**Appendix A:** Codes for pre-operative (chronic) kidney disease requiring dialysis– excluded from study.

|  |  |
| --- | --- |
| **Dialysis ICD-9 Diagnosis/Status Codes** | |
| E870.2 | Accidental cut, puncture, perforation or hemorrhage during kidney dialysis or other perfusion |
| E871.2 | Foreign object left in body during kidney dialysis or other perfusion |
| E872.2 | Failure of sterile precautions during kidney dialysis and other perfusion |
| E874.2 | Mechanical failure of instrument or apparatus during kidney dialysis and other perfustion |
| E879.1 | Kidney dialysis as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at time of procedure |
| V45.1 | Renal dialysis status |
| V56 | Encounter for dialysis and dialysis catheter care |
| V56.0 | Encounter for extracorporeal dialysis |
| V56.1 | Fitting and adjustment of extracorporeal dialysis catheter |
| V56.2 | Fitting and adjustment of peritoneal dialysis catheter |
| V56.3 | Encounter for adequacy testing for dialysis |
| V56.31 | Encounter for adequacy testing for hemodialysis |
| V56.32 | Encounter for adequacy testing for perionteal dialysis |
| V56.8 | Encounter for other dialysis |
| 792.5 | Cloudy (hemodialysis) (peritoneal) dialysis affluent |
| 996.68 | Infection and inflammatory reaction due to peritoneal dialysis catheter |
| 996.73 | Other complications due to renal dialysis device, implant and graft |
| **Dialysis ICD-9 Procedure Codes** | |
| 38.95 | Venous catheterization for renal dialysis |
| 39.27 | Arteriovenostomy for renal dialysis |
| 39.42 | Revision of arteriovenous shunt for renal dialysis |
| 39.43 | Removal of arteriovenous shunt for renal dialysis |
| 39.95 | Hemodialysis |
| 54.93 | Creation of cutaneoperiotneal fistula |
| 54.98 | Peritoneal dialysis |
| **Dialysis CPT Codes** | |
| 36833 | Revision open arteriovenous fistula with thrombectomy autogenous or nonautogenous dialysis graft (separate procedure) |
| 90966 | ESRD related services for home dialysis per full month, for patients 20 years of age or older |
| 90970 | ESRD related services for dialysis less than a full month of service, per day; for patients 20 years of age or older |
| 90989 | Dialysis training, patient, including helper where applicable any mode course not completed per training session |
| 90999 | Unlisted dialysis procedure, inpatient or outpatient |
| 90935 | Hemodialysis procedure with single physician evaluation |
| 90937 | Hemodialysis procedure requiring repeated evaluation(s) with or without substantial revision of dialysis prescription |
| 90940 | Hemodialysis access flow study to determine blood flow in grafts and arteriovenous fistulae by an indicator method |
| 90945 | Dialysis procedure other than hemodialysis with single physician |
| 90947 | Dialysis procedure other than hemodialysis requiring repeated physician evaluations, with or without substantial revision of dialysis prescription |
| 99512 | Home visit for hemodialysis |
| 99601 | Home infusion of peritoneal dialysis (up to 2 hours) |
| 99602 | Home infusion of peritoneal dialysis (each additional hour) |
| 4051F | Referred for an arteriovenous (AV) fistula (ESRD, CKD) |
| 4052F | Hemodialysis via functioning arteriovenous (AV) fistula (ESRD) |
| 4053F | Hemodialysis via functioning arteriovenous (AV) graft (ESRD) |
| 4054F | Hemodialysis via catheter (ESRD) |
| 4055F | Patient receiving peritoneal dialysis (ESRD) |

**Appendix B:1** Codes used to identify AKI, for identifying cases.

|  |  |
| --- | --- |
| **Secondary diagnosis codes** | |
| 5845 | Renal failure with (acute) tubular necrosis |
| 5846 | With lesion of renal cortical necrosis |
| 5847 | With lesion of renal medullary (papillary) necrosis |
| 5848 | With other specified pathological lesion in kidney |
| 5849 | Acute renal failure, unspecified |
| 7885 | Oliguria and anuria |
| 7925 | Cloudy dialysis effluent |
| 99668 | Infection and inflammatory reaction due to peritoneal dialysis catheter (exit site infection or inflammation) |
| 99673 | Other complications due to renal dialysis device, implant, and graft |
| V451 | Renal dialysis status |
| V56 | Encounter for dialysis and dialysis catheter care |
| V560 | Encounter for extracorporeal dialysis |
| V561 | Fitting and adjustment of extracorporeal dialysis |
| V562 | Fitting and adjustment of peritoneal dialysis catheter |
| V563 | Encounter for adequacy testing for dialysis |
| V5631 | Encounter for adequacy testing for hemodialysis |
| V5632 | Encounter for adequacy testing for peritoneal dialysis |
| V568 | Encounter other dialysis |
| E8702 | Accidental cut, puncture, perforation or hemorrhage during kidney dialysis or other perfusion |
| E8712 | Foreign object left in body during kidney dialysis or other perfusion |
| E8722 | Failure of sterile precautions during kidney dialysis or other perfusion |
| E8742 | Mechanical failure of instrument or apparatus during kidney dialysis and other perfusion |
| E8791 | Kidney dialysis as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at time of procedure |
| **Secondary Procedure Codes** | |
| 3895 | Ven cath renal dialysis |
| 3927 | Dialysis arteriovenostom |
| 3995 | Hemodialysis |
| 5493 | Creation of cutaneoperitoneal fistula |
| 5498 | Peritoneal dialysis |
| **CPT Codes** | |
| 90935 | Hemodialysis procedure with single physician evaluation |
| 90937 | Hemodialysis procedure requiring repeated evaluation(s) with or without substantial revision of dialysis prescription |
| 90945 | Dialysis procedure other than hemodialysis with single physician evaluation |
| 90947 | Dialysis procedure other than hemodialysis requiring repeated physician evaluations, with or without substantial revision of dialysis prescription |
| 90997 | Hemoperfusion |
| 90970 | ESRD related services for dialysis less than a full month of service, per day; for patients 20 years of age or older |
| 90999 | Unlisted dialysis procedure, inpatient or outpatient |
| 4054F | Hemodialysis via catheter (ESRD) |
| 4055F | Patient receiving peritoneal dialysis (ESRD) |

1. Silber JH, Romano PS, Rosen AK, et al. Failure-to-rescue: comparing definitions to measure quality of care. Med Care 2007; 45(10):918-25.

**Appendix C:** Codes for chronic kidney disease and end-stage kidney failure cormobidities, used in Match 2.

|  |  |
| --- | --- |
| **Renal dysfunction codes** | |
| 581 | Nephrotic syndrome |
| 5810 | Nephrotic syndrome, prolifer |
| 5811 | Epimembranous nephritis |
| 5812 | Membranoprolif nephrosis |
| 5813 | Minimal change nephrosis |
| 5818 | Nephritic syndrome with other spec pathological lesion in kidney |
| 58181 | Nephrotic syndrome in other disorder |
| 58189 | Nephrotic syndrome nec |
| 5819 | Nephrotic syndrome nos |
| 582 | Chronic glomerulonephritis |
| 5820 | Chronic proliferative nephritis |
| 5821 | Chronic membranous nephritis |
| 5822 | Chronic membranoproliferative nephritis |
| 5824 | Chronic rapid progr nephrit |
| 5828 | Chronic gomerulonephritis with other specific pathologic lesion in kidney |
| 58281 | Chronic nephritis in other dis |
| 58289 | Chronic nephritis nec |
| 5829 | Chronic nephritis nos |
| 583 | Nephritis and nephropathy, not spec as acute or chronic |
| 5830 | Prolefative nephritis nos |
| 5831 | Membranous nephritis nos |
| 5832 | Membranoproliferative nephr nos |
| 5834 | Rapidly prog nephritis nos |
| 5836 | Renal cort necrosis nos |
| 5837 | Nephr nos/medull necro |
| 5838 | Nephritis and nephropathy, not spec as acute or chronic, with other spec pathological lesion in kidney |
| 58381 | Nephritis nos in other dis |
| 58389 | Nephritis nec |
| 5839 | Nephritis nos |
| 588 | Disorders resulting from impaired renal function |
| 5880 | Renal osteodystrophy |
| 5881 | Nephrogen diabetes insip |
| 5888 | Other spec disorder resulting from impaired renal function |
| 58881 | Sec hyperparathyrd-renal |
| 58889 | Impair ren funct dis nec |
| 5889 | Impaired renal funct nos |
| 40300 | Mal hy kid w cr kid I-IV |
| 40310 | Ben hy kid w cr kid I-IV |
| 40390 | Hy kid nos w cr kid I-IV |
| 40400 | Mal hy ht/KD I-IV w/o HF |
| 40401 | Mal hyp ht/kd I-IV w hf |
| 40410 | Ben hy ht/kd I-IV w/o hf |
| 40411 | Ben hyp ht/kd I-IV w hf |
| 40490 | HY ht/kd nos I-IV w/o HF |
| 40491 | Hyp HT/kd nos I-IV w HF |
| 585 | Chronic renal failure |
| 5851 | Chronic kidney disease stage I |
| 5852 | Chronic kidney disease stage II |
| 5853 | Chronic kidney disease stage III |
| 5854 | Chronic kidney disease stage IV |
| 5859 | Chronic kidney disease nos |
| **Renal dysfunction: Current Admission** | |
| 584\* | Acute renal failure |
| 5845\* | Renal failure with (acute) tubular necrosis |
| 5846\* | With lesion of renal cortical necrosis |
| 5847\* | With lesion of renal medullary (papillary) necrosis |
| 5848\* | With other specified pathological lesion in kidney |
| 5849\* | Acute renal failure, unspecified |
| **Renal failure codes** | |
| 40301 | mal hyp kid w cr kid V |
| 40311 | Ben hyp kid w cr kid V |
| 40391 | Hyp kid nos w cr kid V |
| 40402 | Mal hy hy/kd st V w/o HF |
| 40403 | Mal hyp ht/kd stg V w HF |
| 40412 | Ben hy ht/kd st V w/o HF |
| 40413 | Ben hyp ht/kd stg V w HF |
| 40492 | Hy ht/kd nos st V w/o HF |
| 40493 | Hyp ht/kd nos st V w hf |
| 5855 | Chronic kidney disease stage V |
| 5856 | End stage renal disease |
| V420 | Kidney transplant status |
| 586 | Renal failure nos |
| V56 | Encounter for dialysis and dialysis catheter care |
| V56.0 | Encounter for extracorporeal dialysis |
| V56.1 | Fitting and adjustment of extracorporeal dialysis |
| V56.2 | Fitting an dadjustment of peritoneal dialysis catheter |
| V56.3 | Encounter for adequacy testing for dialysis |
| V56.31 | Encounter for adequacy testing for hemodialysis |
| V56.32 | Encounter for adequacy testing for peritoneal dialysis |
| V56.8 | Enounter other dialysis |
| 7925 | Cloudy dialysis effluent |
| 996.68 | Infection and inflammatory reaction due to peritoneal dialysis catheter (exit site infection or inflammation) |
| 996.73 | Other complications due to renal dialysis device, implant, and graft |
| 996.76 | Other complications due to genitourinary device, implant and graft |
| V45.1 | Renal dialysis status |
| 792.5 | Cloudy (hemodialysis) (peritoneal) dialysis affluent |
| E870.2 | Accidental cut, puncture, perforation or hemorrhage during kidney dialysis or other perfusion |
| E871.2 | Foreign object left in body during kidney dialysis or other perfusion |
| E872.2 | Failure of sterile precautions during kidney dialysis or other perfusion |
| E874.2 | Mechanical failure of instrument or apparatus during kidney dialysis and other perfusion |
| E879.1 | Kidney dialysis as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at time of procedure |
| **ICD9 Procedure Codes** | |
| 3895 | Ven cath renal dialysis |
| 3927 | Dialysis arteriovenostom |
| 3942 | Revision of arteriovenous shunt for renal dialysis |
| 3943 | Removal renal dialysis shunt |
| 3995 | Hemodialysis |
| 5498 | Peritoneal dialysis |
| **CPT Codes** | |
| 36833 | Revision open arteriovenous fistula with thrombectomy autogenous or nonautogenous dialysis graft (separate procedure) |
| 90966 | ESRD related services for home dialysis per full month, for patients 20 years of age and older |
| 90970 | ESRD related services for dialysis less than a full month of service, per day; for patients 20 years of age or older |
| 90989 | Dialysis training, patient, including helper where applicable any mode course not completed per training session |
| 90999 | Unlisted dialysis procedure, inpatient or outpatient |
| 90935 | Hemodialysis procedure with single physician evaluation |
| 90937 | Hemodialysis procedure requiring repeated evaluation(s) with or without substantial revision of dialysis prescription |
| 90940 | Hemodialysis access flow study to determine blood flow in grafts and arteriovenous fistulae by an indicator dilution method, hook-up; measurement and disconnection |
| 90945 | Dialysis procedure other than hemodialysis with single physician evaluation |
| 90947 | Dialysis procedure other than hemodialysis requiring repeated physician evaluations, with or without substantial revision of dialysis prescription |
| 99512 | Home visit for hemodialysis |
| 99601 | Home infusion of peritoneal dialysis (up to 2 hours) |
| 99602 | Home infusion of peritoneal dialysis (each additional hour) |
| 4051F | Referred for an arteriovenous (AV) fistula (ESRD, CKD) |
| 4052F | Hemodialysis via functioning arteriovenous (AV) fistula (ESRD) |
| 4053F | Hemodialysis via functioning arteriovenous (AV) graft (ESRD) |
| 4054F | Hemodialysis via catheter (ESRD) |
| 4055F | Patient receiving peritoneal dialysis (ESRD) |

\*all codes identified only in look-back period except those marked with \*

**Appendix D:** Data used to Determine Post-operative Diagnosis of Bleeding, Sepsis, Cardiac Emergency, Cardiac Event, and Hypotension (numbers indicated International Diagnosis Codes, Ninth Edition included in definition or explicitly excluded in definition unless otherwise specified)

|  |  |
| --- | --- |
| **Post-Operative Diagnosis** | **Data Elements** |
| **Bleeding** |  |
| **Included** | |  | | --- | | **Secondary diagnosis codes:**  [2851 or (5780, 5781, 5789 and principal procedure exclusion), or (5307 and DRG exclusion 1) or any of (4560, 45620, 53082, 53100, 53101, 53120, 53121, 53130, 53131, 53190, 53191, 53200, 53201, 53210, 53211, 53220, 53221, 53230, 53231, 53290, 53291, 53300, 53301, 53310, 53311, 53320, 53321, 53330, 53331, 53390, 53391, 53400, 53401, 53410, 53411, 53420, 53421, 53430, 53431, 53490, 53491, 53501, 53511, 53540, 53541, 53551, 53561, 53784, 56212, 56213, 5693, 56985, 5789 and DRG exclusion 2)] and exclusion of Trauma defined by DRG or by principal diagnosis or History of alcoholism  **CPT procedure codes:**  (75726, 43227, 43255, 44366, 44391, 45317, 45334 and principal procedure exclusion) | |
| **Excluded** | |  | | --- | | Trauma defined by DRG or principal diagnosis or History of alcoholism  *Trauma as defined by principal diagnoses(****include all fourth and fifth digit subclassifications for the following codes****)*  800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 817, 818, 819, 820, 821, 822, 823, 824, 825, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 850, 851, 852, 853, 854, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 884, 887, 890, 891, 892, 894, 896, 897, 900, 901, 902, 903, 904, 925, 926, 927, 928, 929, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 952, 953, 958  *Trauma DRGs*  002, 027, 028, 029, 031, 032, 072, 083, 084, 235, 236, 237, 440, 441, 442, 443, 444, 445, 446, 456, 457, 458, 459, 460, 484, 485, 486, 487, 491, 504, 505, 506, 507, 508, 509, 510, 511(2004-2007)  027, 082, 083, 084, 085, 086, 087, 088, 089, 090, 154, 155, 156, 183,184,185, 483, 484, 533, 534, 535, 536, 537, 538, 901, 902, 903, 906, 907, 908, 909, 913, 914, 927, 928, 929, 933, 934, 935, 955, 956, 957, 958, 959, 963, 964, 965(2008-2009)  *History of alcoholism in look back period defined as secondary diagnosis*  2910, 2911, 2912, 2913, 2914, 2915, 29181, 29182, 29189, 2919, 30300, 30301, 30302, 30303, 30390, 30391, 30392, 30500, 30501, 30502, 30503  **Principal procedure codes:**  444, 4440, 4441, 4442 if secondary diagnoses 5780, 5781, 9 | | **DRG**  1) *DRG* = 146-171(2004-2007)  332-358(2008-2009) if secondary diagnosis = 5307  2) *DRG* = 146-167, 170-184, 188-208(2004-2007)  326-358, 374-395, 405-446(2008-2009) if any of the secondary diagnoses in the inclusion are in the set of diagnoses 4560-5789 | |
| **Sepsis** |  |
| **Included** | |  | | --- | | **Secondary diagnosis codes:**  0380, 0381, 0382, 0383, 0384, 03810, 03811, 03840, 03841, 03842, 03843, 03844, 03849, 03819, 0388, 0381, 0382, 0383, 0384, 0385, 0386, 0387, 0388, 0389, 78552, 7907 | |
| **Excluded** | **None** |
| **Cardiac Emergency** |  |
| **Included** | |  |  | | --- | --- | | |  | | --- | | **Secondary diagnosis codes:**  4100, 41001, 4101, 41011, 4102, 41021, 4103, 41031, 4104, 41041, 4105, 41051, 4106, 41061, 4107, 41071, 4108, 41081, 4109, 41091, 4271, 4275, 42741, 7855, 78550, 78551  **Secondary procedure codes:**  (3761, 3791, 9960, 9961, 9962, 9963, 9964, 9969, 996 and exclusion)  **CPT procedure codes:**  (92960, 92950, 92950, 92970, 92971, 92980, 92981, 92982, 92984, 92995, 92996, 92997, 92998 and exclusion) | | |
| **Excluded** | |  | | --- | | **Principal diagnosis codes:**  4275, 7855, 78550, 78551, 78559, 7991  **Principal procedure codes:**  9393, 996, 9963 | |
| **Cardiac Event** |  |
| **Included** | **Secondary diagnosis codes:**  41189, 99601 or (9971 and any of (7943, 79431, 42612, 42613, 42682, 42689, 42731, 42781, 42789))  **Secondary procedure codes:**  3778, 3780, 3781, 3782, 3783, 3606, 3607, 3609  **CPT procedure codes**:  92953, 33200, 33213, 33201, 33206, 33207, 33208, 33210, 33211, 33212, 33214, 33216, 33217, 33240, 33245, 33246, 33249, 93501, 93510, 93511, 93514, 93524, 93526, 93527, 93529 |
| **Excluded** | **None** |
| **Hypotension** |  |
| **Included** | |  | | --- | | **Secondary diagnosis codes:**  2765, 27650, 27651, 27652, 4589, 78550, 78551, 78552, 78559, 7963, 9950, 9954, 9980 | |
| **Excluded** | **None** |

**Appendix E: Conditional logistic models to examine the relationship between obesity and post-operative AKI with adjustment for potential confounders, excluding the patients with missing creatinine.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Complete Match** | | |
|  | **OR** | **CI** | **p-value** |
| **BMI Only** | | | |
| <20 | 0.95 | 0.48-1.89 | 0.89 |
| 20-30 (reference) | -- | -- | -- |
| 30-35 | 0.81 | 0.58-1.13 | 0.21 |
| ≥35 | **1.62** | 1.09-2.39 | 0.02 |
| **BMI and complications excluding hypotension** | | | |
| <20 | 0.86 | 0.40-1.83 | 0.69 |
| 20-30 (reference) | -- | -- | -- |
| 30-35 | 0.96 | 0.67-1.37 | 0.82 |
| ≥35 | **1.73** | 1.12-2.66 | 0.01 |
| Bleeding | 1.22 | 0.89-1.69 | 0.22 |
| Sepsis | **4.55** | 2.77-7.48 | <0.005 |
| Cardiac Emergency | **2.29** | 1.41-3.71 | <0.005 |
| Cardiac Event | 1.75 | 0.94-3.25 | 0.08 |
| **BMI and complications including hypotension** | | | |
| <20 | 0.88 | 0.39-2.01 | 0.77 |
| 20-30 (reference) | -- | -- | -- |
| 30-35 | 0.95 | 0.65-1.39 | 0.78 |
| ≥35 | 1.56 | 0.99-2.47 | 0.06 |
| Bleeding | 1.14 | 0.81-1.62 | 0.46 |
| Sepsis | **3.41** | 2.00-5.82 | <0.005 |
| Cardiac Emergency | 1.59 | 0.92-2.73 | 0.10 |
| Cardiac Event | 1.78 | 0.92-3.44 | 0.09 |
| Hypotension | **4.46** | 2.95-6.73 | <0.005 |

**Bolded** odds ratios denote significant results. Basic match on age, sex, race, emergency status, transfer status, baseline eGFR and procedure type with fine balance on hospitals. Complete match on age, sex, race, emergency status, transfer status, baseline eGFR, procedure type, admission APACHE score, the risk of death score and pre-operative kidney dysfunction and end-stage kidney disease with fine balance on hospitals.