

Measure Information Form

Project Title:

Standardized Hospitalization Ratio

Project Overview:

The Centers for Medicare & Medicaid Services (CMS) has contracted with the University of Michigan Kidney Epidemiology and Cost Center (UM-KECC) develop measures of hospitalization in ESRD patients. The contract name is ESRD Quality Measure Development, Maintenance, and Support. The contract number is HHSM-500-2013-13017I.

Date:

Information included is current on January 29, 2015

Measure Name

Descriptive Information

Measure Name (Measure Title De.2.)

Standardized Hospitalization Ratio for Admissions

Measure Type De.1.

Outcome

Brief Description of Measure De.3.

Standardized hospitalization ratio for admissions for dialysis facility patients. This measure is calculated as a ratio but can also be expressed as a rate.

If Paired or Grouped De.4.

N/A

Subject/Topic Areas De.5.

Renal : Renal, Renal : End Stage Renal Disease (ESRD)

Crosscutting Areas De 6.

N/A

Measure Specifications

Measure-specific Web Page S.1.

N/A

If This Is an eMeasure S.2a.

N/A

Data Dictionary, Code Table, or Value Sets S.2b.

Available in Appendix A.

For Endorsement Maintenance S.3.

This form is being used for endorsement maintenance. Updates include:

- The model now adjusts for each incident comorbidity separately rather than using a comorbidity index.
- We have also modified the indicators for diabetes by consolidating the individual indicators.
- We have included adjustments for 210 prevalent comorbidities (identified through Medicare claims)

Numerator Statement S.4.

Number of inpatient hospital admissions among eligible patients at the facility during the reporting period.

Time Period for Data S.5.

At least one year.

Numerator Details S.6.

The numerator is calculated through use of Medicare claims data. When a claim is made for an inpatient hospitalization, the patient is identified and attributed to a dialysis facility following rules discussed below in the denominator details. The numerator is the count of all such hospitalizations over the reporting period

Denominator Statement S.7.

Number of hospital admissions that would be expected among eligible patients at the facility during the reporting period, given the patient mix at the facility.

Target Population Category S.8.

Populations at Risk : Populations at Risk

Denominator Details S.9.**Assignment of Patients to Facilities**

UM-KECC's treatment history file provides a complete history of the status, location, and dialysis treatment modality of an ESRD patient from the date of the first ESRD service until the patient dies or the data collection cutoff date is reached. For each patient, a new record is created each time he/she changes facility or treatment modality. Each record represents a time period associated with a specific modality and dialysis facility. SIMS/CROWNWeb is the primary basis for placing patients at dialysis facilities, and dialysis claims are used as an additional source. Information regarding first ESRD service date, death and transplant is obtained from additional sources including the CMS Medical Evidence Form (Form CMS-2728), transplant data from the Organ Procurement and Transplant Network (OPTN), the Death Notification Form (Form CMS-2746) and the Social Security Death Master File.

As patients can receive dialysis treatment at more than one facility in a given year, we assign each patient day to a facility (or no facility, in some cases) based on a set of conventions described below, which largely align with those for the Standardized Mortality Ratio (SMR). We detail patient inclusion criteria, facility assignment and how to count days at risk, all of which are required for the risk adjustment model.

General Inclusion Criteria for Dialysis Patients

Though a patient's follow-up in the database can be incomplete during the first 90 days of ESRD therapy, we only include a patient's follow-up in the tabulations after that patient has received chronic renal replacement therapy for at least 90 days. Thus, hospitalizations, mortality and survival during the first 90 days of ESRD do not enter into the calculations. This minimum 90-day period also assures that most patients are eligible for Medicare, either as their primary or secondary insurer. It also excludes from analysis patients who die or recover renal function during the first 90 days of ESRD.

In order to exclude patients who only received temporary dialysis therapy, we assign patients to a facility only after they have been on dialysis there for the past 60 days. This 60 day period is used both for patients who started ESRD for the first time and for those who returned to dialysis after a transplant. That is, hospitalizations during the first 60 days of dialysis at a facility do not affect the SHR of that facility.

Identifying Facility Treatment Histories for Each Patient

For each patient, we identify the dialysis provider at each point in time. Starting with day 91 after onset of ESRD, we attribute patients to facilities according to the following rules. A patient is attributed to a facility once the patient has been treated there for the past 60 days. When a patient transfers from one facility to another, the patient continues to be attributed to the original facility for 60 days and then is attributed to the destination facility. In particular, a patient is attributed to his or her current facility on day 91 of ESRD if that facility had treated him or her for the past 60 days. If on day 91, the facility had not treated a patient for the past 60 days, we wait until the patient reaches day 60 of continuous treatment at that facility before attributing the patient to that facility. When a patient is not treated in a single facility for a span of 60 days (for instance, if there were two switches within 60 days of each other), we do not attribute that patient to any facility. Patients are removed from facilities three days prior to transplant in order to exclude the transplant hospitalization. Patients who withdrew from dialysis or recovered renal function remain assigned to their treatment facility for 60 days after withdrawal or recovery.

If a period of one year passes with neither paid dialysis claims nor SIMS information to indicate that a patient was receiving dialysis treatment, we consider the patient lost to follow-up and do not include that patient in the analysis. If dialysis claims or other evidence of dialysis reappears, the patient is entered into analysis after 60 days of continuous therapy at a single facility.

Days at Risk for Medicare Dialysis Patients

After patient treatment histories are defined as described above, periods of follow-up in time since ESRD onset are created for each patient. In order to adjust for duration of ESRD appropriately, we define 6 time intervals with cut points at 6 months, 1 year, 2 years, 3 years and 5 years. A new time period begins each time the patient is determined to be at a different facility, or at the start of each calendar year or when crossing any of the above cut points.

Since hospitalization data tend not to be as complete as mortality data, we include only patients whose Medicare billing records include all hospitalizations. To achieve this goal, we require that patients reach a certain level of Medicare-paid dialysis bills to be included in the hospitalization statistics, or that patients have Medicare-paid inpatient claims during the period. Specifically, months within a given dialysis patient-period are used for SHR calculation when they meet the criterion of being within two months after a month with either: (a) \$900+ of Medicare-paid dialysis claims OR (b) at least one Medicare-paid inpatient claim. The intention of this criterion is to assure completeness of information on hospitalizations for all patients included in the analysis.

The number of days at risk in each of these patient-ESRD facility-year time periods is used to calculate the expected number of hospital admissions for the patient during that period. The SHR for a facility is the ratio of the total number of observed hospitalizations to the total number of expected hospitalizations during all time periods at the facility. Based on a risk adjustment model for the overall national hospitalization rates, we compute the expected number of hospitalizations that would occur for each month that each patient is attributed to a given facility. The sum of all such expectations for patients and months yields the overall number of hospital admissions that

would be expected given the specific patient mix and this forms the denominator of the measure.

The denominator of the SHR stems from a proportional rates model (Lawless and Nadeau, 1995; Lin et al., 2000; Kalbfleisch and Prentice, 2002). This is the recurrent event analog of the well-known proportional hazards or Cox model (Cox, 1972; Kalbfleisch and Prentice, 2002). To accommodate large-scale data, we adopt a model with piecewise constant baseline rates (e.g. Cook and Lawless, 2007) and the computational methodology developed in Liu, Schaubel and Kalbfleisch (2012).

Denominator Exclusions (NQF Includes “Exceptions” in the “Exclusion” Field) S.10.

None

Denominator Exclusion Details (NQF Includes “Exceptions” in the “Exclusion” Field) S.11.

N/A

Stratification Details/Variables S.12.

N/A

Risk Adjustment Type S.13.

Statistical risk model

Statistical Risk Model and Variables S.14.

The regression model used to compute a facility’s “expected” number of hospitalizations for the SHR measure contains many factors thought to be associated with hospitalization rates. Specifically, the model adjusts for patient age, sex, diabetes as cause of ESRD, duration of ESRD, nursing home status, BMI at incidence, comorbidities at incidence, prevalent comorbidities, and calendar year. The stage 1 model allows the baseline hospitalization rates to vary between strata, which are defined by facilities, but assumes that the regression coefficients are the same across all strata; this approach is robust to possible differences between facilities in the patient mix being treated. In essence, it avoids a possible confounding between facility effects and patient covariates as can arise, for example, if patients with favorable values of the covariate tend to be treated at facilities with better treatment policies and outcomes. Thus, for example, if patients with diabetes as a cause of ESRD tended to be treated at better facilities, one would underestimate the effect of diabetes unless the model is adjusted for facility. In this model, facility adjustment is done by stratification.

The patient characteristics included in the stage 1 model as covariates are:

- Age: We determine each patient’s age for the birth date provided in the SIMS and REMIS databases and group patients into the following categories: 0-14 years old, 15-24 years old, 25-44 years old, 45-59 years old, 60-74 years old, or 75+ years old.
- Sex: We determine each patient’s sex from his/her Medical Evidence Form (CMS-2728).
- Diabetes as cause of ESRD: We determine each patient’s primary cause of ESRD from his/her CMS-2728.
- Duration of ESRD: We determine each patient’s length of time on dialysis using the first service date from his/her CMS-2728, claims history (all claim types), the SIMS database and the SRTR database and categorize as 91 days-6 months, 6 months-1 year, 1-2 years, 2-3 years, 3-5 years, or 5+ years as of the period start date.
- Nursing home status: Using the Nursing Home Minimum Dataset, we determine if a patient was in a nursing home the previous year.

- BMI at incidence: We calculate each patient's BMI as the height and weight provided on his/her CMS 2728. BMI is included as a log-linear term.
- Comorbidities at incidence are determined using a selection of comorbidities reported on the CMS-2728 namely, alcohol dependence, atherosclerotic heart disease, cerebrovascular disease, chronic obstructive pulmonary disease, congestive heart failure, diabetes (includes currently on insulin, on oral medications, without medications, and diabetic retinopathy), drug dependence, inability to ambulate, inability to transfer, malignant neoplasm, cancer, other cardiac disease, peripheral vascular disease, and tobacco use (current smoker). Each comorbidity is included as a separate covariate in the model.
- Prevalent comorbidities: We identify a patient's prevalent comorbidities based on claims from the previous calendar year. The comorbidities adjusted for include those included in Appendix A.
- Calendar year

Categorical indicator variables are included as covariates in the stage I model to account for records with missing values for cause of ESRD, comorbidities at incidence (missing CMS-2728), and BMI. These variables have a value of 1 if the patient is missing the corresponding variable and a value of 0 otherwise. Another categorical indicator variable is included as a covariate in the stage 1 model to flag records where the patient has at least one of the incident comorbidities listed earlier. This variable has a value of 1 if the patient has at least one of the comorbidities and a value of 0 otherwise.

Beside main effects, two-way interaction terms between age, sex and duration and cause of ESRD are also included:

- Diabetes as cause of ESRD*Duration of ESRD
- Diabetes as cause of ESRD*Sex
- Diabetes as cause of ESRD*Age
- Age*Sex

Detailed Risk Model Specifications S.15.

The modeling process has two stages. At stage I, a stratified model is fitted to the national data with piecewise-constant baseline rates and stratification by facility. Specifically, the model is of the following form

$$Pr(\text{hospital admission on day } t \text{ given covariates } X) = r_{ok}(t)\exp(\beta'X_{ik})$$

where X_{ik} is the vector of covariates for the i^{th} patient in the k^{th} facility and β is the vector of regression coefficients. Time t is measured from the start of ESRD. The baseline rate function $r_{ok}(t)$ is specific to the k^{th} facility, and is assumed to be a step function with break points at 6 months, 1 year, 2 years, 3 years and 5 years since the onset of dialysis. This model allows the baseline hospitalization rates to vary between strata (facilities), but assumes that the regression coefficients are the same across all strata; this approach is robust to possible differences between facilities in the patient mix being treated. The stratification on facilities is important in this phase to avoid bias due to possible confounding between covariates and facility effects.

At stage II, the relative risk estimates from the first stage are used to create offsets and an unstratified model is fitted to obtain estimates of an overall baseline rate function. That is, we estimate a common baseline rate of admissions, $r_0(t)$, across all facilities by considering the model

$$Pr(\text{hospital admission on day } t \text{ given covariates } X) = r_0(t) R_{ik},$$

where $R_{ik} = \exp(\beta'X_{ik})$ is the estimated relative risk for patient i in facility k obtained from the stage I. In our computation, we assume the baseline to be a step function with 6 unknown parameters, $\alpha_1, \dots, \alpha_6$, to estimate. These estimates are used to compute the expected number of admissions given a patient's characteristics.

Specifically, let t_{iks} represent the number of days that patient i from facility k is under observation in the s^{th} time interval with estimated rate α_s . The corresponding expected number of hospital admissions in the s^{th} interval for this patient is calculated as

$$E_{iks} = \alpha_s t_{iks} R_{ik}.$$

It should be noted that t_{iks} and hence E_{iks} can be 0 if patient i from facility k is never at risk during the s^{th} time interval. Summing the E_{iks} over all 6 intervals and all N_k patients in facility k gives

$$\text{Exp} = \sum_{i=1}^{N_k} \sum_{s=1}^6 E_{iks} = \sum_{i=1}^{N_k} \sum_{s=1}^6 \alpha_s t_{iks} R_{ik},$$

which is the expected number of hospital admissions during follow-up at that facility.

Let Obs be the observed total number of hospital admissions at this facility. The SHR for hospital admissions is the ratio of the observed total admissions to this expected value, or

$$\text{SHR} = \text{Obs}/\text{Exp}$$

Type of Score S.16.

Ratio

Interpretation of Score S.17.

Better quality = lower score

Calculation Algorithm/Measure Logic S.18.

See denominator details and risk adjustment instructions. Also, a flowchart is included in the appendix.

Calculation Algorithm/Measure Logic Diagram URL or Attachment S.19.

Available in Appendix B.

Sampling S.20.

N/A

Survey/Patient-Reported Data S.21.

N/A

Missing Data S.22.

Patients with missing data are not excluded from the model. For the purposes of calculation, missing values for BMI are replaced with mean values for patients of similar age and identical race, sex, and cause of ESRD. Missing values for cause of ESRD are replaced with the other/unknown category. No patients were missing age, sex, or date of first ESRD treatment. Indicator variables identifying patients with missing values for cause of ESRD, comorbidities at incidence (missing CMS-2728), and BMI are also included as covariates in the model. For 2010-2013, 3% of the patients included in the SHR model calculation were missing BMI.

Data Source S.23.

Administrative claims

Electronic Clinical Data : Electronic Clinical Data

Data Source or Collection Instrument S.24.

Data are derived from an extensive national ESRD patient database, which is largely derived from the CMS Consolidated Renal Operations in a Web-enabled Network (CROWN), which includes Renal Management Information System (REMIS), and the Standard Information Management System (SIMS) database, the Enrollment Database (EDB), Medicare dialysis and hospital payment records, the CMS Medical Evidence Form (Form CMS-2728), transplant data from the Organ Procurement and Transplant Network (OPTN), the Death Notification Form (Form CMS-2746), the Nursing Home Minimum Dataset, the Dialysis Facility Compare (DFC) and the Social Security Death Master File. The database is comprehensive for Medicare patients. Non-Medicare patients are included in all sources except for the Medicare payment records. SIMS/CROWNWeb provides tracking by dialysis provider and treatment modality for non-Medicare patients. Information on hospitalizations is obtained from Medicare Inpatient Claims Standard Analysis Files (SAFs).

In calculating the SHR, Medicare inpatient claims that are adjacent or overlap with another claim are collapsed into one record. Specifically, if the admission date of an inpatient record is within one day of a following admission's discharge date, these adjacent inpatient records will be collapsed into one inpatient record that takes on the first admission's admission date and the following admission's discharge date. Similarly, if an inpatient record overlaps with another inpatient record, the two records are collapsed into one record where the earliest admission date between the two records becomes the new admission date and the latest discharge date between the two records becomes the new discharge date.

Data Source or Collection Instrument (Reference) S.25.

No data collection instrument provided

Level of Analysis S.26.

Facility

Care Setting S.27.

Dialysis Facility

Composite Performance Measure S.28.

N/A

Appendix A

Statistical Risk Model and Variables S.14.

Model Coefficients, Data Years 2010–2013.

Covariate	Coefficient	P-value
Comorbidities at start of ESRD		
At least one of the comorbidities listed below	0.08624	<.0001
Atherosclerotic heart disease	0.04999	<.0001
Other cardiac disease	0.04395	<.0001
Diabetes*	-0.02026	<.0001
Congestive heart failure	0.04269	<.0001
Inability to ambulate	0.02042	<.0001
Chronic obstructive pulmonary disease	0.05646	<.0001
Inability to transfer	0.02401	<.0001
Malignant neoplasm, cancer	0.04102	<.0001
Peripheral vascular disease	0.04104	<.0001
Cerebrovascular disease, CVA, TIA	0.01904	<.0001
Tobacco use (current smoker)	0.08539	<.0001
Alcohol dependence	0.01285	0.036
Drug dependence	0.17361	<.0001
No Medical Evidence (CMS-2728) Form	0.15316	<.0001
Cause of ESRD		
Diabetes	0.03848	<.0001
Missing	-0.03547	<.0001
Sex: Female	0.07156	<.0001
Age		
0-14	0.48884	<.0001
15-24	0.13135	<.0001
25-44	-0.0678	<.0001
45-59	-0.065	<.0001
60-74	Reference	
75+	0.10178	<.0001
BMI		
Log BMI	-0.15032	<.0001
BMI missing	0.01656	0.0002
Calendar year		
2010	Reference	
2011	-0.02546	<.0001
2012	-0.12676	<.0001
2013	-0.16265	<.0001
In nursing home the previous year	0.20788	<.0001
Diabetes as cause of ESRD X time on ESRD interaction term		
91 days-6 months	Reference	
6 months-1 year	0.03417	<.0001
1-2 years	0.01166	0.0737
2-3 years	0.00139	0.8356
3-5 years	-0.01549	0.0147
5+ years	-0.06398	<.0001
Cause of ESRD: diabetes X sex: female interaction term	-0.02622	<.0001
Age X diabetes as cause of ESRD interaction term		
0-14	-0.93749	<.0001
15-24	0.16727	<.0001
25-44	0.15502	<.0001
45-59	0.05013	<.0001

60-74	Reference	
75+	-0.03426	<.0001
Age X female sex interaction term		
0-14	-0.13038	0.0002
15-24	0.24562	<.0001
25-44	0.12877	<.0001
45-59	0.03139	<.0001
60-74	Reference	
75+	-0.00664	0.0685

*The diabetes indicator includes all diabetes comorbidities on CMS-2728 and diabetes as cause of ESRD

Prevalent Comorbidity Coefficients, Data Years 2010–2013

Note: ICD-9 to ICD-10 crosswalk is pending clinician review.

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Protein-cal malnutr NOS	2639	0.10345	<.0001
Aut neurophy in oth dis	3371	0.02621	<.0001
Epilep NOS w/o intr epil	34590	0.19176	<.0001
Cerebral edema	3485	0.09181	<.0001
Subendo infarct, initial	41071	0.18348	<.0001
AMI NEC, unspecified	41080	0.03986	0.0367
AMI NOS, unspecified	41090	-0.03149	<.0001
Intermed coronary synd	4111	0.2052	<.0001
Ac ischemic hrt dis NEC	41189	0.11644	<.0001
Angina pectoris NEC/NOS	4139	0.12568	<.0001
Cardiomyopath in oth dis	4258	0.16331	<.0001
Atriovent block complete	4260	0.02671	0.0001
Parox ventric tachycard	4271	0.09607	<.0001
Parox tachycardia NOS	4272	0.06145	<.0001
Atrial fibrillation	42731	0.13302	<.0001
Atrial flutter	42732	0.08346	<.0001
Sinoatrial node dysfunct	42781	-0.00923	0.0206
Subdural hemorrhage	4321	0.03408	0.0004
Stricture of artery	4471	0.00238	0.6534
Paralytic ileus	5601	0.10245	<.0001
Convulsions NEC	78039	0.10277	<.0001
Gangrene	7854	0.05466	<.0001
Cachexia	7994	0.14375	<.0001
Candidal esophagitis	11284	0.1985	<.0001
Sarcoidosis	135	0.0624	<.0001
Malignant neopl rectum	1541	0.1335	<.0001
Mal neo liver, primary	1550	0.12225	<.0001
Mal neo upper lobe lung	1623	0.08088	<.0001
Mal neo bronch/lung NOS	1629	0.13617	<.0001
Malign neopl prostate	185	-0.03133	<.0001

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Malig neo bladder NOS	1889	0.10792	<.0001
Malig neopl kidney	1890	0.02548	0.0004
Malign neopl thyroid	193	-0.04837	0.0087
Secondary malig neo lung	1970	0.17282	<.0001
Second malig neo liver	1977	0.38071	<.0001
Secondary malig neo bone	1985	0.29043	<.0001
Malignant neoplasm NOS	1991	0.13518	<.0001
Oth lymph unsp xtrndl org	20280	0.14363	<.0001
Mult mye w/o achv rmson	20300	0.19204	<.0001
Ch lym leuk wo achv rmsn	20410	0.25565	<.0001
Essntial thrombocythemia	23871	0.10421	<.0001
Low grde myelody syn les	23872	0.14376	<.0001
Myelodysplastic synd NOS	23875	0.17806	<.0001
DMII wo cmp nt st uncuntr	25000	0.11986	<.0001
DMII wo cmp uncuntrld	25002	0.02111	<.0001
DMII keto nt st uncuntrld	25010	0.03729	<.0001
DMII ketoacd uncontrold	25012	0.13424	<.0001
DMI ketoacd uncontrold	25013	0.25355	<.0001
DMII hprosmrlr uncontrold	25022	0.12376	<.0001
DMII renl nt st uncuntrld	25040	0.0746	<.0001
DMI renl nt st uncuntrld	25041	0.04644	<.0001
DMII ophth nt st uncuntrld	25050	0.00743	0.0064
DMI ophth uncuntrld	25053	0.05823	<.0001
DMII neuro nt st uncuntrld	25060	0.05824	<.0001
DMI neuro nt st uncuntrld	25061	0.04909	<.0001
DMII neuro uncuntrld	25062	0.07612	<.0001
DMI neuro uncuntrld	25063	0.13715	<.0001
DMII circ nt st uncuntrld	25070	-0.04017	<.0001
DMI circ nt st uncuntrld	25071	-0.05298	<.0001
DMII circ uncuntrld	25072	-0.02251	<.0001
DMII oth nt st uncuntrld	25080	0.08205	<.0001
DMI oth nt st uncuntrld	25081	0.02286	0.0002
DMII oth uncuntrld	25082	0.03781	<.0001
DMI oth uncuntrld	25083	0.00729	0.3939
Glucocorticoid deficient	25541	0.17576	<.0001
Oth severe malnutrition	262	0.0382	<.0001
Dis urea cycle metabol	2706	0.06036	0.0002
Amyloidosis NEC	27739	0.15827	<.0001
Metabolism disorder NEC	27789	0.21983	<.0001
Morbid obesity	27801	0.07927	<.0001
Obesity hypovent synd	27803	-0.05432	<.0001
Sickle cell disease NOS	28260	0.71791	<.0001

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Antin chemo indcd pancyt	28411	0.10449	0.0005
Other pancytopenia	28419	0.1945	<.0001
Neutropenia NOS	28800	0.16551	<.0001
Drug induced neutropenia	28803	0.14431	<.0001
Prim hypercoagulable st	28981	0.18562	<.0001
Senile dementia uncomp	2900	-0.02563	0.0001
Senile delusion	29020	-0.11382	<.0001
Vascular dementia,uncomp	29040	-0.00174	0.8249
Drug withdrawal	2920	0.26748	<.0001
Dementia w/o behav dist	29410	0.01212	0.0613
Dementia w behavior dist	29411	-0.02334	0.0177
Demn NOS w/o behv dstrb	29420	0.04516	<.0001
Mental disor NEC oth dis	2948	0.04058	<.0001
Schizophrenia NOS-unspec	29590	0.15532	<.0001
Depress psychosis-unspec	29620	0.17524	<.0001
Recurr depr psychos-unsp	29630	0.08526	<.0001
Recur depr psych-severe	29633	0.07789	<.0001
Bipolar disorder NOS	29680	0.19198	<.0001
Bipolar disorder NEC	29689	0.08524	<.0001
Episodic mood disord NOS	29690	0.07786	<.0001
Alcoh dep NEC/NOS-unspec	30390	0.16788	<.0001
Alcoh dep NEC/NOS-remiss	30393	0.07322	<.0001
Opioid dependence-unspec	30400	0.25245	<.0001
Opioid dependence-contin	30401	0.18003	<.0001
Drug depend NOS-unspec	30490	0.27902	<.0001
Cereb degeneration NOS	3319	0.08582	<.0001
Grand mal status	3453	0.01548	0.1722
Psymotr epil w/o int epi	34540	-0.08114	<.0001
Anoxic brain damage	3481	-0.03408	0.0008
Idio periph neurpthy NOS	3569	0.09859	<.0001
Neuropathy in diabetes	3572	0.04133	<.0001
Critical illness myopathy	35981	-0.09196	<.0001
Prolif diab retinopathy	36202	-0.08631	<.0001
Mod nonprolf db retinoph	36205	-0.07697	<.0001
Diabetic macular edema	36207	-0.0601	<.0001
Hyp ht dis NOS w ht fail	40291	0.03839	<.0001
Pulm embol/infarct NEC	41519	0.13237	<.0001
Prim pulm hypertension	4160	-0.01251	0.0316
Chr pulmon heart dis NEC	4168	0.15189	<.0001
Prim cardiomyopathy NEC	4254	0.16394	<.0001
Crbl emblsm w infrct	43411	0.01754	0.0772
Crbl art ocl NOS w infrc	43491	0.07113	<.0001

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Aortic atherosclerosis	4400	0.09852	<.0001
Athscl extrm ntv art NOS	44020	0.00141	0.6632
Ath ext ntv at w claudct	44021	0.04379	<.0001
Ath ext ntv at w rst pn	44022	0.09607	<.0001
Ath ext ntv art ulcrtion	44023	0.02268	<.0001
Dsct of thoracic aorta	44101	0.23712	<.0001
Lower extremity aneurysm	4423	0.10898	<.0001
Periph vascular dis NEC	44389	0.01881	0.0012
Periph vascular dis NOS	4439	0.09731	<.0001
Deep phlebitis-leg NEC	45119	0.00269	0.7906
Oth inf vena cava thromb	4532	0.2153	<.0001
Ac DVT/emb prox low ext	45341	0.12676	<.0001
Ch DVT/embl low ext NOS	45350	0.12558	<.0001
Ch DVT/embl prox low ext	45351	0.09937	<.0001
Ch emblsm subclav veins	45375	0.17741	<.0001
Ac DVT/embl up ext	45382	0.08862	<.0001
Ac emblsm axillary veins	45384	0.10835	<.0001
Ac embl internl jug vein	45386	0.16307	<.0001
Ac embl thorac vein NEC	45387	0.13445	<.0001
Esoph varice oth dis NOS	45621	0.19764	<.0001
Obs chr bronc w(ac) exac	49121	0.16393	<.0001
Obs chr bronc w ac bronc	49122	0.11419	<.0001
Emphysema NEC	4928	0.05787	<.0001
Chronic obst asthma NOS	49320	0.10527	<.0001
Ch obst asth w (ac) exac	49322	0.10999	<.0001
Bronchiectas w/o ac exac	4940	0.06175	<.0001
Chr airway obstruct NEC	496	0.1908	<.0001
Food/vomit pneumonitis	5070	0.05726	<.0001
Postinflam pulm fibrosis	515	0.11769	<.0001
Lung involv in oth dis	5178	0.17403	<.0001
Ac resp flr fol trma/srg	51851	-0.04255	0.0003
Ot pul insuf fol trm/srg	51852	-0.0827	0.0003
Other pulmonary insuff	51882	0.13098	<.0001
Chronic respiratory fail	51883	0.0293	<.0001
Acute & chronc resp fail	51884	0.02507	<.0001
Gastrostomy comp - mech	53642	0.10042	<.0001
Regional enteritis NOS	5559	0.17154	<.0001
Ulceratve colitis unspcf	5569	0.06821	<.0001
Chr vasc insuff intest	5571	0.15765	<.0001
Fecal impaction	56032	0.09744	<.0001
Intestinal obstruct NOS	5609	0.10671	<.0001
Alcohol cirrhosis liver	5712	0.05621	<.0001

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Cirrhosis of liver NOS	5715	0.20344	<.0001
Hepatic encephalopathy	5722	0.17945	<.0001
Portal hypertension	5723	0.20086	<.0001
Oth sequela, chr liv dis	5728	0.14523	<.0001
Chronic pancreatitis	5771	0.38153	<.0001
Pressure ulcer, low back	70703	0.0362	<.0001
Pressure ulcer, hip	70704	0.09173	<.0001
Pressure ulcer, buttock	70705	0.00396	0.4043
Ulcer of lower limb NOS	70710	0.01138	0.0098
Ulcer other part of foot	70715	0.04066	<.0001
Ulcer oth part low limb	70719	0.03358	<.0001
Chronic skin ulcer NEC	7078	0.07843	<.0001
Syst lupus erythematosus	7100	0.24781	<.0001
Systemic sclerosis	7101	0.12899	<.0001
Pyogen arthritis-unspec	71100	0.03922	0.0151
Pyogen arthritis-l/leg	71106	0.11218	<.0001
Rheumatoid arthritis	7140	0.10921	<.0001
Inflam polyarthrop NOS	7149	0.02641	0.1369
Sacroiliitis NEC	7202	0.16649	<.0001
Ac osteomyelitis-unspec	73000	-0.04005	0.0005
Ac osteomyelitis-ankle	73007	-0.03799	<.0001
Ac osteomyelitis NEC	73008	-0.01851	0.102
Osteomyelitis NOS-hand	73024	0.05835	0.0001
Osteomyelitis NOS-ankle	73027	-0.03107	<.0001
Path fx vertebrae	73313	0.1329	<.0001
Aseptic necrosis femur	73342	0.20291	<.0001
Asept necrosis bone NEC	73349	0.17431	<.0001
Coma	78001	0.02143	0.1083
Fracture of pubis-closed	8082	0.06248	<.0001
Pelvic fracture NOS-clos	8088	-0.01048	0.4819
Fx femur intrcaps NEC-cl	82009	0.03652	0.0079
Fx neck of femur NOS-cl	8208	-0.02685	<.0001
Fx femur NOS-closed	82100	-0.05632	<.0001
Amput below knee, unilat	8970	-0.10393	<.0001
Amputat bk, unilat-compl	8971	-0.10582	<.0001
Amput above knee, unilat	8972	-0.08573	<.0001
Amputat leg, unilat NOS	8974	-0.077	<.0001
React-indwell urin cath	99664	0.15093	<.0001
Compl heart transplant	99683	0.02305	0.3552
Asymp hiv infectn status	V08	0.37403	<.0001
Heart transplant status	V421	0.26702	<.0001
Liver transplant status	V427	0.16234	<.0001

ICD-9 Description	ICD-9 Code	Coefficient	P-value
Trnspl status-pancreas	V4283	0.14978	<.0001
Gastrostomy status	V441	0.02184	0.0173
Ileostomy status	V442	0.12312	<.0001
Colostomy status	V443	0.13378	<.0001
Urinostomy status NEC	V446	0.33981	<.0001
Respirator depend status	V4611	-0.02597	0.001
Status amput othr toe(s)	V4972	0.031	<.0001
Status amput below knee	V4975	0.02473	<.0001
Status amput above knee	V4976	0.01774	0.0036
Atten to gastrostomy	V551	-0.03053	0.0012
Long-term use of insulin	V5867	0.12534	<.0001
BMI 40.0-44.9, adult	V8541	0.03116	<.0001
	miss_comorb	0.73799	<.0001

Appendix B: Calculation Algorithm/Measure Logic Diagram URL or Attachment S.19.

Standardized Hospitalization Ratio: The ratio of observed to expected hospital admissions

Numerator Statement: Number of hospital admissions observed

Denominator Statement: Number of hospital admissions expected based on the national rate for patients with similar characteristics

