P, 3E04002, 3E04002, 3E04003, 3E04003, 3E04005, 3E04005, 3E0400M, 3E0400M, 3E0400P, 3E0400P, 3E04302, 3E04303, 3E04303, 3E04305, 3E04305, 3E0430M, 3E0430M, 3E0430P, 3E0430P, 3E05002, 3E05002, 3E05003, 3E05003, 3E05005, 3E05005, 3E0500M, 3E0500M, 3E0500P, 3E0500P, 3E05302, 3E05303, 3E05303, 3E05305, 3E05305, 3E0530M, 3E0530M, 3E0530P, 3E0530P, 3E06002, 3E06003, 3E06005, 3E0600M, 3E0600P, 3E06303, 3E06305, 3E0630M, 3E0630P, 3E0930M, 3E09705, 3E0970M, 3E09X05, 3E09X0M, 3E0A305, 3E0A30M, 3E0B305, 3E0B30M, 3E0B705, 3E0B70M, 3E0BX05, 3E0BX0M, 3E0C305, 3E0C30M, 3E0C705, 3E0C70M, 3E0CX05, 3E0CX0M, 3E0D305, 3E0D30M, 3E0D705, 3E0D70M, 3E0DX05, 3E0DX0M, 3E0E305, 3E0E30M, 3E0E705, 3E0E70M, 3E0E805, 3E0E80M, 3E0F305, 3E0F30M, 3E0F705, 3E0F70M, 3E0F805, 3E0F80M, 3E0G305, 3E0G30M, 3E0G705, 3E0G70M, 3E0G805, 3E0G80M, 3E0H305, 3E0H30M, 3E0H705, 3E0H70M, 3E0H805, 3E0H80M, 3E0J305, 3E0J30M, 3E0J705, 3E0J70M, 3E0J805, 3E0J80M, 3E0K305, 3E0K30M, 3E0K705, 3E0K70M, 3E0K805, 3E0K80M, 3E0L305, 3E0L30M, 3E0L705, 3E0L70M, 3E0M305, 3E0M30M, 3E0M705, 3E0M70M, 3E0N305, 3E0N30M, 3E0N705, 3E0N70M, 3E0N805, 3E0N80M, 3E0P305, 3E0P30M, 3E0P705, 3E0P70M, 3E0P805, 3E0P80M, 3E0Q005, 3E0Q00M, 3E0Q305, 3E0Q30M, 3E0Q705, 3E0Q70M, 3E0R302, 3E0R303, 3E0R305, 3E0R30M, 3E0S303, 3E0S305, 3E0S30M, 3E0U305, 3E0U30M, 3E0V305, 3E0V30M, 3E0W305, 3E0W30M, 3E0Y305, 3E0Y30M, 3E0Y705, 3E0Y70M, 3E04302 , 3E05302 , 3E06302 , 3E06305, 3E09305 , 3E0S302 , XW03351, XW033B3 , XW033C3 , XW04351 , XW043B3 , XW043C3 | 96400-96549 | Q0083– Q0085 |
| **Transplant** | V42.xx, 996.8x | 11.6x, 33.5\*, 33.6, 37.51, 41.0\*, 46.97, 50.5\*, 52.8\*, 55.6\* | Z94\* Z48.2xx, T86.\* | 02YA, 02YA0, 02YA0Z, 02YA0Z0, 02YA0Z1, 02YA0Z2, 07YM, 07YM0, 07YM0Z, 07YM0Z0, 07YM0Z1, 07YM0Z2, 07YP, 07YP0, 07YP0Z, 07YP0Z0, 07YP0Z1, 07YP0Z2, 0BYC, 0BYC0, 0BYC0Z, 0BYC0Z0, 0BYC0Z1, 0BYC0Z2, 0BYD, 0BYD0, 0BYD0Z, 0BYD0Z0, 0BYD0Z1, 0BYD0Z2, 0BYF, 0BYF0, 0BYF0Z, 0BYF0Z0, 0BYF0Z1, 0BYF0Z2, 0BYG, 0BYG0, 0BYG0Z, 0BYG0Z0, 0BYG0Z1, 0BYG0Z2, 0BYH, 0BYH0, 0BYH0Z, 0BYH0Z0, 0BYH0Z1, 0BYH0Z2, 0BYJ, 0BYJ0, 0BYJ0Z, 0BYJ0Z0, 0BYJ0Z1, 0BYJ0Z2, 0BYK, 0BYK0, 0BYK0Z, 0BYK0Z0, 0BYK0Z1, 0BYK0Z2, 0BYL, 0BYL0, 0BYL0Z, 0BYL0Z0, 0BYL0Z1, 0BYL0Z2, 0BYM, 0BYM0, 0BYM0Z, 0BYM0Z0, 0BYM0Z1, 0BYM0Z2, 0DY5, 0DY50, 0DY50Z, 0DY50Z0, 0DY50Z1, 0DY50Z2, 0DY6, 0DY60, 0DY60Z, 0DY60Z0, 0DY60Z1, 0DY60Z2, 0DY8, 0DY80, 0DY80Z, 0DY80Z0, 0DY80Z1, 0DY80Z2, 0DYE, 0DYE0, 0DYE0Z, 0DYE0Z0, 0DYE0Z1, 0DYE0Z2, 0FY0, 0FY00, 0FY00Z, 0FY00Z0, 0FY00Z1, 0FY00Z2, 0FYG, 0FYG0, 0FYG0Z, 0FYG0Z0, 0FYG0Z1, 0FYG0Z2, 0TY0, 0TY00, 0TY00Z, 0TY00Z0, 0TY00Z1, 0TY00Z2, 0TY1, 0TY10, 0TY10Z, 0TY10Z0, 0TY10Z1, 0TY10Z2, 0UY0, 0UY00, 0UY00Z, 0UY00Z0, 0UY00Z1, 0UY00Z2, 0UY1, 0UY10, 0UY10Z, 0UY10Z0, 0UY10Z1, 0UY10Z2, 0UY9, 0UY90, 0UY90Z, 0UY90Z0, 0UY90Z1, 0UY90Z2, 0WY2, 0WY20, 0WY20Z, 0WY20Z0, 0WY20Z1, 0XYJ, 0XYJ0, 0XYJ0Z, 0XYJ0Z0, 0XYJ0Z1, 0XYK, 0XYK0, 0XYK0Z, 0XYK0Z0, 0XYK0Z1, 30230A, 30230AZ, 30230G, 30230G0, 30230G2, 30230G3, 30230G4, 30230X, 30230X0, 30230X2, 30230X3, 30230X4, 30230Y, 30230Y0, 30230Y2, 30230Y3, 30230Y4, 30233A, 30233AZ, 30233G, 30233G0, 30233G2, 30233G3, 30233G4, 30233X, 30233X0, 30233X2, 30233X3, 30233X4, 30233Y, 30233Y0, 30233Y2, 30233Y3, 30233Y4, 30240A, 30240AZ, 30240G, 30240G0, 30240G2, 30240G3, 30240G4, 30240X, 30240X0, 30240X2, 30240X3, 30240X4, 30240Y, 30240Y0, 30240Y2, 30240Y3, 30240Y4, 30243A, 30243AZ, 30243G, 30243G0, 30243G2, 30243G3, 30243G4, 30243X, 30243X0, 30243X2, 30243X3, 30243X4, 30243Y, 30243Y0, 30243Y2, 30243Y3, 30243Y4, 30250G, 30250G0, 30250G1, 30250X, 30250X0, 30250X1, 30250Y, 30250Y0, 30250Y1, 30253G, 30253G0, 30253G1, 30253X, 30253X0, 30253X1, 30253Y, 30253Y0, 30253Y1, 30260G, 30260G0, 30260G1, 30260X, 30260X0, 30260X1, 30260Y, 30260Y0, 30260Y1, 30263G, 30263G0, 30263G1, 30263X, 30263X0, 30263X1, 30263Y, 30263Y0, 30263Y1, 3E03305, 3E04305, 3E05305, | 32851, 32852, 32853, 32854, 33935, 33945, 38240, 38241, 38242, 38243, 44135, 44136, 47135, 47136, 48160, 48554, 50360, 50365, 50380, 65710, 65730, 65750, 65755, 65756, | S2053, S2054, S2060, G0341, G0342, G0343, S2102, S2103, S2142, S2150, |
| Abbreviations: CDI, *Clostridioides difficile* infection; CPT, Common Procedural Technology; FMT, fecal microbiota transplant; HCPCS, Healthcare Common Procedure Coding System; ICD-9-CM, International Classification of Diseases, 9th revision, Clinical Modifications; ICD-10-CM, International Classification of Diseases, 10th revision, Clinical Modifications | | | | | | |