**Supplemental Table S1:** International Classification of Disease (ICD) codes used to identify persons with SCD in the IBM MarketScan Multi-State Medicaid Database.

|  |  |
| --- | --- |
| ICD-9 CM Codes (2003-2015) | 282.41, 282.42, 282.60, 282.61, 282.62, 282.63, 282.64, 282.68, 282.69 |
| ICD-10 CM Codes (2015-2017) | D5700, D5701, D5702, D571, D5720, D57211, D57212, D57219, D5740, D57411, D57412, D57419, D5780, D57811, D57812, D57819 |

**Supplemental Table S2:** List of International Classification of Disease, Clinical Modification (ICD-9-CM), Healthcare Common Procedure Coding System (HCPCS), and Current Procedural Terminology (CPT) procedure codes used to determine evidence of influenza vaccination in the IBM MarketScan Multi-State Medicaid Database.

|  |  |
| --- | --- |
| ICD-9 Codes | V0481, V066 |
| HCPCS Codes | G0008, G9141, G9142, G8108, G8482, G8639, Q2033, Q2034, Q2035, Q2036, Q2037, Q2038, Q2039 |
| CPT Codes | 90470, 90630, 90653, 90654, 90655, 90656, 90657, 90658, 90659, 90660, 90661, 90662, 90663, 90664, 90666, 90667, 90668, 90672, 90673, 90674, 90682, 90685, 90686, 90687, 90688, 90724, 90756 |

**Supplemental Table S3:** International Classification of Disease, Clinical Modification (ICD-9-CM) codes used to identify influenza and pneumonia/acute chest syndrome (ACS) hospitalizations in the IBM MarketScan Multi-State Medicaid Database.

|  |  |
| --- | --- |
| Influenza ICD-9 Codes | 487\*, 488\* |
| Pneumonia/ACS ICD-9 Codes | 480\*, 481, 482\*, 483\*, 484\*, 485, 486, 48709, 5173 |

**Supplemental Table S4:** List of International Classification of Disease, Clinical Modification (ICD-9-CM), Healthcare Common Procedure Coding System (HCPCS), and Current Procedural Terminology (CPT) procedure codes used to determine evidence of healthcare utilization in the IBM MarketScan Multi-State Medicaid Database.

|  |  |  |
| --- | --- | --- |
|  | **ICD-9-CM Codes** | **CPT Codes** |
| **TCD Screening** | '8871' | '93886','93888' |
| **Echocardiogram** |  | '93303', '93304', '93305', '93306', '93307', '93308', '93312', ‘93313’, ‘93314’, ‘93315’, ‘93316’, ‘93317’, ‘93318’, ‘93320’, ‘93321’, ‘93325’, ‘93350’, ‘93351’, ‘93352’, ‘93355’, ‘C8921’, ‘C8922’, ‘C8923’, ‘C8924’, ‘C8925’, ‘C8926’, ‘C8927’, ‘C8928’, ‘C8929’, ‘C8930’ |
| **Eye Examination** | ‘V720’ | '92002', '92004', '92012', '92014' |

**Supplemental Table S5:** Characteristics of persons under 65 years of age enrolled in the IBM MarketScan Multi-State Medicaid Database according to influenza season and whether they had sickle cell disease (SCD).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|  | **SCD** | **Non-SCD** | **SCD** | **Non-SCD** | **SCD** | **Non-SCD** | **SCD** | **Non-SCD** | **SCD** | **Non-SCD** | **SCD** | **Non-SCD** |
| N | 5,044 | 1,841,756 | 5,515 | 2,145,650 | 5,953 | 2,275,088 | 6,252 | 2,431,607 | 8,651 | 3,796,337 | 8,254 | 3,776,502 |
| Age, N (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-4 years | 577(11.4) | 332,007 (18.0) | 679 (12.3) | 395,055 (18.4) | 660 (11.1) | 396,546 (17.4) | 684 (10.9) | 405,565 (16.7) | 957 (11.1) | 618,717 (16.3) | 824 (10.0) | 611,246 (16.2) |
| 5-9 years | 719(14.3) | 388,692 (21.1) | 785 (14.2) | 467,094 (21.8) | 923 (15.5) | 502,444 (22.1) | 962 (15.4) | 543,760 (22.4) | 1,366 (15.8) | 850,003 (22.4) | 1,389 (16.8) | 885,423 (23.4) |
| 10-14 years | 723(14.3) | 329,428 (17.9) | 779 (14.1) | 398,349 (18.6) | 805 (13.5) | 430,446 (18.9) | 834 (13.3) | 464,460 (19.1) | 1,150 (13.3) | 717,154 (18.9) | 1,171 (14.2) | 728,801 (19.3) |
| 15-19 years | 683(13.5) | 221,954 (12.1) | 696 (12.6) | 252,488 (11.8) | 752 (12.6) | 266,432 (11.7) | 746 (11.9) | 285,030 (11.7) | 1,033 (11.9) | 454,380 (12.0) | 979 (11.9) | 471,932 (12.5) |
| 20-24 years | 531(10.5) | 61,316(3.3) | 569 (10.3) | 70,601 (3.3) | 609 (10.2) | 76,277 (3.4) | 638 (10.2) | 80,833 (3.3) | 851 (9.8) | 128,004 (3.4) | 766 (9.3) | 130,502 (3.5) |
| 25-29 years | 421(8.3) | 63,436(3.4) | 451 (8.2) | 73,577 (3.4) | 488 (8.2) | 79,785 (3.5) | 541 (8.7) | 85,039 (3.5) | 769 (8.9) | 137,216 (3.6) | 739 (9.0) | 135,206 (3.6) |
| 30-34 years | 339(6.7) | 55,380(3.0) | 378 (6.9) | 66,916 (3.1) | 414 (7.0) | 75,346 (3.3) | 458 (7.3) | 83,297 (3.4) | 616 (7.1) | 133,830 (3.5) | 580 (7.0) | 128,286 (3.4) |
| 35-39 years | 279(5.5) | 53,513(2.9) | 297 (5.4) | 58,835 (2.7) | 315 (5.3) | 62,966 (2.8) | 344 (5.5) | 68,706 (2.8) | 500 (5.8) | 113,304 (3.0) | 483 (5.9) | 108,351 (2.9) |
| 40-64 years | 772(15.3) | 336,030 (18.2) | 881 (16) | 362,735 (16.9) | 987 (16.6) | 384,846 (16.9) | 1045 (16.7) | 414,917 (17.1) | 1409 (16.3) | 643,729 (17.0) | 1,323 (16.0) | 576,755 (15.3) |
| Race/Ethnicity, N (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| WhitE | 102(2) | 865,821(47) | 120 (2.2) | 1,070,456 (49.9) | 98 (1.7) | 1,076,728 (47.3) | 108 (1.7) | 1,122,548 (46.2) | 154 (1.8) | 1,720,326 (45.3) | 157 (1.9) | 1,681,766 (44.5) |
| Black | 3,676(72.9) | 625,341(34) | 4,061 (73.6) | 729,045 (34) | 4,351 (73.1) | 791,912 (34.8) | 4,479 (71.6) | 827,761 (34) | 6,519 (75.4) | 1,350,856 (35.6) | 6,009 (72.8) | 1,327,407 (35.2) |
| Hispanic | 22(0.4) | 117,900 (6.4) | 24 (0.4) | 157,013 (7.3) | 32 (0.5) | 171,374 (7.5) | 29 (0.5) | 147,000 (6.1) | 70 (0.8) | 290,543 (7.7) | 62 (0.8) | 291,604 (7.7) |
| Other | 24(0.5) | 31,639(1.7) | 27 (0.5) | 41,508 (1.9) | 39 (0.7) | 46,221(2) | 33 (0.5) | 50,739 (2.1) | 45 (0.5) | 95,873 (2.5) | 48 (0.6) | 94,200 (2.5) |
| uNKNOWN | 1,220(24.2) | 201,055 (10.9) | 1,283 (23.3) | 147,628 (6.9) | 1,433 (24.1) | 188,853 (8.3) | 1,603 (25.6) | 283,559 (11.7) | 1,863 (21.5) | 338,739 (8.9) | 1,978 (24) | 381,525 (10.1) |
| MALE, N (%) | 2,230(44.2) | 851,488 (46.2) | 2,427 (44.0) | 990,372 (46.2) | 2,645 (44.4) | 1,042,683 (45.8) | 2,773 (44.4) | 1,114,559 (45.8) | 3,866 (44.7) | 1,754,100 (46.2) | 3,636 (44.1) | 1,715,885 (45.4) |
| Basis of Eligibility – Disability, N (%) | 3,596(71.3) | 428,402 (23.3) | 3,912 (70.9) | 492,342 (22.9) | 4,210 (70.7) | 511,270 (22.5) | 4,406 (70.5) | 536,204 (22.1) | 5,815 (67.2) | 774,295 (20.4) | 5,159 (62.5) | 652,124 (17.3) |

**Supplemental Table S6:** Rate of influenza hospitalizations per 10,000 person-seasons in the MarketScan Multi-state Medicaid database by influenza season, age, sickle cell disease (SCD) status, and basis of Medicaid eligibility

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|  | Influenza | Influenza | Influenza | Influenza | Influenza | Influenza |
|  | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR |
| **Overall** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 401.2 | 9.9 | 40.6 | 259.6 | 5.1 | 50.6 | 82.1 | 2.2 | 37.7 | 315.9 | 6.6 | 47.8 | 155.0 | 3.5 | 44.2 | 357.0 | 4.1 | 86.7 |
| 10-19 YEARS | 355.6 | 5.5 | 65.1 | 101.7 | 1.5 | 66.9 | 32.1 | 0.7 | 43.0 | 177.2 | 2.2 | 79.5 | 105.4 | 1.5 | 72.2 | 200.0 | 2.0 | 100.1 |
| 20-39 YEARS | 146.5 | 11.2 | 13.1 | 53.1 | 4.9 | 10.9 | 11.0 | 2.0 | 5.5 | 116.1 | 5.9 | 19.6 | 106.0 | 7.7 | 13.7 | 171.3 | 5.4 | 31.6 |
| 40-64 YEARS | 64.8 | 14.8 | 4.4 | 22.7 | 8.7 | 2.6 | 10.1 | 4.7 | 2.2 | 47.8 | 14.1 | 3.4 | 49.7 | 17.1 | 2.9 | 60.5 | 17.3 | 3.5 |
| **Basis of Eligibility - Disability** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 524.7 | 56.6 | 9.3 | 362.6 | 30.7 | 11.8 | 101.4 | 10.2 | 9.9 | 366.2 | 37.8 | 9.7 | 189.6 | 23.1 | 8.2 | 500.6 | 30.6 | 16.4 |
| 10-19 YEARS | 401.8 | 22.8 | 17.6 | 128.9 | 7.4 | 17.4 | 30.9 | 3.3 | 9.4 | 238.6 | 10.5 | 22.7 | 121.8 | 7.1 | 17.2 | 277.8 | 11.8 | 23.5 |
| 20-39 YEARS | 170.0 | 17.0 | 10.0 | 54.7 | 7.1 | 7.7 | 12.8 | 3.1 | 4.1 | 129.6 | 10.3 | 12.6 | 120.9 | 13.8 | 8.8 | 174.4 | 12.1 | 14.4 |
| 40-64 YEARS | 57.2 | 18.0 | 3.2 | 25.0 | 9.9 | 2.5 | 11.3 | 5.5 | 2.1 | 44.0 | 16.5 | 2.7 | 57.7 | 20.8 | 2.8 | 54.5 | 20.9 | 2.6 |
| **Basis of Eligibility - Other** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 277.8 | 7.9 | 35.2 | 160.6 | 4.1 | 39.4 | 63.0 | 1.8 | 34.2 | 269.3 | 5.3 | 50.6 | 126.2 | 2.7 | 46.3 | 258.8 | 3.3 | 77.7 |
| 10-19 YEARS | 274.5 | 4.0 | 69.3 | 55.1 | 1.0 | 54.2 | 34.1 | 0.5 | 64.3 | 69.7 | 1.5 | 45.1 | 80.6 | 1.0 | 78.9 | 110.2 | 1.4 | 76.4 |
| 20-39 YEARS | 0.0 | 6.7 | 0.0 | 43.1 | 3.1 | 13.9 | 0.0 | 1.2 | 0.0 | 35.3 | 2.9 | 12.0 | 39.8 | 4.4 | 9.1 | 160.4 | 2.6 | 62.2 |
| 40-64 YEARS | 137.0 | 5.1 | 26.9 | 0.0 | 4.3 | 0.0 | 0.0 | 1.7 | 0.0 | 74.1 | 6.6 | 11.2 | 0.0 | 8.5 | 0.0 | 90.1 | 9.4 | 9.6 |

**Supplemental Table S7:** Rate of acute chest syndrome (ACS)/pneumonia hospitalizations per 10,000 person-seasons in the MarketScan Multi-state Medicaid database by influenza season, age, sickle cell disease (SCD) status, and basis of Medicaid eligibility

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|  | ACS/Pneumonia | ACS/Pneumonia | ACS/Pneumonia | ACS/Pneumonia | ACS/Pneumonia | ACS/Pneumonia |
|  | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR | SCD | Non-SCD | RR |
| **Overall** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 2237.7 | 56.5 | 39.6 | 1810.1 | 45.9 | 39.4 | 2002.5 | 40.5 | 49.5 | 2235.7 | 43.2 | 51.8 | 1898.4 | 30.7 | 61.8 | 2028.9 | 29.0 | 70.0 |
| 10-19 YEARS | 1906.1 | 19.9 | 95.8 | 1511.9 | 16.3 | 92.6 | 1734.1 | 15.7 | 110.2 | 1879.7 | 15.0 | 125.5 | 1704.1 | 12.5 | 136.4 | 1614.0 | 10.9 | 148.7 |
| 20-39 YEARS | 3293.0 | 111.0 | 29.7 | 3321.5 | 104.3 | 31.8 | 2858.7 | 90.0 | 31.8 | 3205.5 | 92.9 | 34.5 | 3490.5 | 80.6 | 43.3 | 3193.2 | 65.5 | 48.8 |
| 40-64 YEARS | 1696.9 | 364.7 | 4.7 | 1532.3 | 370.7 | 4.1 | 1398.2 | 334.5 | 4.2 | 1531.1 | 339.6 | 4.5 | 1398.2 | 310.2 | 4.5 | 1239.6 | 281.1 | 4.4 |
| **Basis of Eligibility - Disability** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 3086.4 | 311.9 | 9.9 | 2524.4 | 275.0 | 9.2 | 2902.4 | 242.1 | 12.0 | 3358.6 | 263.2 | 12.8 | 2625.6 | 209.6 | 12.5 | 2869.9 | 194.1 | 14.8 |
| 10-19 YEARS | 2399.6 | 103.1 | 23.3 | 2040.8 | 95.3 | 21.4 | 2319.6 | 88.9 | 26.1 | 2415.5 | 87.0 | 27.8 | 2298.3 | 72.2 | 31.8 | 2230.9 | 78.7 | 28.3 |
| 20-39 YEARS | 3592.0 | 203.5 | 17.7 | 3718.4 | 188.5 | 19.7 | 3214.3 | 172.5 | 18.6 | 3674.9 | 179.1 | 20.5 | 3878.2 | 168.6 | 23.0 | 3722.0 | 153.8 | 24.2 |
| 40-64 YEARS | 1788.3 | 437.4 | 4.1 | 1635.5 | 427.9 | 3.8 | 1494.9 | 394.5 | 3.8 | 1692.3 | 406.1 | 4.2 | 1558.1 | 379.9 | 4.1 | 1380.6 | 349.7 | 3.9 |
| **Basis of Eligibility - Other** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-9 YEARS | 1388.9 | 45.7 | 30.4 | 1124.5 | 36.5 | 30.8 | 1108.3 | 32.0 | 34.6 | 1194.4 | 34.1 | 35.0 | 1293.4 | 23.6 | 54.8 | 1453.6 | 24.1 | 60.3 |
| 10-19 YEARS | 1039.2 | 12.7 | 81.8 | 606.6 | 9.6 | 63.5 | 766.6 | 9.5 | 80.7 | 940.8 | 9.1 | 103.4 | 805.5 | 7.8 | 103.3 | 901.8 | 7.0 | 128.8 |
| 20-39 YEARS | 1428.6 | 39.3 | 36.4 | 819.0 | 38.9 | 21.1 | 697.7 | 32.2 | 21.7 | 388.7 | 34.9 | 11.1 | 1769.4 | 33.0 | 53.6 | 1301.2 | 28.1 | 46.3 |
| 40-64 YEARS | 821.9 | 142.5 | 5.8 | 500.0 | 146.8 | 3.4 | 576.9 | 125.6 | 4.6 | 444.4 | 133.5 | 3.3 | 408.2 | 144.3 | 2.8 | 540.5 | 131.8 | 4.1 |