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 **Supplemental Table 1.1**. Characteristics of patients with ESRD on hemodialysis by age, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2013** | **2014** | **2015** | **2016** | **2017** |
| **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** |
| **Demographics** | **N = 86,325** | **N = 82,003** | **N = 86,942** | **N = 89,191** | **N = 85,048** | **N = 90,430** | **N = 83,627** | **N = 92,132** | **N = 74,854** | **N = 88,374** |
| Age (years); mean (sd) | 52.2 (9.5) | 75.3(7.0) | 52.5(9.5) | 75.3(7.0) | 52.7(9.3) | 75.3(7.1) | 52.8(9.2) | 75.3(7.1) | 53.0(9.2) | 75.3(7.1) |
| Sex |   |   |   |   |   |   |   |   |   |   |
|  Male; n (%) | 49832(57.7) | 37301(45.5) | 50416(58.0) | 41764(46.8) | 49560(58.3) | 42963(47.5) | 49037(58.6) | 44667(48.5) | 44119(58.9) | 43347(49.1) |
|  Female; n (%) | 36484(42.3) | 44696(54.5) | 36521(42.0) | 47421(53.2) | 35486(41.7) | 47462(52.5) | 34587(41.4) | 47459(51.5) | 30732(41.1) | 45023(51.0) |
| Race |   |   |   |   |   |   |   |   |   |   |
|  White; n (%) | 39320(45.6) | 50203(61.2) | 39941(45.9) | 54900(61.6) | 39658(46.6) | 55894(61.8) | 39541(47.3) | 57264(62.2) | 36447(48.7) | 55521(62.8) |
|  Black; n (%) | 42376(49.1) | 25876(31.6) | 42326(48.7) | 28029(31.4) | 40768(47.9) | 28198(31.2) | 39393(47.1) | 28346(30.8) | 33955(45.4) | 26262(29.7) |
|  Asian; n (%) | 2016(2.3) | 4083(5.0) | 2085(2.4) | 4310(4.8) | 2072(2.4) | 4382(4.9) | 2125(2.5) | 4499(4.9) | 1928(2.6) | 4566(5.2) |
|  Other; n (%) | 2508(2.9) | 1817(2.2) | 2480(2.9) | 1928(2.2) | 2425(2.9) | 1930(2.1) | 2452(2.9) | 1995(2.2) | 2408(3.2) | 1995(2.3) |
| Ethnicity |   |   |   |   |   |   |   |   |   |   |
|  Hispanic; n (%) | 16106(18.7) | 13703(16.7) | 16259(18.7) | 14162(15.9) | 16033(18.9) | 14086(15.6) | 15487(18.5) | 13560(14.7) | 14444(19.3) | 13340(15.1) |
|  Non-Hispanic; n (%) | 69819(80.9) | 68051(83.0) | 70225(80.8) | 74775(83.8) | 68555(80.6) | 76086(84.1) | 67705(81.0) | 78310(85.0) | 60002(80.2) | 74779(84.6) |
| Dialysis vintage (years); n (%) | 5.2(4.0) | 4.1(3.5) | 5.35(4.1) | 4.2(3.6) | 5.5(4.1) | 4.3(3.7) | 5.5(4.2) | 4.4(3.7) | 5.6(4.2) | 4.4(3.8) |
| Low-income subsidy; n (%) | 74608(86.4) | 51460(62.8) | 74420(85.6) | 51929(58.2) | 72803(85.6) | 51232(56.7) | 71385(85.4) | 50481(54.8) | 64254(85.8) | 48353(54.7) |
| Primary cause |   |   |   |   |   |   |   |   |   |   |
|  Diabetes; n (%) | 39362(45.6) | 41026(50.0) | 39763(45.7) | 44156(49.5) | 39251(46.2) | 44669(49.4) | 39008(46.7) | 45316(49.2) | 35129(46.9) | 43575(49.3) |
|  Hypertension; n (%) | 24523(28.4) | 26418(32.2) | 24876(28.6) | 29088(32.6) | 24751(29.1) | 29505(32.6) | 24396(29.2) | 29960(32.5) | 21990(29.4) | 28794(32.6) |
|  Glomerulonephritis; n (%) | 10457(12.1) | 4401(5.4) | 10346(11.9) | 4892(5.5) | 9715(11.4) | 5048(5.6) | 9356(11.2) | 5289(5.7) | 7996(10.7) | 5032(5.7) |
|  Cystic kidney disease; n (%) | 2126(2.5) | 1182(1.4) | 2182(2.5) | 1309(1.5) | 2141(2.5) | 1374(1.5) | 2067(2.5) | 1451(1.6) | 1920(2.6) | 1386(1.6) |
|  Other urologic disorders; n (%) | 1086(1.3) | 1303(1.6) | 1039(1.2) | 1390(1.6) | 990(1.2) | 1384(1.5) | 945(1.1) | 1441(1.6) | 903(1.2) | 1421(1.6) |
|  Other cause; n (%) | 5487(6.4) | 4864(5.9) | 5468(6.3) | 5444(6.1) | 5085(6.0) | 5611(6.2) | 4973(6.0) | 5893(6.4) | 4450(5.9) | 5828(6.6) |
|  Unknown/missing; n (%) | 3284(3.8) | 2809(3.4) | 3268(3.8) | 2912(3.3) | 3115(3.7) | 2839(3.1) | 2882(3.5) | 2782(3.0) | 2466(3.3) | 2338(2.7) |
| Dialysis chain |   |   |   |   |   |   |   |   |   |   |
|  DaVita; n (%) | 25299(29.3) | 23912(29.2) | 26402(30.4) | 26695(29.9) | 26776(31.5) | 27695(30.6) | 26747(32.0) | 28954(31.4) | 24660(32.9) | 28779(32.6) |
|  Fresenius; n (%) | 27330(31.7) | 25071(30.6) | 27854(32.0) | 27925(31.3) | 27743(32.6) | 28875(31.9) | 27798(33.2) | 29966(32.5) | 25569(34.2) | 29545(33.4) |
|  Small/medium; n (%) | 13015(15.1) | 12037(14.7) | 12645(14.5) | 12614(14.1) | 11863(14.0) | 12544(13.9) | 11566(13.8) | 12491(13.6) | 10011(13.4) | 11613(13.1) |
|  Missing; n (%) | 20681(24.0) | 20983(25.6) | 20041(23.1) | 21957(24.6) | 18666(22.0) | 21316(23.6) | 17516(21.0) | 20721(22.5) | 14614(19.5) | 18437(20.9) |
| Profit status |   |   |   |   |   |   |   |   |   |   |
|  For-profit; n (%) | 71826(83.2) | 67322(82.1) | 72603(83.5) | 73698(82.6) | 71617(84.2) | 75461(83.5) | 71037(85.0) | 77616(84.2) | 64042(85.6) | 75142(85.0) |
|  Non-profit; n (%) | 10796(12.5) | 10745(13.1) | 10533(12.1) | 11321(12.7) | 9942(11.7) | 11038(12.2) | 9543(11.4) | 11011(12.0) | 8318(11.1) | 10053(11.4) |
| **Comorbidities** |   |   |   |   |   |   |   |   |   |   |
| Diabetes; n (%) | 59979(69.5) | 64197(78.3) | 60135(69.2) | 69193(77.6) | 58522(68.8) | 69531(76.9) | 57907(69.2) | 70782(76.8) | 51951(69.4) | 67315(76.2) |
| Hypertension; n (%) | 79373(92.0) | 78227(95.4) | 79953(92.0) | 85045(95.4) | 78191(91.9) | 86224(95.4) | 77410(92.6) | 88210(95.7) | 69980(93.5) | 84855(96.0) |
| Hyperlipidemia; n (%) | 58038(67.2) | 65113(79.4) | 57804(66.5) | 70911(79.5) | 57721(67.9) | 72897(80.6) | 55978(66.9) | 74117(80.5) | 50185(67.0) | 70982(80.3) |
| Coronary artery disease; n (%) | 34561(40.0) | 47294(57.7) | 34748(40.0) | 50428(56.5) | 33665(39.6) | 50573(55.9) | 35435(42.4) | 54020(58.6) | 34740(46.4) | 55289(62.6) |
| Myocardial infarction; n (%) | 14435(16.7) | 19424(23.7) | 14559(16.8) | 20882(23.4) | 14335(16.9) | 20936(23.2) | 14876(17.8) | 21735(23.6) | 13660(18.3) | 21028(23.8) |
| Dysrhythmia; n (%) | 29447(34.1) | 43245(52.7) | 30160(34.7) | 47043(52.7) | 29670(34.9) | 48105(53.2) | 30703(36.7) | 50361(54.7) | 29834(39.9) | 49443(56.0) |
| Congestive heart failure; n (%) | 39339(45.6) | 48598(59.3) | 39579(45.5) | 52287(58.6) | 38839(45.7) | 52530(58.1) | 38783(46.4) | 53744(58.3) | 34899(46.6) | 51049(57.8) |
| Cerebrovascular disease; n (%) | 12038(13.9) | 16903(20.6) | 11950(13.7) | 17445(19.6) | 11768(13.8) | 17381(19.2) | 11866(14.2) | 18128(19.7) | 10501(14.0) | 17388(19.7) |
| Chronic obstructive pulmonary disease; n (%) | 21055(24.4) | 29610(36.1) | 21178(24.4) | 31776(35.6) | 20449(24.0) | 31678(35.0) | 20926(25.0) | 32780(35.6) | 20059(26.8) | 32484(36.8) |
| Cancer; n (%) | 6911(8.0) | 15588(19.0) | 6927(8.0) | 17318(19.4) | 7006(8.2) | 17920(19.8) | 7023(8.4) | 18713(20.3) | 6125(8.2) | 17670(20.0) |
| Depression; n (%) | 21902(25.4) | 20071(24.5) | 22756(26.2) | 22058(24.7) | 22534(26.5) | 22941(25.4) | 23315(27.9) | 24321(26.4) | 21509(28.7) | 23571(26.7) |
| Dementia; n (%) | 6412(7.4) | 18315(22.3) | 6459(7.4) | 19267(21.6) | 6120(7.2) | 19028(21.0) | 6663(8.0) | 19872(21.6) | 7242(9.7) | 20249(22.9) |
| Nursing home residence; n (%) | 9163(10.6) | 17746(21.6) | 9280(10.7) | 19057(21.4) | 9066(10.7) | 19419(21.5) | 9370(11.2) | 19959(21.7) | 8509(11.4) | 19040(21.5) |
| Hospitalization during baseline; n (%) | 49209(57.0) | 49217(60.0) | 49128(56.5) | 53955(60.5) | 47405(55.7) | 53679(59.4) | 46206(55.3) | 54288(58.9) | 41716(55.7) | 51827(58.7) |

**Supplemental Table 1.2.** Medication use in patients with ESRD on hemodialysis by age, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Medication** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** | **<65** | **≥65** |
| **N = 86,325** | **N = 82,003** | **N = 86,942** | **N = 89,191** | **N = 85,048** | **N = 90,430** | **N = 83,627** | **N = 92,132** | **N = 74,854** | **N = 88,374** |
| Number of medications; mean (sd) | 7.7(4.0) | 7.0(3.6) | 7.3(3.8) | 6.7(3.5) | 7.4(3.8) | 6.6(3.5) | 7.4(3.8) | 6.6(3.4) | 7.2(3.7) | 6.4(3.4) |
| Number of medications |   |   |   |   |   |   |   |   |   |   |
|  0-4; n (%) | 18064(20.9) | 19803(24.2) | 20149(23.2) | 24036(27.0) | 19043(22.4) | 24391(27.0) | 18671(22.3) | 25261(27.4) | 17581(23.5) | 25219(28.5) |
|  5-9; n (%) | 42527(49.3) | 43474(53.0) | 43862(50.5) | 47799(53.6) | 42737(50.3) | 48757(53.9) | 42564(50.9) | 49879(54.1) | 38159(51.0) | 47848(54.1) |
|  10-14; n (%) | 21147(24.5) | 16518(20.1) | 19419(22.3) | 15715(17.6) | 19641(23.1) | 15606(17.3) | 19050(22.8) | 15521(16.9) | 16445(22.0) | 13991(15.8) |
|  15+; n (%) | 4587(5.3) | 2208(2.7) | 3512(4.0) | 1641(1.8) | 3627(4.3) | 1676(1.9) | 3342(4.0) | 1471(1.6) | 2669(3.6) | 1316(1.5) |
| **Medication Classes** |   |   |   |   |   |   |   |   |   |   |
| Cardiovascular / Blood Pressure |   |   |   |   |   |   |   |   |   |   |
|  ACEI and ARB\* | 41419(48.0) | 33988(41.5) | 39995(46.0) | 35088(39.3) | 37524(44.1) | 33351(36.9) | 36025(43.1) | 32894(35.7) | 31283(41.8) | 30290(34.3) |
|  Beta blocker | 57261(66.3) | 52479(64.0) | 57478(66.1) | 56702(63.6) | 56094(66.0) | 57019(63.1) | 55611(66.5) | 58273(63.3) | 49734(66.4) | 55477(62.8) |
|  Calcium channel blocker | 41590(48.2) | 34625(42.2) | 41645(47.9) | 37258(41.8) | 40468(47.6) | 37097(41.0) | 40258(48.1) | 38066(41.3) | 36467(48.7) | 36734(41.6) |
|  Loop diuretic | 12971(15.0) | 16201(19.8) | 10336(11.9) | 14414(16.2) | 12383(14.6) | 17282(19.1) | 12914(15.4) | 18670(20.3) | 12348(16.5) | 18937(21.4) |
|  Non loop diuretic | 1990(2.3) | 2052(2.5) | 1944(2.2) | 2139(2.4) | 1928(2.3) | 2143(2.4) | 2020(2.4) | 2219(2.4) | 1874(2.5) | 2212(2.5) |
|  Statin | 35072(40.6) | 44282(54.0) | 36249(41.7) | 49130(55.1) | 36400(42.8) | 50491(55.8) | 37007(44.3) | 52968(57.5) | 34389(45.9) | 51878(58.7) |
| Diabetes |   |   |   |   |   |   |   |   |   |   |
|  Insulin | 28034(32.5) | 26398(32.2) | 27983(32.2) | 28039(31.4) | 27162(31.9) | 27532(30.5) | 26807(32.1) | 27645(30.0) | 23887(31.9) | 26055(29.5) |
|  DPP-4 inhibitor\* | 2203(2.6) | 3090(3.8) | 2302(2.7) | 3634(4.1) | 2490(2.9) | 3886(4.3) | 2722(3.3) | 4290(4.7) | 2780(3.7) | 4427(5.0) |
|  GLP-1 RA\* | 194(0.2) | 106(0.1) | 235(0.3) | 158(0.2) | 324(0.4) | 207(0.2) | 409(0.5) | 245(0.3) | 508(0.7) | 346(0.4) |
|  Sulfonylurea | 6196(7.2) | 7780(9.5) | 5793(6.7) | 7613(8.5) | 5286(6.2) | 7135(7.9) | 4833(5.8) | 6673(7.2) | 4221(5.6) | 6243(7.1) |
|  TZD\* | 1217(1.4) | 1485(1.8) | 991(1.1) | 1296(1.5) | 838(1.0) | 1102(1.2) | 699(0.8) | 1036(1.1) | 616(0.8) | 925(1.1) |
| Renal |   |   |   |   |   |   |   |   |   |   |
|  Erythropoietin stimulating agent\*\* | 77686(90.0) | 76468(93.3) | 77932(89.6) | 82933(93.0) | 76057(89.4) | 83669(92.5) | 74404(89.0) | 84695(91.9) | 65900(88.0) | 80103(90.6) |
|  Cinacalcet\*\* | 35705(41.4) | 20805(25.4) | 36574(42.1) | 23366(26.2) | 37163(43.7) | 24724(27.3) | 37912(45.3) | 26046(28.3) | 33901(45.3) | 24753(28.0) |
|  Phosphate binder | 70075(81.2) | 58031(70.8) | 68844(79.2) | 61785(69.3) | 66947(78.7) | 61345(67.8) | 65410(78.2) | 62119(67.4) | 56375(75.3) | 56983(64.5) |
|  Kayexalate | 5265(6.1) | 4052(4.9) | 5142(5.9) | 4421(5.0) | 4766(5.6) | 4131(4.6) | 5092(6.1) | 4446(4.8) | 4387(5.9) | 4204(4.8) |
|  Patiromer |   |   |   |   |   |   | 434(0.5) | 222(0.2) | 1091(1.5) | 686(0.8) |
| Hematology |   |   |   |   |   |   |   |   |   |   |
|  Anticoagulant | 10026(11.6) | 12507(15.3) | 10232(11.8) | 13863(15.5) | 10164(12.0) | 14651(16.2) | 10577(12.7) | 16105(17.5) | 9702(13.0) | 16043(18.2) |
|  Antiplatelet | 14907(17.3) | 19249(23.5) | 14809(17.0) | 20571(23.1) | 14495(17.0) | 20440(22.6) | 14535(17.4) | 20662(22.4) | 13330(17.8) | 19774(22.4) |
| Neurological |   |   |   |   |   |   |   |   |   |   |
|  Antipsychotic | 5449(6.3) | 4803(5.9) | 5333(6.1) | 4920(5.5) | 5184(6.1) | 4801(5.3) | 5079(6.1) | 4658(5.1) | 4600(6.2) | 4608(5.2) |
|  Mood stabilizer | 1158(1.3) | 814(1.0) | 1121(1.3) | 896(1.0) | 1131(1.3) | 945(1.1) | 1107(1.3) | 979(1.1) | 985(1.3) | 958(1.1) |
|  Cholinesterase | 823(1.0) | 5356(6.5) | 798(0.9) | 5601(6.3) | 709(0.8) | 5392(6.0) | 602(0.7) | 5234(5.7) | 599(0.8) | 4860(5.5) |
|  Non benzodiazepine hypnotic | 11941(13.8) | 8647(10.5) | 10468(12.0) | 7693(8.6) | 9125(10.7) | 6534(7.2) | 7997(9.6) | 5521(6.0) | 6089(8.1) | 4189(4.7) |
|  SSRI\* | 18486(21.4) | 17934(21.9) | 18584(21.4) | 19175(21.5) | 18148(21.3) | 19198(21.2) | 17975(21.5) | 19663(21.3) | 16251(21.7) | 18865(21.4) |
|  Tricyclic antidepressant | 4534(5.3) | 2868(3.5) | 4259(4.9) | 2875(3.2) | 4148(4.9) | 2476(2.7) | 3952(4.7) | 2561(2.8) | 3662(4.9) | 2716(3.1) |
| Muscle |   |   |   |   |   |   |   |   |   |   |
|  Antispasmodic | 14268(16.5) | 9790(11.9) | 12076(13.9) | 8405(9.4) | 12737(15.0) | 8179(9.0) | 12831(15.3) | 7942(8.6) | 10715(14.3) | 7478(8.5) |
|  Muscle relaxant | 10225(11.8) | 4360(5.3) | 9996(11.5) | 4281(4.8) | 11128(13.1) | 4025(4.5) | 10029(12.0) | 4031(4.4) | 9538(12.7) | 4510(5.1) |
|  NSAID\* | 7170(8.3) | 4725(5.8) | 6342(7.3) | 4385(4.9) | 6304(7.4) | 4293(4.8) | 5970(7.1) | 4042(4.4) | 4944(6.6) | 3614(4.1) |
| Gastrointestinal |   |   |   |   |   |   |   |   |   |   |
|  Antihistamine | 293(0.3) | 151(0.2) | 107(0.1) | 56(0.1) | 135(0.2) | 66(0.1) | 140(0.2) | 62(0.1) | 78(0.1) | 61(0.1) |
|  Proton pump inhibitor | 37026(42.9) | 37005(45.1) | 37102(42.7) | 39843(44.7) | 35512(41.8) | 39610(43.8) | 34119(40.8) | 39674(43.1) | 29932(40.0) | 36945(41.8) |
| **Harmful** |   |   |   |   |   |   |   |   |   |   |
| Harmful medication\*\*\* | 65496(75.9) | 59118(72.1) | 62320(71.7) | 60520(67.9) | 62796(73.8) | 62698(69.3) | 60991(72.9) | 62741(68.1) | 53138(71.0) | 58631(66.3) |
| Benzodiazepine | 21394(24.8) | 18023(22.0) | 18927(21.8) | 16846(18.9) | 20041(23.6) | 18507(20.5) | 18809(22.5) | 18203(19.8) | 15508(20.7) | 15945(18.0) |
| Opioid | 55794(64.6) | 45226(55.2) | 51410(59.1) | 44270(49.6) | 53036(62.4) | 47620(52.7) | 51189(61.2) | 47272(51.3) | 43859(58.6) | 43274(49.0) |
| \*ACEI = angiotensin converting enzyme inhibitors, ARB = angiotensin receptor blockers, DPP-4 inhibitor = dipeptidyl-peptidase 4 inhibitors, GLP-1 RA = glucagon-like peptide-1 receptor agonists, TZD = thiazolidinedione, SSRI = selective serotonin reuptake inhibitors, NSAID = non-steroidal anti-inflammatory drugs\*\*Part D and Procedure\*\*\*Harmful medications include non-benzodiazepine hypnotics, benzodiazepines, opioids, antipsychotics, mood stabilizers, cholinesterase inhibitors, first-generation antihistamines, antispasmodic agents, SSRIs, and tricyclic antidepressants. |

 **Supplemental Table 2.1**. Characteristics of patients with ESRD on hemodialysis by sex, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **Demographics** | **N = 87,133** | **N = 81,180** | **N = 92,180** | **N = 83,942** | **N = 92,523** | **N = 82,948** | **N = 93,704** | **N = 82,046** | **N = 87,466** | **N = 75,755** |
| Age (years); mean (sd) | 61.8(14.1) | 65.2(14.2) | 62.6(14.1) | 65.6(14.1) | 63.1(13.9) | 65.8(14.0) | 63.4(13.8) | 66.0(13.8) | 63.9(13.7) | 66.4(13.7) |
|  18-65; n (%) | 49832(57.2) | 36484(44.9) | 50416(54.7) | 36521(43.5) | 49560(53.6) | 35486(42.8) | 49037(52.3) | 34587(42.2) | 44119(50.4) | 30732(40.6) |
|  65-69; n (%) | 10985(12.6) | 12095(14.9) | 12011(13.0) | 12965(15.5) | 12481(13.5) | 13157(15.9) | 13374(14.3) | 13320(16.2) | 12959(14.8) | 12620(16.7) |
|  70-74; n (%) | 9752(11.2) | 11119(13.7) | 10869(11.8) | 11641(13.9) | 11061(12.0) | 11789(14.2) | 11116(11.9) | 11793(14.4) | 10858(12.4) | 11132(14.7) |
|  75-79; n (%) | 7652(8.8) | 9405(11.6) | 8633(9.4) | 9946(11.9) | 8905(9.6) | 9769(11.8) | 9210(9.8) | 9681(11.8) | 8781(10.0) | 9229(12.2) |
|  >80; n (%) | 8912(10.2) | 12077(14.9) | 10251(11.1) | 12869(15.3) | 10516(11.4) | 12747(15.4) | 10967(11.7) | 12665(15.4) | 10749(12.3) | 12042(15.9) |
| Race |   |   |   |   |   |   |   |   |   |   |
|  White; n (%) | 47923(55.0) | 41593(51.2) | 51364(55.7) | 43470(51.8) | 52263(56.5) | 43285(52.2) | 53597(57.2) | 43203(52.7) | 50975(58.3) | 40989(54.1) |
|  Black; n (%) | 33879(38.9) | 34366(42.3) | 35280(38.3) | 35072(41.8) | 34633(37.4) | 34330(41.4) | 34271(36.6) | 33465(40.8) | 30662(35.1) | 29553(39.0) |
|  Asian; n (%) | 3191(3.7) | 2907(3.6) | 3379(3.7) | 3015(3.6) | 3444(3.7) | 3010(3.6) | 3572(3.8) | 3051(3.7) | 3497(4.0) | 2996(4.0) |
|  Other; n (%) | 2055(2.4) | 2270(2.8) | 2071(2.3) | 2337(2.8) | 2084(2.3) | 2271(2.7) | 2170(2.3) | 2277(2.8) | 2242(2.6) | 2161(2.9) |
| Ethnicity |   |   |   |   |   |   |   |   |   |   |
|  Hispanic; n (%) | 16366(18.8) | 13439(16.6) | 16754(18.2) | 13664(16.3) | 16686(18.0) | 13431(16.2) | 16458(17.6) | 12588(15.3) | 15726(18) | 12056(15.9) |
|  Non-Hispanic; n (%) | 70421(80.8) | 67439(83.1) | 75039(81.4) | 69955(83.3) | 75447(81.5) | 69191(83.4) | 76880(82.1) | 69129(84.3) | 71391(81.6) | 63386(83.7) |
| Dialysis vintage (years); n (%) | 4.7(3.8) | 4.7(3.8) | 4.8(3.8) | 4.8(3.9) | 4.8(3.9) | 4.9(4.0) | 4.9(3.9) | 4.98(4.1) | 4.9(4.0) | 4.96(4.1) |
| Low-income subsidy; n (%) | 62139(71.3) | 63918(78.7) | 62687(68.0) | 63652(75.8) | 61979(67.0) | 62050(74.8) | 61659(65.8) | 60200(73.4) | 57202(65.4) | 55398(73.1) |
| Primary cause |   |   |   |   |   |   |   |   |   |   |
|  Diabetes; n (%) | 39300(45.1) | 41085(50.6) | 41626(45.2) | 42292(50.4) | 42097(45.5) | 41822(50.4) | 43000(45.9) | 41323(50.4) | 40350(46.1) | 38353(50.6) |
|  Hypertension; n (%) | 27866(32.0) | 23066(28.4) | 29825(32.4) | 24133(28.8) | 30206(32.7) | 24047(29.0) | 30503(32.6) | 23848(29.1) | 28714(32.8) | 22066(29.1) |
|  Glomerulonephritis; n (%) | 7648(8.8) | 7209(8.9) | 7871(8.5) | 7366(8.8) | 7612(8.2) | 7150(8.6) | 7593(8.1) | 7052(8.6) | 6682(7.6) | 6346(8.4) |
|  Cystic kidney disease; n (%) | 1627(1.9) | 1681(2.1) | 1754(1.9) | 1737(2.1) | 1775(1.9) | 1740(2.1) | 1778(1.9) | 1740(2.1) | 1697(1.9) | 1609(2.1) |
|  Other urologic disorders; n (%) | 1531(1.8) | 858(1.1) | 1557(1.7) | 872(1.0) | 1574(1.7) | 800(1.0) | 1569(1.7) | 817(1.0) | 1556(1.8) | 768(1.0) |
|  Other cause; n (%) | 5789(6.6) | 4562(5.6) | 6110(6.6) | 4802(5.7) | 5952(6.4) | 4744(5.7) | 6100(6.5) | 4766(5.8) | 5782(6.6) | 4496(5.9) |
|  Unknown/missing; n (%) | 3372(3.9) | 2719(3.4) | 3437(3.7) | 2740(3.3) | 3307(3.6) | 2645(3.2) | 3161(3.4) | 2500(3.1) | 2685(3.1) | 2117(2.8) |
| Dialysis chain |   |   |   |   |   |   |   |   |   |   |
|  DaVita; n (%) | 25688(29.5) | 23518(29.0) | 27976(30.4) | 25118(29.9) | 29110(31.5) | 25358(30.6) | 29971(32.0) | 25727(31.4) | 28939(33.1) | 24497(32.3) |
|  Fresenius; n (%) | 26792(30.8) | 25601(31.5) | 28840(31.3) | 26934(32.1) | 29424(31.8) | 27191(32.8) | 30510(32.6) | 27251(33.2) | 29266(33.5) | 25847(34.1) |
|  Small/medium; n (%) | 12764(14.7) | 12288(15.1) | 13045(14.2) | 12214(14.6) | 12730(13.8) | 11677(14.1) | 12719(13.6) | 11338(13.8) | 11374(13.0) | 10250(13.5) |
|  Missing; n (%) | 21889(25.1) | 19773(24.4) | 22319(24.2) | 19676(23.4) | 21259(23.0) | 18722(22.6) | 20504(21.9) | 17730(21.6) | 17887(20.5) | 15161(20.0) |
| Profit status |   |   |   |   |   |   |   |   |   |   |
|  For-profit; n (%) | 71770(82.4) | 67363(83.0) | 76260(82.7) | 70031(83.4) | 77336(83.6) | 69735(84.1) | 79147(84.5) | 69497(84.7) | 74519(85.2) | 64658(85.4) |
|  Non-profit; n (%) | 11153(12.8) | 10388(12.8) | 11463(12.4) | 10391(12.4) | 10998(11.9) | 9982(12.0) | 10872(11.6) | 9682(11.8) | 9767(11.2) | 8604(11.4) |
| **Comorbidities** |   |   |   |   |   |   |   |   |   |   |
| Diabetes; n (%) | 61676(70.8) | 62491(77.0) | 65064(70.6) | 64259(76.6) | 65137(70.4) | 62912(75.9) | 66331(70.8) | 62352(76.0) | 61792(70.7) | 57471(75.9) |
| Hypertension; n (%) | 80241(92.1) | 77346(95.3) | 85101(92.3) | 79888(95.2) | 85498(92.4) | 78910(95.1) | 87322(93.2) | 78291(95.4) | 82073(93.8) | 72756(96.0) |
| Hyperlipidemia; n (%) | 61978(71.1) | 61160(75.3) | 65463(71.0) | 63244(75.3) | 67236(72.7) | 63376(76.4) | 67739(72.3) | 62350(76.0) | 63312(72.4) | 57851(76.4) |
| Coronary artery disease; n (%) | 41893(48.1) | 39954(49.2) | 44693(48.5) | 40479(48.2) | 44702(48.3) | 39532(47.7) | 48222(51.5) | 41227(50.3) | 48421(55.4) | 41604(54.9) |
| Myocardial infarction; n (%) | 17584(20.2) | 16273(20.1) | 18833(20.4) | 16607(19.8) | 18938(20.5) | 16332(19.7) | 19953(21.3) | 16657(20.3) | 18904(21.6) | 15784(20.8) |
| Dysrhythmia; n (%) | 37050(42.5) | 35638(43.9) | 40143(43.6) | 37058(44.2) | 41027(44.3) | 36744(44.3) | 43316(46.2) | 37744(46.0) | 42182(48.2) | 37092(49.0) |
| Congestive heart failure; n (%) | 42765(49.1) | 45166(55.6) | 45477(49.3) | 46385(55.3) | 45640(49.3) | 45727(55.1) | 46707(49.9) | 45816(55.8) | 43604(49.9) | 42340(55.9) |
| Cerebrovascular disease; n (%) | 13290(15.3) | 15646(19.3) | 13843(15.0) | 15550(18.5) | 13838(15.0) | 15309(18.5) | 14510(15.5) | 15481(18.9) | 13708(15.7) | 14178(18.7) |
| Chronic obstructive pulmonary disease; n (%) | 24461(28.1) | 26199(32.3) | 25977(28.2) | 26975(32.1) | 25767(27.9) | 26357(31.8) | 26726(28.5) | 26977(32.9) | 26163(29.9) | 26377(34.8) |
| Cancer; n (%) | 12699(14.6) | 9799(12.1) | 14030(15.2) | 10213(12.2) | 14603(15.8) | 10323(12.5) | 15138(16.2) | 10598(12.9) | 13983(16.0) | 9812(13.0) |
| Depression; n (%) | 18266(21.0) | 23703(29.2) | 19772(21.5) | 25041(29.8) | 20292(21.9) | 25183(30.4) | 21395(22.8) | 26241(32.0) | 20425(23.4) | 24652(32.5) |
| Dementia; n (%) | 11283(13.0) | 13442(16.6) | 12047(13.1) | 13679(16.3) | 11933(12.9) | 13214(15.9) | 12826(13.7) | 13707(16.7) | 13256(15.2) | 14231(18.8) |
| Nursing home residence; n (%) | 12272(14.1) | 14637(18.0) | 13198(14.3) | 15138(18.0) | 13320(14.4) | 15163(18.3) | 13929(14.9) | 15398(18.8) | 13131(15.0) | 14415(19.0) |
| Hospitalization during baseline; n (%) | 48498(55.7) | 49921(61.5) | 51744(56.1) | 51334(61.2) | 51085(55.2) | 49995(60.3) | 51336(54.8) | 49155(59.9) | 48129(55.0) | 45410(59.9) |

**Supplemental Table 2.2**. Medication use in patients with ESRD on hemodialysis by sex, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Medication** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **N = 87,133** | **N = 81,180** | **N = 92,180** | **N = 83,942** | **N = 92,523** | **N = 82,948** | **N = 93,704** | **N = 82,046** | **N = 87,466** | **N = 75,755** |
| Number of medications; mean (sd) | 6.9(3.7) | 7.9(3.8) | 6.6(3.6) | 7.5(3.7) | 6.6(3.6) | 7.5(3.7) | 6.6(3.5) | 7.4(3.6) | 6.4(3.5) | 7.2(3.6) |
| Number of medications |   |   |   |   |   |   |   |   |   |   |
|  0-4; n (%) | 23215(26.6) | 14647(18.0) | 26775(29.1) | 17408(20.7) | 26385(28.5) | 17048(20.6) | 26824(28.6) | 17107(20.9) | 26083(29.8) | 16715(22.1) |
|  5-9; n (%) | 44535(51.1) | 41459(51.1) | 47508(51.5) | 44145(52.6) | 48003(51.9) | 43486(52.4) | 48946(52.2) | 43490(53.0) | 45592(52.1) | 40411(53.3) |
|  10-14; n (%) | 16626(19.1) | 21036(25.9) | 15792(17.1) | 19341(23.0) | 15993(17.3) | 19253(23.2) | 15916(17.0) | 18654(22.7) | 14162(16.2) | 16273(21.5) |
|  15+; n (%) | 2757(3.2) | 4038(5.0) | 2105(2.3) | 3048(3.6) | 2142(2.3) | 3161(3.8) | 2018(2.2) | 2795(3.4) | 1629(1.9) | 2356(3.1) |
| **Medication Classes** |   |   |   |   |   |   |   |   |   |   |
| Cardiovascular / Blood Pressure |   |   |   |   |   |   |   |   |   |   |
|  ACEI and ARB\* | 38527(44.2) | 36875(45.4) | 38850(42.2) | 36227(43.2) | 36893(39.9) | 33980(41.0) | 36463(38.9) | 32454(39.6) | 32670(37.4) | 28901(38.2) |
|  Beta blocker | 56153(64.5) | 53577(66.0) | 59104(64.1) | 55068(65.6) | 59201(64.0) | 53906(65.0) | 60385(64.4) | 53492(65.2) | 56002(64.0) | 49205(65.0) |
|  Calcium channel blocker | 37646(43.2) | 38562(47.5) | 39249(42.6) | 39648(47.2) | 38942(42.1) | 38621(46.6) | 39926(42.6) | 38393(46.8) | 37509(42.9) | 35688(47.1) |
|  Loop diuretic | 14234(16.3) | 14938(18.4) | 12242(13.3) | 12508(14.9) | 14833(16.0) | 14832(17.9) | 15960(17.0) | 15624(19.0) | 15907(18.2) | 15378(20.3) |
|  Non loop diuretic | 2030(2.3) | 2012(2.5) | 2070(2.3) | 2013(2.4) | 2007(2.2) | 2064(2.5) | 2149(2.3) | 2090(2.6) | 2079(2.4) | 2007(2.7) |
|  Statin | 38968(44.7) | 40381(49.7) | 42756(46.4) | 42618(50.8) | 44241(47.8) | 42647(51.4) | 46737(49.9) | 43234(52.7) | 45198(51.7) | 41068(54.2) |
| Diabetes |   |   |   |   |   |   |   |   |   |   |
|  Insulin | 24928(28.6) | 29504(36.3) | 26100(28.3) | 29921(35.6) | 25953(28.1) | 28741(34.7) | 26241(28.0) | 28210(34.4) | 24116(27.6) | 25826(34.1) |
|  DPP-4 inhibitor\* | 2533(2.9) | 2760(3.4) | 2973(3.2) | 2963(3.5) | 3281(3.6) | 3095(3.7) | 3599(3.8) | 3413(4.2) | 3661(4.2) | 3546(4.7) |
|  GLP-1 RA\* | 146(0.2) | 154(0.2) | 176(0.2) | 217(0.3) | 253(0.3) | 278(0.3) | 313(0.3) | 341(0.4) | 413(0.5) | 441(0.6) |
|  Sulfonylurea | 7489(8.6) | 6486(8.0) | 7293(7.9) | 6111(7.3) | 6940(7.5) | 5479(6.6) | 6492(6.9) | 5013(6.1) | 5944(6.8) | 4520(6.0) |
|  TZD\* | 1370(1.6) | 1332(1.6) | 1206(1.3) | 1081(1.3) | 1073(1.2) | 867(1.1) | 955(1.0) | 780(1.0) | 886(1.0) | 655(0.9) |
| Renal |   |   |   |   |   |   |   |   |   |   |
|  Erythropoietin stimulating agent\*\* | 76925(88.3) | 77216(95.1) | 81129(88.0) | 79726(95.0) | 81208(87.8) | 78511(94.7) | 81813(87.3) | 77278(94.2) | 75422(86.2) | 70576(93.2) |
|  Cinacalcet\*\* | 27850(32.0) | 28654(35.3) | 29742(32.3) | 30194(36.0) | 31043(33.6) | 30840(37.2) | 32605(34.8) | 31347(38.2) | 29966(34.3) | 28684(37.9) |
|  Phosphate binder | 64644(74.2) | 63449(78.2) | 66903(72.6) | 63716(75.9) | 66148(71.5) | 62137(74.9) | 66658(71.1) | 60862(74.2) | 59512(68.0) | 53841(71.1) |
|  Kayexalate | 4797(5.5) | 4520(5.6) | 4860(5.3) | 4703(5.6) | 4607(5.0) | 4290(5.2) | 4918(5.3) | 4620(5.6) | 4476(5.1) | 4114(5.4) |
|  Patiromer |   |   |   |   |   |   | 357(0.4) | 299(0.4) | 969(1.1) | 808(1.1) |
| Hematology |   |   |   |   |   |   |   |   |   |   |
|  Anticoagulant | 11171(12.8) | 11362(14.0) | 12267(13.3) | 11828(14.1) | 12834(13.9) | 11981(14.4) | 14098(15.1) | 12584(15.3) | 13592(15.5) | 12153(16.0) |
|  Antiplatelet | 16899(19.4) | 17255(21.3) | 17850(19.4) | 17529(20.9) | 17943(19.4) | 16991(20.5) | 18301(19.5) | 16895(20.6) | 17454(20.0) | 15650(20.7) |
| Neurological |   |   |   |   |   |   |   |   |   |   |
|  Antipsychotic | 5058(5.8) | 5193(6.4) | 5058(5.5) | 5195(6.2) | 4985(5.4) | 4999(6.0) | 4968(5.3) | 4767(5.8) | 4737(5.4) | 4470(5.9) |
|  Mood stabilizer | 899(1.0) | 1073(1.3) | 879(1.0) | 1138(1.4) | 886(1.0) | 1190(1.4) | 931(1.0) | 1155(1.4) | 856(1.0) | 1087(1.4) |
|  Cholinesterase | 2716(3.1) | 3463(4.3) | 2936(3.2) | 3463(4.1) | 2810(3.0) | 3290(4.0) | 2710(2.9) | 3126(3.8) | 2550(2.9) | 2909(3.8) |
|  Non benzodiazepine hypnotic | 10164(11.7) | 10422(12.8) | 9178(10.0) | 8982(10.7) | 7973(8.6) | 7686(9.3) | 7078(7.6) | 6439(7.9) | 5510(6.3) | 4768(6.3) |
|  SSRI\* | 15636(17.9) | 20782(25.6) | 16440(17.8) | 21318(25.4) | 16352(17.7) | 20993(25.3) | 16639(17.8) | 20998(25.6) | 15561(17.8) | 19554(25.8) |
|  Tricyclic antidepressant | 3108(3.6) | 4293(5.3) | 3024(3.3) | 4110(4.9) | 2795(3.0) | 3829(4.6) | 2765(3.0) | 3748(4.6) | 2794(3.2) | 3584(4.7) |
| Muscle |   |   |   |   |   |   |   |   |   |   |
|  Antispasmodic | 10017(11.5) | 14040(17.3) | 8700(9.4) | 11781(14.0) | 8858(9.6) | 12058(14.5) | 8900(9.5) | 11873(14.5) | 7846(9.0) | 10347(13.7) |
|  Muscle relaxant | 6756(7.8) | 7826(9.6) | 6532(7.1) | 7744(9.2) | 6980(7.5) | 8169(9.9) | 6606(7.1) | 7453(9.1) | 6542(7.5) | 7505(9.9) |
|  NSAID\* | 5780(6.6) | 6114(7.5) | 5203(5.6) | 5521(6.6) | 5258(5.7) | 5338(6.4) | 4969(5.3) | 5042(6.2) | 4259(4.9) | 4299(5.7) |
| Gastrointestinal |   |   |   |   |   |   |   |   |   |   |
|  Antihistamine | 191(0.2) | 253(0.3) | 66(0.1) | 97(0.1) | 79(0.1) | 122(0.2) | 74(0.1) | 128(0.2) | 50(0.1) | 89(0.1) |
|  Proton pump inhibitor | 35076(40.3) | 38949(48.0) | 36783(39.9) | 40157(47.8) | 36426(39.4) | 38695(46.7) | 36238(38.7) | 37551(45.8) | 32947(37.7) | 33926(44.8) |
| **Harmful** |   |   |   |   |   |   |   |   |   |   |
| Harmful medication\*\*\* | 60941(69.9) | 63663(78.4) | 60709(65.9) | 62124(74.0) | 62512(67.6) | 62977(75.9) | 62224(66.4) | 61503(75.0) | 56234(64.3) | 55530(73.3) |
| Benzodiazepine | 17482(20.1) | 21931(27.0) | 16056(17.4) | 19715(23.5) | 17356(18.8) | 21191(25.6) | 16764(17.9) | 20246(24.7) | 14282(16.3) | 17169(22.7) |
| Opioid | 48844(56.1) | 52169(64.3) | 46723(50.7) | 48952(58.3) | 49576(53.6) | 51075(61.6) | 48935(52.2) | 49522(60.4) | 43512(49.8) | 43617(57.6) |
| \*ACEI = angiotensin converting enzyme inhibitors, ARB = angiotensin receptor blockers, DPP-4 inhibitor = dipeptidyl-peptidase 4 inhibitors, GLP-1 RA = glucagon-like peptide-1 receptor agonists, TZD = thiazolidinedione, SSRI = selective serotonin reuptake inhibitors, NSAID = non-steroidal anti-inflammatory drugs\*\*Part D and Procedure\*\*\*Harmful medications include non-benzodiazepine hypnotics, benzodiazepines, opioids, antipsychotics, mood stabilizers, cholinesterase inhibitors, first-generation antihistamines, antispasmodic agents, SSRIs, and tricyclic antidepressants. |

**Supplemental Table 3.1**. Characteristics of patients with ESRD on hemodialysis by race, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2013** | **2014** | **2015** | **2016** | **2017** |
| **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** |
| **Demographics** | **N = 89,523** | **N = 68,252** | **N = 6,099** | **N = 94,841** | **N = 70,355** | **N = 6,395** | **N = 95,552** | **N = 68,966** | **N = 6,454** | **N = 96,805** | **N = 67,739** | **N = 6,624** | **N = 91,968** | **N = 60,217** | **N = 6,494** |
| Age (years); mean (sd) | 65.8(13.9) | 60.1(14.0) | 69.0(14.4) | 66.3(13.7) | 60.7(14.0) | 69.2(14.2) | 66.5(13.6) | 61.1(13.8) | 69.5(14.2) | 66.7(13.4) | 61.3(13.7) | 69.6(13.9) | 67.0(13.3) | 61.8(13.7) | 70.3(13.7) |
|  18-65; n (%) | 39320(43.9) | 42376(62.1) | 2016(33.1) | 39941(42.1) | 42326(60.2) | 2085(32.6) | 39658(41.5) | 40768(59.1) | 2072(32.1) | 39541(40.9) | 39393(58.2) | 2125(32.1) | 36447(39.6) | 33955(56.4) | 1928(29.7) |
|  65-69; n (%) | 13288(14.8) | 8398(12.3) | 784(12.9) | 14378(15.2) | 9098(12.9) | 838(13.1) | 14857(15.6) | 9269(13.4) | 866(13.4) | 15416(15.9) | 9704(14.3) | 902(13.6) | 14810(16.1) | 9194(15.3) | 904(13.9) |
|  70-74; n (%) | 12298(13.7) | 7154(10.5) | 912(15.0) | 13434(14.2) | 7579(10.8) | 961(15.0) | 13752(14.4) | 7598(11.0) | 950(14.7) | 13925(14.4) | 7481(11.1) | 962(14.5) | 13709(14.9) | 6751(11.2) | 996(15.3) |
|  75-79; n (%) | 10621(11.9) | 5147(7.5) | 937(15.4) | 11547(12.2) | 5703(8.1) | 967(15.1) | 11659(12.2) | 5650(8.2) | 965(15.0) | 11955(12.4) | 5517(8.1) | 995(15.0) | 11572(12.6) | 5060(8.4) | 954(14.7) |
|  >80; n (%) | 13996(15.6) | 5177(7.6) | 1450(23.8) | 15541(16.4) | 5649(8.0) | 1544(24.1) | 15626(16.4) | 5681(8.2) | 1601(24.8) | 15968(16.5) | 5644(8.3) | 1640(24.8) | 15430(16.8) | 5257(8.7) | 1712(26.4) |
| Sex |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Male; n (%) | 47923(53.5) | 33879(49.6) | 3191(52.3) | 51364(54.2) | 35280(50.2) | 3379(52.8) | 52263(54.7) | 34633(50.2) | 3444(53.4) | 53597(55.4) | 34271(50.6) | 3572(53.9) | 50975(55.4) | 30662(50.9) | 3497(53.9) |
|  Female; n (%) | 41593(46.5) | 34366(50.4) | 2907(47.7) | 43470(45.8) | 35072(49.9) | 3015(47.2) | 43285(45.3) | 34330(49.8) | 3010(46.6) | 43203(44.6) | 33465(49.4) | 3051(46.1) | 40989(44.6) | 29553(49.1) | 2996(46.1) |
| Ethnicity |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Hispanic; n (%) | 28415(31.7) | 779(1.1) | 134(2.2) | 29023(30.6) | 769(1.1) | 129(2.0) | 28738(30.1) | 744(1.1) | 145(2.3) | 27754(28.7) | 701(1.0) | 142(2.1) | 26569(28.9) | 630(1.1) | 142(2.2) |
|  Non-Hispanic; n (%) | 60825(67.9) | 67194(98.5) | 5922(97.1) | 65515(69.1) | 69265(98.5) | 6222(97.3) | 66516(69.6) | 67903(98.5) | 6260(97.0) | 68763(71.0) | 66744(98.5) | 6432(97.1) | 65115(70.8) | 59325(98.5) | 6301(97.0) |
| Dialysis vintage (years); n (%) | 4.1(3.4) | 5.5(4.2) | 4.4(3.5) | 4.1(3.4) | 5.7(4.2) | 4.6(3.7) | 4.2(3.5) | 5.8(4.3) | 4.76(3.8) | 4.2(3.5) | 5.9(4.4) | 4.9(3.9) | 4.3(3.6) | 5.9(4.5) | 4.9(4.0) |
| Low-income subsidy; n (%) | 59963(67.0) | 57120(83.7) | 5170(84.8) | 60400(63.7) | 56797(80.7) | 5291(82.7) | 60011(62.8) | 54922(79.6) | 5277(81.8) | 59394(61.4) | 53287(78.7) | 5334(80.5) | 56148(61.1) | 47446(78.8) | 5177(79.7) |
| Primary cause |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Diabetes; n (%) | 46262(51.7) | 28111(41.2) | 3018(49.5) | 48638(51.3) | 29036(41.3) | 3192(49.9) | 49020(51.3) | 28695(41.6) | 3201(49.6) | 49562(51.2) | 28415(42.0) | 3284(49.6) | 47198(51.3) | 25235(41.9) | 3226(49.7) |
|  Hypertension; n (%) | 21473(24.0) | 27093(39.7) | 1759(28.8) | 23385(24.7) | 28098(39.9) | 1827(28.6) | 23834(24.9) | 27896(40.5) | 1863(28.9) | 24350(25.2) | 27426(40.5) | 1904(28.7) | 23416(25.5) | 24758(41.1) | 1906(29.4) |
|  Glomerulonephritis; n (%) | 7606(8.5) | 6196(9.1) | 649(10.6) | 7934(8.4) | 6236(8.9) | 680(10.6) | 7896(8.3) | 5781(8.4) | 712(11.0) | 7993(8.3) | 5546(8.2) | 728(11.0) | 7365(8.0) | 4665(7.8) | 650(10.0) |
|  Cystic kidney disease; n (%) | 2392(2.7) | 782(1.2) | 91(1.5) | 2533(2.7) | 818(1.2) | 94(1.5) | 2574(2.7) | 786(1.1) | 107(1.7) | 2582(2.7) | 773(1.1) | 105(1.6) | 2474(2.7) | 675(1.1) | 106(1.6) |
|  Other urologic disorders; n (%) | 1878(2.1) | 413(0.6) | 64(1.1) | 1902(2.0) | 421(0.6) | 67(1.1) | 1885(2.0) | 393(0.6) | 61(1.0) | 1905(2.0) | 384(0.6) | 62(0.9) | 1852(2.0) | 370(0.6) | 69(1.1) |
|  Other cause; n (%) | 6507(7.3) | 3497(5.1) | 211(3.5) | 7011(7.4) | 3557(5.1) | 210(3.3) | 7011(7.3) | 3343(4.9) | 208(3.2) | 7262(7.5) | 3229(4.8) | 234(3.5) | 7024(7.6) | 2874(4.8) | 246(3.8) |
|  Unknown/missing; n (%) | 3405(3.8) | 2160(3.2) | 307(5.0) | 3438(3.6) | 2189(3.1) | 325(5.1) | 3332(3.5) | 2072(3.0) | 302(4.7) | 3151(3.3) | 1966(2.9) | 307(4.6) | 2639(2.9) | 1640(2.7) | 291(4.5) |
| Dialysis chain |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  DaVita; n (%) | 26359(29.4) | 19682(28.8) | 1860(30.5) | 28630(30.2) | 21052(29.9) | 2037(31.9) | 29587(31.0) | 21383(31.0) | 2108(32.7) | 30672(31.7) | 21339(31.5) | 2234(33.7) | 29960(32.6) | 19679(32.7) | 2279(35.1) |
|  Fresenius; n (%) | 27912(31.2) | 22562(33.1) | 1080(17.7) | 30351(32.0) | 23424(33.3) | 1143(17.9) | 31232(32.7) | 23366(33.9) | 1155(17.9) | 32266(33.3) | 23439(34.6) | 1180(17.8) | 31705(34.5) | 21232(35.3) | 1231(19.0) |
|  Small/medium; n (%) | 12416(13.9) | 10791(15.8) | 1037(17.0) | 12886(13.6) | 10432(14.8) | 1120(17.5) | 12741(13.3) | 9693(14.1) | 1158(17.9) | 12799(13.2) | 9211(13.6) | 1205(18.2) | 11873(12.9) | 7843(13.0) | 1131(17.4) |
|  Missing; n (%) | 22836(25.5) | 15217(22.3) | 2122(34.8) | 22974(24.2) | 15447(22.0) | 2095(32.8) | 21992(23.0) | 14524(21.1) | 2033(31.5) | 21068(21.8) | 13750(20.3) | 2005(30.3) | 18430(20.0) | 11463(19.0) | 1853(28.5) |
| Profit status |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  For-profit; n (%) | 73947(82.6) | 57304(84.0) | 4775(78.3) | 78870(83.2) | 59167(84.1) | 5047(78.9) | 80223(84.0) | 58511(84.8) | 5166(80.0) | 82157(84.9) | 57839(85.4) | 5381(81.2) | 78836(85.7) | 51782(86.0) | 5271(81.2) |
|  Non-profit; n (%) | 11387(12.7) | 8042(11.8) | 1005(16.5) | 11481(12.1) | 8267(11.8) | 1016(15.9) | 11133(11.7) | 7816(11.3) | 969(15.0) | 10943(11.3) | 7592(11.2) | 943(14.2) | 9894(10.8) | 6517(10.8) | 919(14.2) |
| **Comorbidities** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Diabetes; n (%) | 67970(75.9) | 47764(70.0) | 4648(76.2) | 71397(75.3) | 49199(69.9) | 4838(75.7) | 71282(74.6) | 48121(69.8) | 4838(75.0) | 72362(74.8) | 47447(70.0) | 4998(75.5) | 68354(74.3) | 42200(70.1) | 4846(74.6) |
| Hypertension; n (%) | 83914(93.7) | 63874(93.6) | 5698(93.4) | 88957(93.8) | 65845(93.6) | 5967(93.3) | 89686(93.9) | 64581(93.6) | 5982(92.7) | 91444(94.5) | 63752(94.1) | 6175(93.2) | 87308(94.9) | 57192(95.0) | 6107(94.0) |
| Hyperlipidemia; n (%) | 68992(77.1) | 46261(67.8) | 4700(77.1) | 73169(77.2) | 47362(67.3) | 4949(77.4) | 74639(78.1) | 47752(69.2) | 4941(76.6) | 75234(77.7) | 46503(68.7) | 5051(76.3) | 71477(77.7) | 41506(68.9) | 4921(75.8) |
| Coronary artery disease; n (%) | 47804(53.4) | 29198(42.8) | 3029(49.7) | 50014(52.7) | 30097(42.8) | 3183(49.8) | 50048(52.4) | 29185(42.3) | 3142(48.7) | 53473(55.2) | 30555(45.1) | 3361(50.7) | 54366(59.1) | 29914(49.7) | 3562(54.9) |
| Myocardial infarction; n (%) | 20204(22.6) | 11843(17.4) | 1111(18.2) | 21237(22.4) | 12213(17.4) | 1210(18.9) | 21387(22.4) | 11893(17.2) | 1187(18.4) | 22490(23.2) | 12039(17.8) | 1212(18.3) | 21457(23.3) | 11131(18.5) | 1280(19.7) |
| Dysrhythmia; n (%) | 42092(47.0) | 26459(38.8) | 2636(43.2) | 45224(47.7) | 27617(39.3) | 2750(43.0) | 46013(48.2) | 27323(39.6) | 2817(43.7) | 48407(50.0) | 27974(41.3) | 2947(44.5) | 47799(52.0) | 26620(44.2) | 2988(46.0) |
| Congestive heart failure; n (%) | 48400(54.1) | 34572(50.7) | 2986(49.0) | 51182(54.0) | 35613(50.6) | 3052(47.7) | 51327(53.7) | 34914(50.6) | 3116(48.3) | 52425(54.2) | 34822(51.4) | 3219(48.6) | 49559(53.9) | 31150(51.7) | 3164(48.7) |
| Cerebrovascular disease; n (%) | 15246(17.0) | 12198(17.9) | 980(16.1) | 15531(16.4) | 12299(17.5) | 993(15.5) | 15520(16.2) | 12117(17.6) | 969(15.0) | 16239(16.8) | 12155(17.9) | 1050(15.9) | 15345(16.7) | 10931(18.2) | 1023(15.8) |
| Chronic obstructive pulmonary disease; n (%) | 30581(34.2) | 17854(26.2) | 1320(21.6) | 32216(34.0) | 18530(26.3) | 1306(20.4) | 31900(33.4) | 18047(26.2) | 1264(19.6) | 33039(34.1) | 18255(27.0) | 1413(21.3) | 32728(35.6) | 17174(28.5) | 1516(23.3) |
| Cancer; n (%) | 14409(16.1) | 7169(10.5) | 587(9.6) | 15681(16.5) | 7615(10.8) | 611(9.6) | 16227(17.0) | 7717(11.2) | 639(9.9) | 16910(17.5) | 7782(11.5) | 688(10.4) | 15925(17.3) | 6857(11.4) | 685(10.6) |
| Depression; n (%) | 26211(29.3) | 14062(20.6) | 842(13.8) | 28277(29.8) | 14763(21.0) | 857(13.4) | 29004(30.4) | 14660(21.3) | 903(14.0) | 30721(31.7) | 14956(22.1) | 990(15.0) | 29277(31.8) | 13899(23.1) | 993(15.3) |
| Dementia; n (%) | 13556(15.1) | 9770(14.3) | 971(15.9) | 14217(15.0) | 10074(14.3) | 1013(15.8) | 14108(14.8) | 9622(14.0) | 998(15.5) | 15063(15.6) | 9944(14.7) | 1066(16.1) | 15939(17.3) | 9842(16.3) | 1164(17.9) |
| Nursing home residence; n (%) | 16280(18.2) | 9445(13.8) | 741(12.2) | 17308(18.3) | 9802(13.9) | 751(11.7) | 17691(18.5) | 9601(13.9) | 736(11.4) | 18226(18.8) | 9762(14.4) | 832(12.6) | 17306(18.8) | 8958(14.9) | 790(12.2) |
| Hospitalization during baseline; n (%) | 53821(60.1) | 39228(57.5) | 2974(48.8) | 57276(60.4) | 40080(57.0) | 3188(49.9) | 56811(59.5) | 38828(56.3) | 3045(47.2) | 57234(59.1) | 37601(55.5) | 3218(48.6) | 54624(59.4) | 33464(55.6) | 3068(47.2) |

**Supplemental Table 3.2**. Medication use in patients with ESRD on hemodialysis by race, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Medication** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** | **White** | **Black** | **Asian** |
| **N = 89,523** | **N = 68,252** | **N = 6,099** | **N = 94,841** | **N = 70,355** | **N = 6,395** | **N = 95,552** | **N = 68,966** | **N = 6,454** | **N = 96,805** | **N = 67,739** | **N = 6,624** | **N = 91,968** | **N = 60,217** | **N = 6,494** |
| Number of medications; mean (sd) | 7.5(3.9) | 7.2(3.7) | 7.0(3.5) | 7.2(3.7) | 6.8(3.6) | 6.7(3.3) | 7.2(3.7) | 6.9(3.6) | 6.7(3.4) | 7.1(3.6) | 6.8(3.5) | 6.6(3.4) | 7.0(3.6) | 6.6(3.5) | 6.5(3.3) |
| Number of medications |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  0-4; n (%) | 19212(21.5) | 16206(23.7) | 1367(22.4) | 22695(23.9) | 18720(26.6) | 1557(24.4) | 22737(23.8) | 17847(25.9) | 1635(25.3) | 23304(24.1) | 17649(26.1) | 1703(25.7) | 23264(25.3) | 16501(27.4) | 1765(27.2) |
|  5-9; n (%) | 44922(50.2) | 35340(51.8) | 3443(56.5) | 48835(51.5) | 36833(52.4) | 3646(57.0) | 49277(51.6) | 36264(52.6) | 3622(56.1) | 50223(51.9) | 36066(53.2) | 3739(56.5) | 47789(52.0) | 32232(53.5) | 3606(55.5) |
|  10-14; n (%) | 21327(23.8) | 14297(21.0) | 1124(18.4) | 20198(21.3) | 12995(18.5) | 1063(16.6) | 20379(21.3) | 12956(18.8) | 1073(16.6) | 20377(21.1) | 12335(18.2) | 1068(16.1) | 18377(20.0) | 10232(17.0) | 1017(15.7) |
|  15+; n (%) | 4062(4.5) | 2409(3.5) | 165(2.7) | 3113(3.3) | 1807(2.6) | 129(2.0) | 3159(3.3) | 1899(2.8) | 124(1.9) | 2901(3.0) | 1689(2.5) | 114(1.7) | 2538(2.8) | 1252(2.1) | 106(1.6) |
| **Medication Classes** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Cardiovascular / Blood Pressure |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  ACEI and ARB\* | 38087(42.5) | 31783(46.6) | 3264(53.5) | 38531(40.6) | 31034(44.1) | 3283(51.3) | 36828(38.5) | 28832(41.8) | 3157(48.9) | 36464(37.7) | 27317(40.3) | 3111(47.0) | 33350(36.3) | 23204(38.5) | 2956(45.5) |
|  Beta blocker | 57637(64.4) | 45126(66.1) | 4220(69.2) | 60757(64.1) | 46178(65.6) | 4430(69.3) | 60832(63.7) | 45029(65.3) | 4439(68.8) | 62058(64.1) | 44458(65.6) | 4534(68.5) | 58724(63.9) | 39238(65.2) | 4392(67.6) |
|  Calcium channel blocker | 37621(42.0) | 33025(48.4) | 3409(55.9) | 39515(41.7) | 33655(47.8) | 3567(55.8) | 39346(41.2) | 32584(47.3) | 3531(54.7) | 40050(41.4) | 32431(47.9) | 3677(55.5) | 38364(41.7) | 29059(48.3) | 3598(55.4) |
|  Loop diuretic | 18776(21.0) | 8621(12.6) | 1066(17.5) | 16273(17.2) | 7017(10.0) | 902(14.1) | 19473(20.4) | 8386(12.2) | 1081(16.8) | 21001(21.7) | 8695(12.8) | 1157(17.5) | 20969(22.8) | 8297(13.8) | 1198(18.5) |
|  Non loop diuretic | 2138(2.4) | 1648(2.4) | 187(3.1) | 2188(2.3) | 1615(2.3) | 185(2.9) | 2196(2.3) | 1587(2.3) | 200(3.1) | 2303(2.4) | 1669(2.5) | 189(2.9) | 2265(2.5) | 1564(2.6) | 180(2.8) |
|  Statin | 45446(50.8) | 28485(41.7) | 3292(54.0) | 49346(52.0) | 30260(43.0) | 3548(55.5) | 50541(52.9) | 30452(44.2) | 3636(56.3) | 52712(54.5) | 31106(45.9) | 3831(57.8) | 51310(55.8) | 28763(47.8) | 3799(58.5) |
| Diabetes |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Insulin | 32338(36.1) | 18548(27.2) | 1856(30.4) | 33735(35.6) | 18664(26.5) | 1929(30.2) | 33260(34.8) | 17872(25.9) | 1931(29.9) | 33412(34.5) | 17396(25.7) | 2014(30.4) | 31283(34.0) | 15104(25.1) | 1953(30.1) |
|  DPP-4 inhibitor\* | 3140(3.5) | 1576(2.3) | 430(7.1) | 3532(3.7) | 1770(2.5) | 482(7.5) | 3792(4.0) | 1911(2.8) | 519(8.0) | 4211(4.4) | 2050(3.0) | 571(8.6) | 4310(4.7) | 2078(3.5) | 604(9.3) |
|  GLP-1 RA\* | 182(0.2) | 95(0.1) | 14(0.2) | 248(0.3) | 123(0.2) | 12(0.2) | 350(0.4) | 142(0.2) | 23(0.4) | 429(0.4) | 182(0.3) | 28(0.4) | 566(0.6) | 223(0.4) | 45(0.7) |
|  Sulfonylurea | 8313(9.3) | 4464(6.5) | 733(12.0) | 7995(8.4) | 4273(6.1) | 699(10.9) | 7531(7.9) | 3833(5.6) | 648(10.0) | 7069(7.3) | 3409(5.0) | 656(9.9) | 6501(7.1) | 2972(4.9) | 632(9.7) |
|  TZD\* | 1537(1.7) | 788(1.2) | 200(3.3) | 1327(1.4) | 642(0.9) | 182(2.9) | 1116(1.2) | 545(0.8) | 163(2.5) | 991(1.0) | 506(0.8) | 151(2.3) | 910(1.0) | 429(0.7) | 131(2.0) |
| Renal |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Erythropoietin stimulating  agent\*\* | 81582(91.1) | 62883(92.1) | 5711(93.6) | 86198(90.9) | 64661(91.9) | 5982(93.5) | 86460(90.5) | 63296(91.8) | 5959(92.3) | 87016(89.9) | 61923(91.4) | 6088(91.9) | 81749(88.9) | 54400(90.3) | 5866(90.3) |
|  Cinacalcet\*\* | 23961(26.8) | 29599(43.4) | 1625(26.6) | 25714(27.1) | 31090(44.2) | 1773(27.7) | 26660(27.9) | 31895(46.3) | 1939(30.0) | 28127(29.1) | 32347(47.8) | 2004(30.3) | 26601(28.9) | 28687(47.6) | 1886(29.0) |
|  Phosphate binder | 66418(74.2) | 53229(78.0) | 4890(80.2) | 68794(72.5) | 53157(75.6) | 5079(79.4) | 67912(71.1) | 51708(75.0) | 5122(79.4) | 68566(70.8) | 50180(74.1) | 5181(78.2) | 62329(67.8) | 42624(70.8) | 4906(75.6) |
|  Kayexalate | 5783(6.5) | 2938(4.3) | 352(5.8) | 5858(6.2) | 3109(4.4) | 357(5.6) | 5462(5.7) | 2813(4.1) | 391(6.1) | 5750(5.9) | 3135(4.6) | 400(6.0) | 5333(5.8) | 2632(4.4) | 375(5.8) |
|  Patiromer |   |   |   |   |   |   |   |   |   |  489(0.5) |  123(0.2) |  26(0.4) |  1263(1.4) |  391(0.7) |  85(1.3) |
| Hematology |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Anticoagulant | 13239(14.8) | 8384(12.3) | 533(8.7) | 14311(15.1) | 8785(12.5) | 602(9.4) | 14989(15.7) | 8811(12.8) | 617(9.6) | 16474(17.0) | 9042(13.4) | 729(11.0) | 16281(17.7) | 8269(13.7) | 729(11.2) |
|  Antiplatelet | 19972(22.3) | 12082(17.7) | 1357(22.3) | 20869(22.0) | 12371(17.6) | 1364(21.3) | 20644(21.6) | 12142(17.6) | 1358(21.0) | 20974(21.7) | 12066(17.8) | 1381(20.9) | 19963(21.7) | 10910(18.1) | 1382(21.3) |
| Neurological |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Antipsychotic | 5981(6.7) | 3866(5.7) | 260(4.3) | 5986(6.3) | 3853(5.5) | 279(4.4) | 5896(6.2) | 3696(5.4) | 259(4.0) | 5815(6.0) | 3522(5.2) | 271(4.1) | 5668(6.2) | 3142(5.2) | 241(3.7) |
|  Mood stabilizer | 1290(1.4) | 617(0.9) | 32(0.5) | 1311(1.4) | 633(0.9) | 44(0.7) | 1380(1.4) | 620(0.9) | 47(0.7) | 1402(1.5) | 608(0.9) | 43(0.7) | 1312(1.4) | 549(0.9) | 50(0.8) |
|  Cholinesterase | 3505(3.9) | 2283(3.3) | 313(5.1) | 3640(3.8) | 2325(3.3) | 350(5.5) | 3470(3.6) | 2237(3.2) | 316(4.9) | 3405(3.5) | 2089(3.1) | 272(4.1) | 3265(3.6) | 1826(3.0) | 284(4.4) |
|  Non benzodiazepine hypnotic | 11884(13.3) | 7567(11.1) | 776(12.7) | 10515(11.1) | 6650(9.5) | 666(10.4) | 9090(9.5) | 5755(8.3) | 548(8.5) | 7930(8.2) | 4888(7.2) | 473(7.1) | 6176(6.7) | 3512(5.8) | 404(6.2) |
|  SSRI\* | 24584(27.5) | 10419(15.3) | 668(11.0) | 25758(27.2) | 10580(15.0) | 679(10.6) | 25610(26.8) | 10365(15.0) | 665(10.3) | 25951(26.8) | 10271(15.2) | 694(10.5) | 24389(26.5) | 9311(15.5) | 701(10.8) |
|  Tricyclic antidepressant | 4103(4.6) | 2958(4.3) | 163(2.7) | 3979(4.2) | 2842(4.0) | 155(2.4) | 3666(3.8) | 2678(3.9) | 139(2.2) | 3664(3.8) | 2545(3.8) | 158(2.4) | 3701(4.0) | 2364(3.9) | 170(2.6) |
| Muscle |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Antispasmodic | 13157(14.7) | 9627(14.1) | 550(9.0) | 11420(12.0) | 7947(11.3) | 471(7.4) | 11544(12.1) | 8233(11.9) | 497(7.7) | 11526(11.9) | 8106(12.0) | 483(7.3) | 10275(11.2) | 6842(11.4) | 451(6.9) |
|  Muscle relaxant | 7068(7.9) | 7009(10.3) | 203(3.3) | 7161(7.6) | 6649(9.5) | 210(3.3) | 7562(7.9) | 7104(10.3) | 201(3.1) | 7109(7.3) | 6460(9.5) | 199(3.0) | 7407(8.1) | 6113(10.2) | 217(3.3) |
|  NSAID\* | 5324(6.0) | 5745(8.4) | 488(8.0) | 4917(5.2) | 5033(7.2) | 462(7.2) | 4926(5.2) | 4908(7.1) | 452(7.0) | 4662(4.8) | 4653(6.9) | 414(6.3) | 4095(4.5) | 3789(6.3) | 411(6.3) |
| Gastrointestinal |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  Antihistamine | 163(0.2) | 249(0.4) | 18(0.3) | 58(0.1) | 91(0.1) |  \*\*\*\* | 72(0.1) | 101(0.2) | 13(0.2) | 78(0.1) | 90(0.1) | 19(0.3) | 54(0.1) | 57(0.1) | 18(0.3) |
|  Proton pump inhibitor | 40670(45.4) | 29062(42.6) | 2661(43.6) | 42997(45.3) | 29473(41.9) | 2822(44.1) | 42377(44.4) | 28320(41.1) | 2805(43.5) | 42198(43.6) | 27236(40.2) | 2803(42.3) | 38893(42.3) | 23759(39.5) | 2666(41.1) |
| **Harmful** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Harmful medication\*\*\* | 67936(75.9) | 49961(73.2) | 3651(59.9) | 68476(72.2) | 47896(68.1) | 3578(56.0) | 70189(73.5) | 48750(70.7) | 3578(55.4) | 70169(72.5) | 47098(69.5) | 3547(53.6) | 64915(70.6) | 40643(67.5) | 3359(51.7) |
| Benzodiazepine | 25258(28.2) | 12507(18.3) | 820(13.4) | 23153(24.4) | 11128(15.8) | 742(11.6) | 25212(26.4) | 11738(17.0) | 800(12.4) | 24699(25.5) | 10808(16.0) | 782(11.8) | 21435(23.3) | 8682(14.4) | 669(10.3) |
| Opioid | 53164(59.4) | 42901(62.9) | 2481(40.7) | 51233(54.0) | 39875(56.7) | 2321(36.3) | 54313(56.8) | 41568(60.3) | 2388(37.0) | 53827(55.6) | 39941(59.0) | 2334(35.2) | 48916(53.2) | 33806(56.1) | 2194(33.8) |
| \*ACEI = angiotensin converting enzyme inhibitors, ARB = angiotensin receptor blockers, DPP-4 inhibitor = dipeptidyl-peptidase 4 inhibitors, GLP-1 RA = glucagon-like peptide-1 receptor agonists, TZD = thiazolidinedione, SSRI = selective serotonin reuptake inhibitors, NSAID = non-steroidal anti-inflammatory drugs\*\*Part D and Procedure\*\*\*Harmful medications include non-benzodiazepine hypnotics, benzodiazepines, opioids, antipsychotics, mood stabilizers, cholinesterase inhibitors, first-generation antihistamines, antispasmodic agents, SSRIs, and tricyclic antidepressants.\*\*\*\*Insufficient number of patients to include in the Table. |

 **Supplemental Table 4.1**. Characteristics of patients with ESRD on hemodialysis by LIS status, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2013** | **2014** | **2015** | **2016** | **2017** |
| **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** |
| **Demographics** | **N = 42,260** | **N = 126,068** | **N = 49,784** | **N = 126,349** | **N = 51,443** | **N = 124,035** | **N = 53,893** | **N = 121,866** | **N = 50,621** | **N = 112,607** |
| Age (years); mean (sd) | 70.6(11.9) | 61.0(14.2) | 71.3(11.4) | 61.2(14.1) | 71.6(11.2) | 61.4(13.9) | 71.76(11.0) | 61.5(13.8) | 72.2(10.8) | 61.9(13.7) |
|  18-65; n (%) | 11717(27.7) | 74608(59.2) | 12522(25.2) | 74420(58.9) | 12245(23.8) | 72803(58.7) | 12242(22.7) | 71385(58.6) | 10600(20.9) | 64254(57.1) |
|  65-69; n (%) | 6925(16.4) | 16156(12.8) | 8335(16.7) | 16643(13.2) | 8913(17.3) | 16727(13.5) | 9693(18.0) | 17003(14.0) | 9106(18.0) | 16475(14.6) |
|  70-74; n (%) | 7474(17.7) | 13399(10.6) | 9140(18.4) | 13372(10.6) | 9740(18.9) | 13111(10.6) | 10297(19.1) | 12613(10.4) | 9898(19.6) | 12092(10.7) |
|  75-79; n (%) | 6630(15.7) | 10430(8.3) | 8197(16.5) | 10383(8.2) | 8612(16.7) | 10063(8.1) | 9122(16.9) | 9771(8.0) | 8960(17.7) | 9051(8.0) |
|  >80; n (%) | 9514(22.5) | 11475(9.1) | 11590(23.3) | 11531(9.1) | 11933(23.2) | 11331(9.1) | 12539(23.3) | 11094(9.1) | 12057(23.8) | 10735(9.5) |
| Sex |   |   |   |   |   |   |   |   |   |   |
|  Male; n (%) | 24994(59.1) | 62139(49.3) | 29493(59.2) | 62687(49.6) | 30544(59.4) | 61979(50.0) | 32045(59.5) | 61659(50.6) | 30264(59.8) | 57202(50.8) |
|  Female; n (%) | 17262(40.9) | 63918(50.7) | 20290(40.8) | 63652(50.4) | 20898(40.6) | 62050(50.0) | 21846(40.5) | 60200(49.4) | 20357(40.2) | 55398(49.2) |
| Race |   |   |   |   |   |   |   |   |   |   |
|  White; n (%) | 29560(70.0) | 59963(47.6) | 34441(69.2) | 60400(47.8) | 35541(69.1) | 60011(48.4) | 37411(69.4) | 59394(48.7) | 35820(70.8) | 56148(49.9) |
|  Black; n (%) | 11132(26.3) | 57120(45.3) | 13558(27.2) | 56797(45.0) | 14044(27.3) | 54922(44.3) | 14452(26.8) | 53287(43.7) | 12771(25.2) | 47446(42.1) |
|  Asian; n (%) | 929(2.2) | 5170(4.1) | 1104(2.2) | 5291(4.2) | 1177(2.3) | 5277(4.3) | 1290(2.4) | 5334(4.4) | 1317(2.6) | 5177(4.6) |
|  Other; n (%) | 628(1.5) | 3697(2.9) | 674(1.4) | 3734(3.0) | 669(1.3) | 3686(3.0) | 730(1.4) | 3717(3.1) | 704(1.4) | 3699(3.3) |
| Ethnicity |   |   |   |   |   |   |   |   |   |   |
|  Hispanic; n (%) | 3516(8.3) | 26293(20.9) | 3951(7.9) | 26470(21.0) | 3964(7.7) | 26155(21.1) | 3990(7.4) | 25057(20.6) | 3824(7.6) | 23960(21.3) |
|  Non-hispanic; n (%) | 38613(91.4) | 99257(78.7) | 45677(91.8) | 99323(78.6) | 47321(92.0) | 97320(78.5) | 49746(92.3) | 96269(79.0) | 46647(92.2) | 88134(78.3) |
| Dialysis vintage (years); n (%) | 4.0(3.4) | 4.9(3.9) | 4.1(3.5) | 5.1(4.0) | 4.1(3.6) | 5.2(4.0) | 4.2(3.6) | 5.3(4.1) | 4.1(3.7) | 5.3(4.2) |
| Primary cause |   |   |   |   |   |   |   |   |   |   |
|  Diabetes; n (%) | 18705(44.3) | 61683(48.9) | 22173(44.5) | 61746(48.9) | 23094(44.9) | 60826(49.0) | 24268(45.0) | 60056(49.3) | 22717(44.9) | 55987(49.7) |
|  Hypertension; n (%) | 13448(31.8) | 37493(29.7) | 15969(32.1) | 37995(30.1) | 16530(32.1) | 37726(30.4) | 17225(32.0) | 37131(30.5) | 16340(32.3) | 34444(30.6) |
|  Glomerulonephritis; n (%) | 3644(8.6) | 11214(8.9) | 4149(8.3) | 11089(8.8) | 4167(8.1) | 10596(8.5) | 4370(8.1) | 10275(8.4) | 4008(7.9) | 9020(8.0) |
|  Cystic kidney disease; n (%) | 1053(2.5) | 2255(1.8) | 1235(2.5) | 2256(1.8) | 1271(2.5) | 2244(1.8) | 1339(2.5) | 2179(1.8) | 1250(2.5) | 2056(1.8) |
|  Other urologic disorders; n (%) | 733(1.7) | 1656(1.3) | 860(1.7) | 1569(1.2) | 850(1.7) | 1524(1.2) | 880(1.6) | 1506(1.2) | 866(1.7) | 1458(1.3) |
|  Other cause; n (%) | 3238(7.7) | 7113(5.6) | 3800(7.6) | 7112(5.6) | 3923(7.6) | 6773(5.5) | 4208(7.8) | 6658(5.5) | 4085(8.1) | 6193(5.5) |
|  Unknown/missing; n (%) | 1439(3.4) | 4654(3.7) | 1598(3.2) | 4582(3.6) | 1608(3.1) | 4346(3.5) | 1603(3.0) | 4061(3.3) | 1355(2.7) | 3449(3.1) |
| Dialysis chain |   |   |   |   |   |   |   |   |   |   |
|  DaVita; n (%) | 12257(29.0) | 36954(29.3) | 14729(29.6) | 38368(30.4) | 15523(30.2) | 38948(31.4) | 16796(31.2) | 38905(31.9) | 16386(32.4) | 37053(32.9) |
|  Fresenius; n (%) | 13956(33.0) | 38445(30.5) | 16651(33.5) | 39128(31.0) | 17523(34.1) | 39095(31.5) | 18646(34.6) | 39118(32.1) | 17910(35.4) | 37204(33.0) |
|  Small/med; n (%) | 5947(14.1) | 19105(15.2) | 6771(13.6) | 18488(14.6) | 6887(13.4) | 17520(14.1) | 7178(13.3) | 16879(13.9) | 6592(13.0) | 15032(13.4) |
|  Missing; n (%) | 10100(23.9) | 31564(25.0) | 11633(23.4) | 30365(24.0) | 11510(22.4) | 28472(23.0) | 11273(20.9) | 26964(22.1) | 9733(19.2) | 23318(20.7) |
| Profit status |   |   |   |   |   |   |   |   |   |   |
|  For-profit; n (%) | 34510(81.7) | 104638(83.0) | 40954(82.3) | 105347(83.4) | 42779(83.2) | 104299(84.1) | 45492(84.4) | 103161(84.7) | 43157(85.3) | 96027(85.3) |
|  Non-profit; n (%) | 5532(13.1) | 16009(12.7) | 6359(12.8) | 15495(12.3) | 6331(12.3) | 14649(11.8) | 6330(11.8) | 14224(11.7) | 5704(11.3) | 12667(11.3) |
| **Comorbidities** |   |   |   |   |   |   |   |   |   |   |
| Diabetes; n (%) | 29800(70.5) | 94376(74.9) | 35187(70.7) | 94141(74.5) | 36131(70.2) | 91922(74.1) | 38165(70.8) | 90524(74.3) | 35602(70.3) | 83664(74.3) |
| Hypertension; n (%) | 39163(92.7) | 118437(94.0) | 46336(93.1) | 118662(93.9) | 48064(93.4) | 116351(93.8) | 50766(94.2) | 114854(94.3) | 47979(94.8) | 106856(94.9) |
| Hyperlipidemia; n (%) | 32550(77.0) | 90601(71.9) | 38564(77.5) | 90151(71.4) | 40648(79.0) | 89970(72.5) | 42473(78.8) | 87622(71.9) | 39889(78.8) | 81278(72.2) |
| Coronary artery disease; n (%) | 22320(52.8) | 59535(47.2) | 26208(52.6) | 58968(46.7) | 27223(52.9) | 57015(46.0) | 30079(55.8) | 59376(48.7) | 30407(60.1) | 59622(53.0) |
| Myocardial infarction; n (%) | 9252(21.9) | 24607(19.5) | 10861(21.8) | 24580(19.5) | 11445(22.3) | 23826(19.2) | 12260(22.8) | 24351(20.0) | 11663(23.0) | 23025(20.5) |
| Dysrhythmia; n (%) | 20767(49.1) | 51925(41.2) | 24856(49.9) | 52347(41.4) | 26208(51.0) | 51567(41.6) | 28408(52.7) | 52656(43.2) | 27512(54.4) | 51765(46.0) |
| Congestive heart failure; n (%) | 21961(52.0) | 65976(52.3) | 26272(52.8) | 65594(51.9) | 27164(52.8) | 64205(51.8) | 28642(53.2) | 63885(52.4) | 26768(52.9) | 59180(52.6) |
| Cerebrovascular disease; n (%) | 6562(15.5) | 22379(17.8) | 7736(15.5) | 21659(17.1) | 7985(15.5) | 21164(17.1) | 8635(16.0) | 21359(17.5) | 8090(16.0) | 19799(17.6) |
| Chronic obstructive pulmonary disease; n (%) | 12811(30.3) | 37854(30.0) | 15258(30.7) | 37696(29.8) | 15678(30.5) | 36449(29.4) | 16803(31.2) | 36903(30.3) | 16535(32.7) | 36008(32.0) |
| Cancer; n (%) | 9136(21.6) | 13363(10.6) | 11014(22.1) | 13231(10.5) | 11634(22.6) | 13292(10.7) | 12440(23.1) | 13296(10.9) | 11778(23.3) | 12017(10.7) |
| Depression; n (%) | 8468(20.0) | 33505(26.6) | 10372(20.8) | 34442(27.3) | 11210(21.8) | 34265(27.6) | 12199(22.6) | 35437(29.1) | 11684(23.1) | 33396(29.7) |
| Dementia; n (%) | 5541(13.1) | 19186(15.2) | 6629(13.3) | 19097(15.1) | 6842(13.3) | 18306(14.8) | 7540(14.0) | 18995(15.6) | 7883(15.6) | 19608(17.4) |
| Nursing home residence; n (%) | 6394(15.1) | 20515(16.3) | 7885(15.8) | 20452(16.2) | 8442(16.4) | 20043(16.2) | 9084(16.9) | 20245(16.6) | 8519(16.8) | 19030(16.9) |
| Hospitalization during baseline; n (%) | 23895(56.5) | 74531(59.1) | 28864(58.0) | 74219(58.7) | 29426(57.2) | 71658(57.8) | 30720(57.0) | 69774(57.3) | 29000(57.3) | 64543(57.3) |

**Supplemental Table 4.2**. Medication use in patients with ESRD on hemodialysis by LIS status, 2013-2017

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Medication** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** |
| **N = 42,260** | **N = 126,068** | **N = 49,784** | **N = 126,349** | **N = 51,443** | **N = 124,035** | **N = 53,893** | **N = 121,866** | **N = 50,621** | **N = 112,607** |
| Number of medications; mean (sd) | 6.0(3.4) | 7.8(3.8) | 5.8(3.3) | 7.4(3.7) | 5.9(3.3) | 7.5(3.7) | 5.9(3.2) | 7.4(3.7) | 5.8(3.2) | 7.3(3.6) |
| Number of medications |   |   |   |   |   |   |   |   |   |   |
|  0-4; n (%) | 14083(33.3) | 23784(18.9) | 17519(35.2) | 26666(21.1) | 17573(34.2) | 25861(20.9) | 18358(34.1) | 25574(21.0) | 17983(35.5) | 24817(22.0) |
|  5-9; n (%) | 22007(52.1) | 63994(50.8) | 25930(52.1) | 65731(52.0) | 27141(52.8) | 64353(51.9) | 28422(52.7) | 64021(52.5) | 26528(52.4) | 59479(52.8) |
|  10-14; n (%) | 5641(13.4) | 32024(25.4) | 5909(11.9) | 29225(23.1) | 6278(12.2) | 28969(23.4) | 6646(12.3) | 27925(22.9) | 5737(11.3) | 24699(21.9) |
|  15+; n (%) | 529(1.3) | 6266(5.0) | 426(0.9) | 4727(3.7) | 451(0.9) | 4852(3.9) | 467(0.9) | 4346(3.6) | 373(0.7) | 3612(3.2) |
| **Medication Classes** |   |   |   |   |   |   |   |   |   |   |
| Cardiovascular / Blood Pressure |   |   |   |   |   |   |   |   |   |   |
|  ACEI and ARB\* | 16026(37.9) | 59381(47.1) | 18089(36.3) | 56994(45.1) | 17546(34.1) | 53329(43.0) | 17957(33.3) | 50962(41.8) | 16175(32.0) | 45398(40.3) |
|  Beta blocker | 25899(61.3) | 83841(66.5) | 30380(61.0) | 83800(66.3) | 31384(61.0) | 81729(65.9) | 33171(61.6) | 80713(66.2) | 31032(61.3) | 74179(65.9) |
|  Calcium channel blocker | 15439(36.5) | 60776(48.2) | 18128(36.4) | 60775(48.1) | 18574(36.1) | 58991(47.6) | 19804(36.8) | 58520(48.0) | 18677(36.9) | 54524(48.4) |
|  Loop diuretic | 8159(19.3) | 21013(16.7) | 8041(16.2) | 16709(13.2) | 9727(18.9) | 19938(16.1) | 10826(20.1) | 20758(17.0) | 10833(21.4) | 20452(18.2) |
|  Non loop diuretic | 959(2.3) | 3083(2.5) | 1056(2.1) | 3027(2.4) | 1125(2.2) | 2946(2.4) | 1211(2.3) | 3028(2.5) | 1183(2.3) | 2903(2.6) |
|  Statin | 20593(48.7) | 58761(46.6) | 25038(50.3) | 60341(47.8) | 26616(51.7) | 60275(48.6) | 28914(53.7) | 61061(50.1) | 27812(54.9) | 58455(51.9) |
| Diabetes |   |   |   |   |   |   |   |   |   |   |
|  Insulin | 10633(25.2) | 43799(34.7) | 12515(25.1) | 43507(34.4) | 12773(24.8) | 41921(33.8) | 13302(24.7) | 41150(33.8) | 12230(24.2) | 37712(33.5) |
|  DPP-4 inhibitor\* | 922(2.2) | 4371(3.5) | 1289(2.6) | 4647(3.7) | 1435(2.8) | 4941(4.0) | 1637(3.0) | 5375(4.4) | 1555(3.1) | 5652(5.0) |
|  GLP-1 RA\* | 44(0.1) | 256(0.2) | 89(0.2) | 304(0.2) | 129(0.3) | 402(0.3) | 148(0.3) | 506(0.4) | 188(0.4) | 666(0.6) |
|  Sulfonylurea | 3610(8.5) | 10366(8.2) | 3878(7.8) | 9528(7.5) | 3783(7.4) | 8638(7.0) | 3733(6.9) | 7773(6.4) | 3371(6.7) | 7093(6.3) |
|  TZD\* | 473(1.1) | 2229(1.8) | 479(1.0) | 1808(1.4) | 428(0.8) | 1512(1.2) | 461(0.9) | 1274(1.1) | 440(0.9) | 1101(1.0) |
| Renal |   |   |   |   |   |   |   |   |   |   |
|  Erythropoietin stimulating agent\*\* | 38251(90.5) | 115903(91.9) | 45087(90.6) | 115778(91.6) | 46482(90.4) | 113244(91.3) | 48486(90.0) | 110613(90.8) | 45016(88.9) | 100987(89.7) |
|  Cinacalcet\*\* | 9593(22.7) | 46917(37.2) | 11890(23.9) | 48050(38.0) | 12981(25.2) | 48906(39.4) | 14078(26.1) | 49880(40.9) | 12677(25.0) | 45977(40.8) |
|  Phosphate binder | 25037(59.3) | 103069(81.8) | 28847(57.9) | 101782(80.6) | 29078(56.5) | 99214(80.0) | 30880(57.3) | 96649(79.3) | 26507(52.4) | 86851(77.1) |
|  Kayexalate | 1784(4.2) | 7533(6.0) | 2200(4.4) | 7363(5.8) | 2084(4.1) | 6813(5.5) | 2339(4.3) | 7199(5.9) | 2114(4.2) | 6477(5.8) |
|  Patiromer |   |   |   |   |   |   | 128(0.2) | 528(0.4) | 334(0.7) | 1443(1.3) |
| Hematology |   |   |   |   |   |   |   |   |   |   |
|  Anticoagulant | 6878(16.3) | 15655(12.4) | 8174(16.4) | 15921(12.6) | 8859(17.2) | 15956(12.9) | 9884(18.3) | 16798(13.8) | 9624(19.0) | 16121(14.3) |
|  Antiplatelet | 8408(19.9) | 25748(20.4) | 10058(20.2) | 25322(20.0) | 10380(20.2) | 24555(19.8) | 11111(20.6) | 24086(19.8) | 10573(20.9) | 22531(20.0) |
| Neurological |   |   |   |   |   |   |   |   |   |   |
|  Antipsychotic | 1414(3.4) | 8838(7.0) | 1611(3.2) | 8642(6.8) | 1676(3.3) | 8309(6.7) | 1757(3.3) | 7980(6.6) | 1752(3.4) | 7456(6.6) |
|  Mood stabilizer | 371(0.9) | 1601(1.3) | 409(0.8) | 1608(1.3) | 474(0.9) | 1602(1.3) | 510(1.0) | 1576(1.3) | 436(0.9) | 1507(1.3) |
|  Cholinesterase | 1529(3.6) | 4650(3.7) | 1841(3.7) | 4558(3.6) | 1868(3.6) | 4233(3.4) | 1940(3.6) | 3896(3.2) | 1790(3.5) | 3669(3.3) |
|  Non benzodiazepine hypnotic | 4304(10.2) | 16284(12.9) | 4328(8.7) | 13833(11) | 3888(7.6) | 11771(9.5) | 3420(6.4) | 10098(8.3) | 2695(5.3) | 7583(6.7) |
|  SSRI\* | 8194(19.4) | 28226(22.4) | 9647(19.4) | 28112(22.3) | 10109(19.7) | 27237(22.0) | 10730(19.9) | 26908(22.1) | 10118(20.0) | 24998(22.2) |
|  Tricyclic antidepressant | 1477(3.5) | 5925(4.7) | 1570(3.2) | 5564(4.4) | 1457(2.8) | 5167(4.2) | 1540(2.9) | 4973(4.1) | 1440(2.8) | 4938(4.4) |
| Muscle |   |   |   |   |   |   |   |   |   |   |
|  Antispasmodic | 3679(8.7) | 20379(16.2) | 3671(7.4) | 16810(13.3) | 3828(7.4) | 17088(13.8) | 3955(7.3) | 16818(13.8) | 3641(7.2) | 14552(12.9) |
|  Muscle relaxant | 2222(5.3) | 12363(9.8) | 2615(5.3) | 11662(9.2) | 2629(5.1) | 12524(10.1) | 2512(4.7) | 11548(9.5) | 2732(5.4) | 11316(10.1) |
|  NSAID\* | 1568(3.7) | 10327(8.2) | 1610(3.2) | 9117(7.2) | 1721(3.4) | 8876(7.2) | 1655(3.1) | 8357(6.9) | 1382(2.7) | 7176(6.4) |
| Gastrointestinal |   |   |   |   |   |   |   |   |   |   |
|  Antihistamine | 73(0.2) | 371(0.3) | 17(0.0) | 146(0.1) | 17(0.0) | 184(0.2) |  \*\*\*\* | 191(0.2) |  \*\*\*\* | 129(0.1) |
|  Proton pump inhibitor | 15108(35.8) | 58923(46.7) | 18263(36.7) | 58682(46.4) | 18767(36.5) | 56355(45.4) | 19645(36.5) | 54148(44.4) | 17957(35.5) | 48920(43.4) |
| **Harmful** |   |   |   |   |   |   |   |   |   |   |
| Harmful medication\*\*\* | 28101(66.5) | 96513(76.6) | 31288(62.9) | 91552(72.5) | 33736(65.6) | 91758(74.0) | 34864(64.7) | 88868(72.9) | 31778(62.8) | 79991(71.0) |
| Benzodiazepine | 8798(20.8) | 30619(24.3) | 8897(17.9) | 26876(21.3) | 9981(19.4) | 28567(23.0) | 10221(19.0) | 26791(22.0) | 8954(17.7) | 22499(20.0) |
| Opioid | 21385(50.6) | 79635(63.2) | 22663(45.5) | 73017(57.8) | 25672(49.9) | 74984(60.5) | 26301(48.8) | 72160(59.2) | 23512(46.5) | 63621(56.5) |
| \*ACEI = angiotensin converting enzyme inhibitors, ARB = angiotensin receptor blockers, DPP-4 inhibitor = dipeptidyl-peptidase 4 inhibitors, GLP-1 RA = glucagon-like peptide-1 receptor agonists, TZD = thiazolidinedione, SSRI = selective serotonin reuptake inhibitors, NSAID = non-steroidal anti-inflammatory drugs\*\*Part D and Procedure\*\*\*Harmful medications include non-benzodiazepine hypnotics, benzodiazepines, opioids, antipsychotics, mood stabilizers, cholinesterase inhibitors, first-generation antihistamines, antispasmodic agents, SSRIs, and tricyclic antidepressants.\*\*\*\*Insufficient number of patients to include in the Table. |