MEASURE INFORMATION FORM

Project Title:

End-Stage Renal Disease Emergency Department Visits Measure Development

Project Overview:

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

Date:

End-Stage Renal Disease Emergency Department Visits Measure Development

Measure Name

Standardized Ratio of Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge (ED30) for Dialysis Facilities

Descriptive Information
Measure Name (Measure Title De.2.)
Standardized Ratio of Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge (ED30) for Dialysis Facilities

Measure Type De.1.
Outcome

Brief Description of Measure De.3.
The Standardized Ratio of Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge for Dialysis Facilities (ED30) is defined to be the ratio of the number of index discharges from acute care hospitals that are followed by an outpatient emergency department encounter within 4-30 days after discharge for adult dialysis patients treated at a particular dialysis facility, to the expected number of index discharges followed by an ED encounter within 4-30 days given the discharging hospital's characteristics, characteristics of the dialysis facility's patients, and the national norm for dialysis facilities. Note that in this document, "hospital" always refers to acute care hospital and "emergency department encounter" always refers to an outpatient encounter that does not end in a hospital admission. This measure is calculated as a ratio but can also be expressed as a rate.

If Paired or Grouped De.4.
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.
See ED30_DataDictionary.xlsx

For Endorsement Maintenance S.3.1 and S.3.2
N/A

Numerator Statement S.4.
The observed number of index hospital discharges during a year that are followed by an emergency department encounter within 4–30 days of the discharge among patients at a facility.

Numerator Details S.5.
General Inclusion Criteria for Dialysis Patients
To be eligible for the measure a patient must be an adult (aged 18 or more) Medicare dialysis patient with at least 90 days of ESRD treatment on date of index discharge. Thus, index discharges during the first 90 days of ESRD are not counted. The 90 days of ESRD is counted without regard to which facility, or the number of facilities, a patient received their dialysis treatments. The date of index discharge is considered day 0 when identifying ED visits within 4-30 days of discharge.

Index Discharges
We use Medicare inpatient hospital claims to identify acute hospital discharges. All live discharges of eligible patients in a calendar year are considered eligible for this measure. Those that do not meet one of the exclusion criteria described in the next section are considered index discharges.

Assignment of Index Discharges to Facilities
Index discharges are attributed to the facility of record on the day of discharge for the patient. That is, if the patient transfers dialysis facilities at the time of hospital discharge, it is the new facility that is assigned the index discharge.

Emergency Department Encounters
Emergency department (ED) encounters are identified from Medicare outpatient claims using revenue center codes that indicate an ED visit (0450, 0451, 0452, 0453, 0454, 0455, 0456, 0457, 0458, 0459, 0981). Note that this means that we include both outpatient ED visits and those that result in an observation stay, but not those that result in a hospital admission. Outpatient ED claims that have overlapping or consecutive dates of service are combined and considered as a single ED encounter. To further ensure that these outpatient ED encounters are distinct from those associated with hospitalizations, we exclude ED encounters where there is an inpatient claim that has dates of service included in any of the same time period covered by the ED encounter.

An ED encounter “follows” the index discharge only if there is no intervening inpatient hospitalization. In other words, if after hospital discharge there is another inpatient hospitalization and then an ED encounter within the time frame the original index discharge is not counted as having been followed by an ED encounter. If eligible, the second hospitalization could become a new index discharge. The measure does not count the number of ED encounters after each index discharge, but instead determines whether or not there is at least one such encounter. If there are multiple ED encounters during days 4-30 after an index discharge, only the first ED encounter during that time is relevant to

determining whether or not the index discharge is counted as having been followed by an ED encounter. ED encounters that occur before the 4th day after index discharge are not considered.

The 4-30 day time frame was selected to harmonize with the Standardized Readmission Ratio (NQF #2496) that also uses the same time period after an index hospitalization. This time interval was selected in response to providers and stakeholders concerns that there may be up to 72 hours before a patient is seen at the facility after hospital discharge.

The time period for the measure calculation is two calendar years, meaning that index discharges must occur during the two calendar years being measured. Eligible ED encounters within 4-30 days must occur during those two calendar years or in the first 30 days of the next calendar year.

Denominator Statement S.6.
The expected number of index hospital discharges during the reporting period that are followed by an emergency department encounter within 4-30 days of the discharge among eligible patients at a facility, adjusted for the characteristics of the patients, the dialysis facility, and the discharging hospitals.

Denominator Details S.7.
Expected Calculation
We calculate each dialysis facility's expected number of index hospital discharges during a year that are followed by an ED encounter within 4-30 days of the discharge. The expected number is calculated by fitting a model with random effects for discharging hospitals, fixed effects for facilities, and regression adjustments for a set of patient-level characteristics. We compute the expectation for the given facility assuming ED encounter rates corresponding to an "average" facility with the same patient characteristics and same discharging hospitals as this facility.

Denominator Exclusion (NQF Includes "Exception" in the "Exclusion" Field) S.8.
Exclusions that are implicit in the denominator definition include discharges for which the patient:

- Has had ESRD for 90 days or less at time of discharge
- Is less than 18 years of age at the time of discharge

We also exclude discharges and emergency department encounters for which the patient was:

- Actively enrolled in hospice at any time of during the calendar month of the discharge date or ED encounter admit date

The hospice exclusion is done because hospice patients are considered to be under the purview of hospice care givers and may have other reasons for Emergency Department use such as pain management.

Additionally we exclude hospital discharges that:

- Do not result in a live discharge
- Result in a patient dying, being transplanted, discontinuing dialysis, recovering renal function, or being lost to follow-up within 30 days with no emergency department encounter or hospitalization
- Are against medical advice

- Include a primary diagnosis for cancer, mental health or rehabilitation (see below for excluded CCSs)
- Are from a PPS-exempt cancer hospital
- Result in another hospitalization within four days of discharge

Denominator Exclusion Details (NQF Includes "Exception" in the "Exclusion" Field) S.9.
Death in hospital/within 30 days of discharge: We exclude death within 30 days of discharge to harmonize this measure with the Standardized Readmission Ratio, which also excludes patient deaths within that time frame. We determine a patient's death date from a number of sources: CMS Medicare Enrollment Database, CMS forms 2746 and 2728, OPTN transplant follow-up form, CROWNWeb database, Social Security Death Master File, and Inpatient Claims. In addition, if the discharge status on the index discharge claim indicates death and the death date occurs within 5 days after discharge we consider this a death in the hospital. We determine transplant status from OPTN and CROWNWeb and discontinuation of dialysis or recovery of renal function from CROWNWeb.

Discharged against medical advice: We determine discharge status from the inpatient claim.

Certain diagnoses: The primary diagnosis at discharge is available on the inpatient claim; we group these diagnoses into more general categories using AHRQ's Clinical Classification Software (CCS; see http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp for descriptions of each CCS).

The excluded CCSs for a primary diagnosis for cancer, mental health or rehabilitation are shown below.
Cancer: 42, 19, 45, 44, 17, 38, 39, 14, 40, 35, 16, 13, 29, 15, 18, 12, 11, 27, 33, 32, 24, 43, 25, 36, 21, 41, 20, 23, 26, 28, 34, 37, 22, 31, 30
Psychiatric: 657, 659, 651, 670, 654, 650, 658, 652, 656, 655, 662
Rehab for prosthesis: 254

PPS-exempt cancer hospitals: The following hospitals are listed as PPS-exempt cancer hospitals in the Federal Register (http://www.gpo.gov/fdsys/pkg/FR-2011-07-18/html/2011-16949.htm): 050146, 050660, 100079, 100271, 220162, 330154, 330354, 360242, 390196, 450076, 500138

Stratification Details/Variables S.10.
N/A

Risk Adjustment Type S.11.
Statistical risk model

To estimate the probability of 30-day emergency department encounter, we use a two-stage model, the first of which is a double random-effects logistic regression model. In this stage of the model, both dialysis facilities and hospitals are represented as random effects, and regression adjustments are made for a set of patient-level characteristics. From this model, we obtain the estimated standard deviation of the random effects of hospitals (Diggle, et. al., 2002).

The second stage of the model is a mixed-effects logistic regression model, in which dialysis facilities are modeled as fixed effects and hospitals are modeled as random effects, with the standard deviation specified as equal to its estimates from the first model. The expected number of emergency department encounters for each facility is estimated as the summation of the probabilities of emergency department encounter of all patients in this facility and assuming the national norm (i.e., the median) for facility effect. This model accounts for a given facility's case mix using the same set of patient-level characteristics as those in the first model.

The equations used in the measure calculation are as follows:

- To estimate the probability of 30-day emergency department encounter, we use a two-stage approach. The main model, which produces the estimates used to calculate ED30, takes the form:

$$\log \frac{p_{ijk}}{1- p_{ijk}} = \gamma_i + \alpha_j + \beta^T Z_{ijk}\,, \tag{1}$$

  where p_{ijk} represents the probability of an emergency department encounter for the k^{th} discharge among patients from the i^{th} facility who are discharged from j^{th} hospital, and Z_{ijk} represents the set of patient-level characteristics. Here, γ_i is the fixed effect for facility and α_j is the random effect for hospital j. It is assumed that the α_js arise as independent normal variables (i.e., $\alpha_j \sim N(0, \sigma^2)$).

- We then use the estimates from this model to calculate each facility's ED30:

$$ED30_i = \frac{O_i}{E_i} = \frac{O_i}{\sum_{j\in H(i)} \sum_{k=1}^{n_{ij}} \tilde{p}_{ijk}}\,, \tag{2}$$

  where, for the i^{th} facility, O_i is the number of observed emergency department encounter, E_i is the expected number of emergency department encounter for discharges, $H(i)$ is the collection of indices of hospitals from which patients are discharged, and $\tilde{p}_{ijk}$ is the predicted probability of emergency department encounter under the national norm for each discharge. Specifically, $\tilde{p}_{ijk}$ takes the form

$$\tilde{p}_{ijk} = \frac{\exp(\widehat{\gamma_M} + \widehat{\alpha_j} + \hat{\beta}^T Z_{ijk})}{1+\exp(\widehat{\gamma_M} + \widehat{\alpha_j} + \hat{\beta}^T Z_{ijk})}\,, \tag{3}$$

  which estimates the probability that a discharge from hospital *j* of an individual in facility *i* with characteristics Z_{ijk} would result in an emergency department encounter if the facility effect corresponded to the median of national facility effects, denoted by $\widehat{\gamma_M}$. Here, $\widehat{\alpha_j}$ and $\hat{\beta}$ are estimates from model (1). The sum of these probabilities is the expected number of emergency department encounter E_i at facility *i*; e.g., the number of emergency department encounter that would have been expected in facility i had they progressed to the emergency department encounter at the same rate as the national population of dialysis patients. If a facility has less than 11 discharges, they are excluded from the measure for the purposes of modeling.

As mentioned previously, the model accounts for a set of patient-level characteristics:

- Sex

- Age
- Years on dialysis
- Diabetes as cause of ESRD
- BMI at incidence of ESRD
- Length (days) of index hospitalization
- Prevalent comorbidities (see appendix A) are determined using the previous 12 months of CMS claims after the index discharge. The fiscal year 2015 Agency for Healthcare Research and Quality Clinical Classification Software (AHRQ CCS) single-level diagnoses groupers were used to define the prevalent comorbidity risk factors. Each comorbidity is included as a separate covariate in the model. If a patient has less than 6 months of claims in the year before the analysis, we consider prevalent comorbidities to be "missing" for that patient even if there are comorbidities identified in claims.

Reference:
Elixhauser A, Steiner C, Palmer L. Clinical Classifications Software (CCS), 2015. U.S. Agency for Healthcare Research and Quality.
Available: http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp

Type of Score S.12.
Rate/Proportion

Interpretation of Score S.13.
Better quality = Lower score

Calculation Algorithm/Measure Logic S.14.
See appendix

Sampling S.15.
N/A

Survey/Patient-Reported Data S.16.
N/A

Data Source S.17.
Claims, Registry Data

Data Source or Collection Instrument S.18.
Data are derived from an extensive national ESRD patient database, which is primarily based on the CMS Consolidated Renal Operations in a Web-enabled Network (CROWN) system. The CROWN data include the Renal Management Information System (REMIS), CROWNWeb facility-reported clinical and administrative data (including CMS-2728 Medical Evidence Form, CMS-2746 Death Notification Form, and CMS-2744 Annual Facility Survey Form data), the historical Standard Information Management System (SIMS) database (formerly maintained by the 18 ESRD Networks until replaced by CROWNWeb in May 2012), the National Vascular Access Improvement Initiative's Fistula First Catheter Last project (in CROWNWeb since May 2012), Medicare dialysis and hospital payment records, transplant data from the Organ Procurement and Transplant Network (OPTN), the Nursing Home Minimum Dataset, the Quality Improvement Evaluation System (QIES) Workbench, which includes data from the Certification and Survey Provider Enhanced Report System (CASPER), 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. CROWNWeb provides tracking by dialysis provider and treatment modality for non-Medicare patients. Information on hospitalizations is obtained from Part A Medicare Inpatient Claims Standard Analysis Files (SAFs), and past-year comorbidity data are obtained from multiple Part A types (inpatient, home health, hospice, skilled nursing facility claims) and Part B outpatient types of Medicare Claims SAFs.

Data Source or Collection Instrument (Reference) S.19.
N/A

Level of Analysis S.20.
Facility

Care Setting S.21.
Dialysis Facility

Composite Performance Measure S.22.
N/A

MEASURE JUSTIFICATION FORM

Project Title:

End-Stage Renal Disease Emergency Department Visits Measure Development

Project Overview:

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

Date:

End-Stage Renal Disease Emergency Department Visits Measure Development

Measure Name

Standardized Ratio for Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge for Dialysis Facilities (ED30)

Type of Measure
Outcome

Importance
1a—Opportunity for Improvement
1a.1. - This is a measure of: Health outcome: Emergency department utilization occurring within 30 days of hospital discharge that does not result in hospitalization
1a.2.—Linkage
Emergency Department (ED) utilization is an important indicator of patient morbidity and quality of life. Nearly half (46.2%) of ED visits by patients with ESRD result in a hospital admission [1]. The need for acute care after hospital discharge in this population is also quite high with 27% of patients being seen in an ED [2] and 36.6% of patients experiencing re-hospitalization [3] in the 30 days after a hospital discharge. This readmission rate is twice that of older Medicare beneficiaries without a diagnosis of kidney disease. The overall aim is to reduce dialysis patients' need for unscheduled acute care in the ED following hospitalization. Post-discharge care by dialysis facilities—and coordination of that care with other providers—has the potential to prevent excessive ED utilization during this time period.

There are numerous dialysis care processes that can influence the likelihood of a patient requiring care in the ED in the 30 days following hospital discharge. These processes include:

(1) Timely evaluation of target weight: Inadequate control of total body fluid balance and fluid removal can result in fluid overload and congestive heart failure, increasing the possibility of the need for ED use and emergent dialysis. This is particularly true in the period immediately following hospitalization where a patient's target weight may have changed abruptly.
(2) Inadequate infection prevention. Inadequate infection prevention processes, including suboptimal management of vascular access, can lead to bacteremia or septicemia, increasing the possibility of the need for ED use.

(3) Management of electrolyte abnormalities. Following hospitalization a patient's electrolyte and nutritional status may change abruptly and failure to maintain processes to ensure adequate dialysis and nutritional counseling can lead to either hypo- or hyperkalemia, increasing the possibility of the need for ED use.

1a.2.1 Rationale

Among Medicare beneficiaries, 30% of hospital admissions that originate in the ED are for diagnoses that are often dialysis related such as complications of vascular access, congestive heart failure/fluid overload, septicemia, and hyperkalemia [1]. Recent research points to many additional opportunities to further reduce unnecessary ED use in this population.

While interventions to decrease the frequency of ED use in the post-hospitalization period have not been tested specifically in the dialysis patient population [3], there are effective interventions reported in this population to reduce hospital re-admission. Acknowledging the strong association between ED encounters and subsequent hospitalization, these dialysis facility interventions would likely be effective in preventing outpatient ED encounters as well.

Given the association between missed dialysis treatments and increased risk of an ED visit [4], dialysis facility interventions that improve adherence to the treatment schedule would be expected to decrease ED utilization, particularly in the post-acute care period. Other interventions, such as telehealth, have been demonstrated to reduce ED utilization in high-risk dialysis patients [5]. In the general population, outpatient ED visits were reported to have increased more slowly for Medicare patients being treated by patient-centered medical home practices when compared to non-patient-centered medical homes[6]. While similar data are lacking in the ESRD patient population, the current Comprehensive ESRD Care (ESRD Seamless Care Organization, ESCO) model may provide similar infrastructure to reduce ED utilization.

ESRD patients are often discharged from the hospital to Skilled Nursing Facilities (SNF) before transitioning back to home. After discharge from a SNF back to home, dialysis patients who have visiting home health services are less likely to need acute care in the ED during the subsequent 30 day period [7] Finally, other critical activities in the post-hospitalization period focus on medication reconciliation, appointment scheduling, as well as appraisal of the target weight and volume management. This is particularly important since heart failure has been implicated as one of the most frequent reasons for an ED visit within 30 days of hospital discharge [8].

References:

1. Lovasik, B.P., et al., Emergency Department Use and Hospital Admissions Among Patients With End-Stage Renal Disease in the United States. *JAMA Intern Med*, 2016. 176(10): p. 1563-1565.

Patients with end-stage renal disease (ESRD) have the highest risk for hospitalization among those with chronic medical conditions, including heart failure, pulmonary disease, or cancer.1 However, to our knowledge, no study has examined use of the emergency department (ED) among the national Medicare population with ESRD. We sought to describe ED visits and hospitalizations through the ED and to determine the sociodemographic and clinical characteristics of patients with ESRD who use ED services in the United States.

2. United States Renal Data System. 2016 USRDS annual data report: Epidemiology of kidney disease in the United States. Volume 2, Chapter 5. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2016.

3. Mathew, A. T.; Strippoli, G. F.;Ruospo, M.;Fishbane, S. Reducing hospital readmissions in patients with end-stage kidney disease**.** *Kidney Int.* 2015 88(6):1250-1260 doi:10.1038/ki.2015.307.

   ESKD patients have a large burden of disease, with high rates of readmission to hospital compared with the general population. A readmission after an acute index hospital discharge is either planned or unplanned. A proportion of unplanned readmissions are potentially avoidable, and could have been prevented with optimized transitional care. Readmissions pose financial cost to the health care system and emotional cost to patients and caregivers. In other chronic diseases with high readmission risk, such as congestive heart failure, interventions have improved transitional care and reduced readmission risk. In reviewing the existing literature on readmissions in ESKD, the definition and risk of readmission varied widely by study, with many potentially associated factors including comorbid diseases such as anemia and hypoalbuminemia. An ESKD patient's requisite follow-up in the outpatient dialysis facility provides an opportunity to improve transitional care at the time of discharge. Despite this, our review of existing literature found no studies which have tested interventions to reduce the risk of readmission in ESKD patients. We propose a framework to define the determinants of avoidable readmission in ESKD, and use this framework to define a research agenda. Avoidable readmissions in ESKD patients is a topic prime for in-depth study, given the high-risk nature in this patient population, financial and societal costs, and potential for risk modification through targeted interventions.

4. Chan, K. E.;Thadhani, R. I.;Maddux, F. W. Adherence barriers to chronic dialysis in the United States**.** *J Am Soc Nephrol.* 2014 25(11):2642-8 doi:10.1681/asn.2013111160

   Hemodialysis patients often do not attend their scheduled treatment session. We investigated factors associated with missed appointments and whether such nonadherence poses significant harm to patients and increases overall health care utilization in an observational analysis of 44 million hemodialysis treatments for 182,536 patients with ESRD in the United States. We assessed the risk of hospitalization, emergency room visit, or intensive-coronary care unit (ICU-CCU) admission in the 2 days after a missed treatment relative to the risk for patients who received hemodialysis. Over the 5-year study period, the average missed treatment rate was 7.1 days per patient-year. In covariate adjusted logistic regression, the risk of hospitalization (odds ratio [OR], 3.98; 95% confidence interval [95% CI], 3.93 to 4.04), emergency room visit (OR, 2.00; 95% CI, 1.87 to 2.14), or ICU-CCU admission (OR, 3.89; 95% CI, 3.81 to 3.96) increased significantly after a missed treatment. Overall, 0.9 missed treatment days per year associated with suboptimal transportation to dialysis, inclement weather, holidays, psychiatric illness, pain, and gastrointestinal upset. These barriers also associated with excess hospitalization (5.6 more events per patient-year), emergency room visits (1.1 more visits), and ICU-CCU admissions (0.8 more admissions). In conclusion, poor adherence to hemodialysis treatments may be a substantial roadblock to achieving better patient outcomes. Addressing systemic and patient barriers that impede access to hemodialysis care may decrease missed appointments and

reduce patient morbidity.

5. Minatodani, D. E.;Berman, S. J. Home telehealth in high-risk dialysis patients: a 3-year study. *Telemed J E Health.* 2013 19(7):520-2 doi:10.1089/tmj.2012.0196

   OBJECTIVE: This study is a continuation of a previous pilot project that demonstrated improved health outcomes and significant cost savings using home telehealth with nurse oversight in patients with end-stage renal disease undergoing chronic dialysis. We are reporting the results of a larger sample size over a 3-year study period to test the validity of our original observations.
   SUBJECTS AND METHODS: Ninety-nine patients were included in this study; 43 (18 females, 25 males) with a mean age of 58.6 years were enrolled in the remote technology (RT) group, and 56 (26 females, 30 males) with a mean age of 63.1 years were enrolled in the usual-care (UC) group. Health resource outcome measures included hospitalizations, emergency room (ER) visits, and number of days hospitalized. Economic analysis was conducted on hospital and ER charges.

   RESULTS: Hospitalizations (RT, 1.8; UC, 3.0), hospital days (RT, 11.6; UC, 25.0), and hospital and ER charges (RT, $66,000; UC, $157,000) were significantly lower in the RT group, as were hospital and ER charges per study day (RT, $159; UC, $317).
   CONCLUSIONS: The results support our previous findings, that is, home telehealth can contribute to improved health outcomes and cost of care in high-risk dialysis patients.

6. Pines, J. M.;Keyes, V.;van Hasselt, M.;McCall, N. Emergency department and inpatient hospital use by Medicare beneficiaries in patient-centered medical homes. *Ann Emerg Med.* 2015 65(6):652-60 doi:10.1016/j.annemergmed.2015.01.002

   STUDY OBJECTIVE: Patient-centered medical homes are primary care practices that focus on coordinating acute and preventive care. Such practices can obtain patient-centered medical home recognition from the National Committee for Quality Assurance. We compare growth rates for emergency department (ED) use and costs of ED visits and hospitalizations (all-cause and ambulatory-care-sensitive conditions) between patient-centered medical homes recognized in 2009 or 2010 and practices without recognition.

   METHODS: We studied a sample of US primary care practices and federally qualified health centers: 308 with and 1,906 without patient-centered medical home recognition, using fiscal year 2008 to 2010 Medicare fee-for-service data. We assessed average annual practice-level payments per beneficiary for ED visits and hospitalizations and rates of ED visits and hospitalizations (overall and ambulatory-care-sensitive condition) per 100 beneficiaries before and after patient-centered medical home recognition, using a difference-in-differences regression model comparing patient-centered medical homes and propensity-matched non-patient-centered medical homes.

   RESULTS: Comparing patient-centered medical home with non-patient-centered medical home practices, the rate of growth in ED payments per beneficiary was $54 less for 2009 patient-centered medical homes and $48 less for 2010 patient-centered medical homes relative to non-patient-centered medical home practices. The rate of growth in all-cause and ambulatory-care-sensitive condition ED visits per 100 beneficiaries was 13 and 8 visits fewer for 2009 patient-centered medical homes and 12 and 7 visits fewer for 2010 patient-centered medical homes,

respectively. There was no hospitalization effect.
CONCLUSION: From 2008 to 2010, outpatient ED visits increased more slowly for Medicare patients being treated by patient-centered medical home practices than comparison non-patient-centered medical homes. The reduction was in visits for both ambulatory-care-sensitive and non-ambulatory-care-sensitive conditions, suggesting that steps taken by practices to attain patient-centered medical home recognition such as improving care access may decrease some of the demand for outpatient ED care.

7. Hall RK; Toles M; Massing M; Jackson E; Peacokc-Hinton S; O'Hare AM; Colon-Emeric C. Utilization of Acute Care among Patients with ESRD Discharged Home from Skilled Nursing Facilities. Clin J Am Soc Nephrol. 2015 10(3):428-434. doi: 10/2215/CJN.03510414

   Background and objectives: Older adults with ESRD often receive care in skilled nursing facilities (SNFs) after an acute hospitalization; however, little is known about acute care use after SNF discharge to home.
   Design, setting, participants, & measurements: This study used Medicare claims for North and South Carolina to identify patients with ESRD who were discharged home from a SNF between January 1, 2010 and August 31, 2011. Nursing Home Compare data were used to ascertain SNF characteristics. The primary outcome was time from SNF discharge to first acute care use (hospitalization or emergency department visit) within 30 days. Cox proportional hazards models were used to identify patient and facility characteristics associated with the outcome.
   Results: Among 1223 patients with ESRD discharged home from a SNF after an acute hospitalization, 531 (43%) had at least one rehospitalization or emergency department visit within 30 days. The median time to first acute care use was 37 days. Characteristics associated with a shorter time to acute care use were black race (hazard ratio [HR], 1.25; 95% confidence interval [95% CI], 1.04 to 1.51), dual Medicare-Medicaid coverage (HR, 1.24; 95% CI, 1.03 to 1.50), higher Charlson comorbidity score (HR, 1.07; 95% CI, 1.01 to 1.12), number of hospitalizations during the 90 days before SNF admission (HR, 1.12; 95%CI, 1.03 to 1.22), and index hospital discharge diagnoses of cellulitis, abscess, and/or skin ulcer (HR, 2.59; 95% CI, 1.36 to 4.45). Home health use after SNF discharge was associated with a lower rate of acute care use (HR, 0.72; 95%CI, 0.59 to 0.87). There were no statistically significant associations between SNF characteristics and time to first acute care use.
   Conclusions: Almost one in every two older adults with ESRD discharged home after a post–acute SNF stay used acute care services within 30 days of discharge. Strategies to reduce acute care utilization in these patients are needed.

8. Harel, Z.;Wald, R.;McArthur, E.;Chertow, G. M.;Harel, S.;Gruneir, A.;Fischer, H. D.;Garg, A. X.;Perl, J.;Nash, D. M.;Silver, S.;Bell, C. M. Rehospitalizations and Emergency Department Visits after Hospital Discharge in Patients Receiving Maintenance Hemodialysis**.** *J Am Soc Nephrol.* 2015 26(12):3141-50 doi:10.1681/ASN.2014060614
   Clinical outcomes after a hospital discharge are poorly defined for patients receiving maintenance in-center (outpatient) hemodialysis. To describe the proportion and characteristics of these patients who are rehospitalized, visit an emergency department, or die within 30 days after discharge from an acute hospitalization, we conducted a population-based study of all adult patients receiving maintenance in-center hemodialysis who were discharged between January 1, 2003, and December 31, 2011, from 157 acute care hospitals in Ontario, Canada. For patients with more than one hospitalization, we randomly selected a single hospitalization as

the index hospitalization. Of the 11,177 patients included in the final cohort, 1926 (17%) were rehospitalized, 2971 (27%) were treated in the emergency department, and 840 (7.5%) died within 30 days of discharge. Complications of type 2 diabetes mellitus were the most common reason for rehospitalization, whereas heart failure was the most common reason for an emergency department visit. In multivariable analysis using a cause-specific Cox proportional hazards model, the following characteristics were associated with 30-day rehospitalization: older age, the number of hospital admissions in the preceding 6 months, the number of emergency department visits in the preceding 6 months, higher Charlson comorbidity index score, and the receipt of mechanical ventilation during the index hospitalization. Thus, a large proportion of patients receiving maintenance in-center hemodialysis will be readmitted or visit an emergency room within 30 days of an acute hospitalization. A focus on improving care transitions from the inpatient setting to the outpatient dialysis unit may improve outcomes and reduce healthcare costs.

1a.3.—Linkage

N/A

1a.3.1. Source of Systematic Review

1a.4.—Clinical Practice Guideline Recommendation

1a.4.1. Guideline Citation

1a.4.2. Specific Guideline

1a.4.3. Grade

1a.4.4. Grades and Associated Definitions

1a.4.5. Methodology Citation

1a.4.6. Quantity, Quality, and Consistency

1a.5.—United States Preventative Services Task Force Recommendation

1a.5.1. Recommendation Citation

1a.5.2. Specific Recommendation

1a.5.3. Grade

1a.5.4. Grades and Associated Definitions1a.5.5. Methodology Citation

1a.6.—Other Systematic Review of the Body of Evidence

1a.6.1. Review Citation

1a.6.2. Methodology Citation

1a.7.—Findings from Systematic Review of Body of the Evidence Supporting the Measure

1a.7.1. Specifics Addressed in Evidence Review

1a.7.2. Grade

1a.7.3. Grades and Associated Definitions

1a.7.4. Time Period

1a.7.5. Number and Type of Study Designs

1a.7.6. Overall Quality of Evidence

1a.7.7. Estimates of Benefit

1a.7.8. Benefits Over Harms

1a.7.9. Provide for Each New Study

1a.8.—Other Source of Evidence

1a.8.1. Process Used 1a.8.2. Citation

1b.—Evidence to Support Measure Focus

1b.1. Rationale

Emergency department encounters within 30 days of an index discharge are an important indicator of care coordination and quality of life. In the general population, studies have shown higher risk of an emergency department encounter subsequent to a discharge from an inpatient hospitalization or an outpatient emergency department encounter (e.g., see Hastings et al., 2008). This has been demonstrated in the ESRD population as well with 27% of patients being treated in an ED within 30 days of hospital discharge, most frequently for congestive heart failure (Harel et al., 2015)

More than half (55%) of all patients with end-stage renal disease (ESRD) visit the ED during their first year of dialysis, and patients with ESRD have a mean of 2.7 ED visits per patient-year (Lovasik et al., 2016). This rate is 6-fold higher than the national mean rates for US adults in the general population (CDC, 2011). Furthermore, the Lovasik study notes that among Medicare beneficiaries, 30% of hospital admissions that originate in the ED are for diagnoses that are often dialysis related such as complications of vascular access, congestive heart failure/fluid overload, septicemia, and hyperkalemia.

Measures of the frequency of ED encounters subsequent to a hospital discharge may help dialysis facility efforts to prevent emergent unscheduled care, for example through greater care coordination, and control escalating medical costs. Specifically, dialysis facility activities such as evaluation of the patients target weight or medication reconciliation and review may help reduce the risk of ED encounters after hospital discharge. This measure will supplement existing measures targeting care coordination (such as the Standardized Readmission Ratio NQF #2496) by identifying impactful events that can be influenced by dialysis facility care.

References:

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1b.2. Performance Scores

After applying all exclusion criteria, we evaluated all Medicare-certified dialysis facilities (n=6,254) treating Medicare dialysis patients (n=303,450) that had at least 11 index discharges in 2013-2014. Median facility size was 66 patients. The distribution of ED30 across these facilities is shown in the

tables below. ED30 rates vary widely across facilities. For example, for the 6,254 facilities included in 2013-2014, the ED30 varied from 0.00 to 5.06. The mean value was 1.02 and the SD was 0.74 (see below). Deciles of ED30 for 2013-2014 can be found in the Appendix.

Performance Score Descriptives, 2013-2014
N (facilities) = 6,254
Mean = 1.02
Std Dev = 0.741
Min = 0.0
25% = 0.78
Median = 1.00
75% = 1.23
Max = 5.06

1b.3. Summary of Data Indicating Opportunity
N/A

1b.4. and 1b.5. Disparities
Several studies suggest that rates of frequent ED use and similarly post-acute care use in the general population differ by race, female sex, insurance status, age, and other sociodemographic (SDS) and socioeconomic (SES) characteristics (Capp et al., 2015; Colligan et al., 2016; LaCalle et al., 2010; Zuckerman and Shen 2004). In the ESRD population, low health literacy (a proxy of SES) was found to be a predictor of ED use in one study (Green et al., 2013), as well as SDS/SES factors of younger age, female sex, black race, and public insurance (Medicaid), while lower ED use was associated with private insurance (Lovasik et al., 2016). Additionally, Hastings et al., report that Medicare beneficiaries that had a return ED visit or other acute care encounter were of older age, had Medicaid status, and had higher chronic health burden (Hastings et al, 2008). These indicate potential disparities in care along with different clinical risk factors.

The odds of an ED visit after a discharge are shown below for various patient subgroups.

Age:
For the 18-<25 age group: OR = 1.60, p-value <.0001.
For the 25-<44 age group: OR = 1.32, p-value <.0001.
For the 45-<59 age group: OR = 1.11, p-value <.0001.
The 60-<75 age group was used as the reference group.
For the 75+ age group: OR = 0.98, p-value 0.0016.

Sex:
For Female: OR = 0.99, p-value 0.0685
Male was used as the reference group.

Race:
White was used as the reference group.
For Black: OR = 1.12, p-value <.0001.
For Native American/Alaskan Native: OR = 0.97, p-value = 0.0934.
For Asian/Pacific Islander: OR = 0.95, p-value 0.0224.
For Other race: OR =1.03, p-value = 0.3632.

Ethnicity:
For Hispanic: OR = 1.04, p-value = 0.0005.
Non-Hispanic was used as the reference group.
For Unknown: OR = 1.05, p-value = 0.2928.

Employment Status:
Unemployed was used as the reference group.
For Employed: OR = 0.97, p-value 0.0228.
For Other: OR = 0.96, p-value <0.0001

Medicare Coverage:
Medicare as primary w/o Medicaid was used as the reference group.
Medicare as primary with Medicaid: OR = 1.13 p-value < .0001.
Medicare as secondary/Medicare HMO: OR = 0.20, p-value < .0001.

Our results indicate potential disparities in emergency department utilization within 4-30 days of an inpatient discharge. Differences are observed by age (younger age), race (blacks), ethnicity (Hispanic), and dual Medicare-Medicaid status.

Compared to the reference age group, those who were younger had higher odds of an emergency department encounter subsequent to a recent discharge (4-30 days). The odds were highest for 18-<25 year olds, with a negative gradient for the 25-<44 age group, and the 45-<59 age group. Compared to whites, black patients had 11% higher odds of an emergency department encounter within 4-30 days. Compared to non-Hispanic patients, Hispanic patients had 4 % higher odds of an emergency department encounter within 4-30 days. Finally, those with dual Medicare-Medicaid status had 13% higher odds of an ED encounter while those with Medicare as secondary coverage had 80% lower odds of an ED encounter within 4-30 days of an index discharge.

While there are notable differences by younger age, black race, and Hispanic ethnicity, as well as Medicare coverage type, it is unclear if these disparities in emergency department encounters following discharge from an inpatient admission are based on different clinical risk factors for these subgroups or differences in care quality.

Refer to Risk Adjustment section (2b4) for further analyses on race, ethnicity, sex and socioeconomic status.

References:
Capp R, West DR, Doran K, Sauaia A, Wiler J, Coolman T, Ginde AA. Characteristics of Medicaid-Covered Emergency Department Visits Made by Nonelderly Adults: A National Study. J Emerg Med. 2015 Dec;49(6):984-9.

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maintenance hemodialysis. Am J Kidney Dis. 2013 Jul;62(1):73-80.

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Scientific Acceptability

1.—Data Sample Description

1.1 What Type of Data was Used for Testing?
Medicare claims, Registry
1.2 Identify the Specific Dataset
Data are derived from an extensive national ESRD patient database, which is primarily based on the CMS Consolidated Renal Operations in a Web-enabled Network (CROWN) system. The CROWN data include the Renal Management Information System (REMIS), CROWNWeb facility-reported clinical and administrative data (including CMS-2728 Medical Evidence Form, CMS-2746 Death Notification Form, and CMS-2744 Annual Facility Survey Form data), the historical Standard Information Management System (SIMS) database (formerly maintained by the 18 ESRD Networks until replaced by CROWNWeb in May 2012), the National Vascular Access Improvement Initiative's Fistula First Catheter Last project (in CROWNWeb since May 2012), Medicare dialysis and hospital payment records, transplant data from the Organ Procurement and Transplant Network (OPTN), the Nursing Home Minimum Dataset, the Quality Improvement Evaluation System (QIES) Workbench, which includes data from the Certification and Survey Provider Enhanced Report System (CASPER), 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. CROWNWeb provides tracking by dialysis provider and treatment modality for non-Medicare patients. Information on emergency department visits is obtained from Medicare Outpatient Claims Standard Analysis Files (SAFs). Medicare Inpatient Claims SAFs are used to determine if emergency department visits resulted in an admission. Prevalent comorbidities are identified from Medicare inpatient, outpatient, skilled nursing facility, home health, and hospice claims.

1.3 What are the Dates of the Data Used in Testing?
January 2013 – December 2014 for index discharges
January 2013 – January 2015 for emergency department encounters
January 2012 – December 2014 for prior year comorbidities

1.4 What Levels of Analysis Were Tested?
Hospital/facility/agency

1.5 How Many and Which Measured Entities Were Included in the Testing and Analysis?

Table 1. Number of facilities and median facility size by year

Year	Number of Facilities	Median Facility Size (as of 12/31)
2012	5,663	60
2013	5,842	61
2014	6,059	61
2015	6,256	61

1.6 How Many and Which Patients Were Included in the Testing and Analysis?
Medicare dialysis patients were included in the testing and analysis for each of the four years from 2012-2015 of which there were 394,778; 404,353; 413,602 and 421,570 patients respectively.

Table 2. Descriptives of Patient Characteristics Included in the Measure

Patient Demographics	Percent
Age	
Patient Age: 18-24	0.6
Patient Age: 25-44	10.6
Patient Age: 45-59	25.6
Patient Age: 60-74	39.9
Patient Age: 75+	23.3
Sex (% female)	44.5
ESRD due to Diabetes (%)	46.7
Medicare coverage(%)	
Medicare primary + Medicaid	40.2
Medicare primary + no Medicaid	46.7
Medicare secondary/HMO	13.1
Time since Start of ESRD	
91 days-6 months	11.6
6 months-1 year	13.6
1-2 years	17.1
2-3 years	14.8
3-5 years	18.2
5+ years	24.8
Employment status 6 months prior to ESRD (%)	
Unemployed	22.1
Employed	19.0
Other/Unknown *	59.0
Race (%)	
White	59.7
Black	34.0
Native American/Alaskan Native	1.2

Patient Demographics	Percent
Asian/Pacific Islander	4.8
Other/Unknown	0.3
Ethnicity (%)	
Hispanic	15.8
Non-Hispanic	83.6
Unknown	0.6

* Other/Unknown groups includes Homemaker, Retired due to age/preference, retired due to disability, Medical leave of absence, or missing employment status. Note: Some categories (Time since start of ESRD and Employment) sum to 100.1% due to rounding.

1.7 Sample Differences, if Applicable

N/A

1.8 What were the social risk factors that were available and analyzed? For example, patient-reported data (e.g., income, education, language), proxy variables when social risk data are not collected from each patient (e.g. census tract), or patient community characteristics (e.g. percent vacant housing, crime rate) which do not have to be a proxy for patient-level data.

Patient level:

- Employment status 6 months prior to ESRD
- Sex
- Race
- Ethnicity
- Medicare coverage*

**Assessed at the start of time at risk based on calendar year and facility assignment. Medicare coverage in the model was defined as:*
1. Medicare as primary and Medicaid
2. Medicare as primary and NO Medicaid
3. Medicare as secondary or Medicare HMO

Data on patient level SDS/SES factors obtained from Medicare claims and administrative data.
Proxy/Area level: ZIP code level – Area Deprivation Index (ADI) elements from 2014 Census data:

- Unemployment rate (%)
- Median family income (rescaled as (income-60,000)/10,000)
- Income disparity
- Families below the poverty level (%)
- Single-parent households w/ children <18 (%)
- Home ownership rate (%)
- Median home value (rescaled as (homevalue-200,000)/100,000)
- Median monthly mortgage (rescaled as (mortgage-1,500)/1,000)
- Median gross rent (rescaled as (rent-900)/1,000)
- Population (aged 25+) with <9 years of education (%)
- Population (aged 25+) without high school diploma (%)

2a.2—Reliability Testing

2a2.1. Level of Reliability Testing

Performance measure score

2a2.2. Method of Reliability Testing

If the measure were a simple average across individuals in the facility, the NQF-recommended approach for determining measure reliability would be a one-way analysis of variance (ANOVA), in which the between and within facility variation in the measure is determined. The inter-unit reliability (IUR) measures the proportion of the measure variability that is attributable to the between-facility variance. The ED30, however, is not a simple average and we instead estimate the IUR using a bootstrap approach, which uses a resampling scheme to estimate the within facility variation that cannot be directly estimated by ANOVA.

Suppose that there are N facilities with at least 11 discharges in the year. Let $T_1,\ldots,T_N$ be the ED30 for these facilities. Within each facility, select at random and with replacement $B = 100$ bootstrap samples. That is, if the ith facility has n_i subjects, randomly draw with replacement n_i subjects from those in the same facility, find their corresponding $ED30_i$ and repeat the process 100 times. Thus, for the ith facility, we have bootstrapped ED30s of $T^*_{i1}\ldots, T^*_{i100}$. Let S^*_i be the sample variance of this bootstrap sample. From this it can be seen that

$$s^2_{t,w} = \frac{\sum_{i=1}^{N}[(n_i - 1)S^{*2}_i]}{\sum_{i=1}^{N}(n_i - 1)}$$

is a bootstrap estimate of the within-facility variance in the ED30, namely $\sigma^2_{t,w}$.Calling on formulas from the one way analysis of variance, an estimate of the overall variance of T_i is

$$s^2_t = \frac{1}{n'(N-1)}\sum_{i=1}^{N} n_i(T_i - \bar{T})^2$$

where

$$\bar{T} = \sum n_i T_i / \sum n_i$$

is the weighted mean of the observed ED30 and

$$n' = \frac{1}{N-1}\left(\sum n_i - \sum n_i^2 \Big/ \sum n_i\right)$$

is approximately the average facility size (number of patients per facility). Note that s^2_t is an estimate of $\sigma^2_b + \sigma^2_{t,w}$where σ^2_b is the between-facility variance, the true signal reflecting the differences across facilities. Thus, the IUR, which is defined by

$$IUR = \frac{\sigma_b^2}{\sigma_b^2 + \sigma_{t,w}^2}$$

can be estimated with $(s_t^2 - s_{t,w}^2)/s_t^2$

The measure calculation only included facilities that had at least 11 eligible index discharges in 2013-2014.

2a2.3. Statistical Results from Reliability Testing

Overall, we found that IUR = 0.47, which indicates that 47% of the variation in the ED30 can be attributed to the between-facility differences and 53% to within-facility variation.

2a2.4. Interpretation

The IUR value is considered moderate. As described in section 2b5.3 the measure demonstrates it is effective at detecting outlier facilities and statistically meaningful differences in performance scores across measured entities.

2b2—Validity Testing

2b2.1. Level of Validity Testing

Empirical validity testing

Systematic assessment of face validity of performance measure score

2b2.2. Method of Validity Testing

Face Validity: In May 2016, we presented a preliminary version of the ED30 measure to a CMS Technical Expert Panel (TEP) for clinical validity. The nine member TEP was composed of clinical nephrologists, ED physicians, a renal nurse, and ESRD patients. The TEP discussions were informed by a review of relevant literature and related ED and hospital measures as part of the environmental scan we prepared for the TEP. Potential measures were evaluated using the criteria for clinical performance measures adopted by the National Quality Forum (NQF) and CMS (importance, scientific acceptability, feasibility, and usability). During the discussion, the TEP considered:

- Relevant measures endorsed by the National Quality Forum (NQF), or reported in the Dialysis Facility Reports (DFRs)
- Components of a potential ED measure, such as the location of the patient prior to the ED encounter, the method by which the patient was directed to the ED, presenting complaint, severity of illness, and outcome of the ED encounter
- The degree to which performance on a measure is under control of the dialysis facility
- The potential need for exclusion criteria and/or risk adjustment
- Data availability and additional analyses

The TEP discussed different ED outcomes and recommended limiting an ED encounter measure to visits that do not result in an inpatient admission because ED visits resulting in hospitalization are already captured through the respective NQF endorsed Standardized Hospitalization Ratio (SHR) for Admissions and the Standardized Readmission Ratio (SRR) for dialysis facilities measures. In addition, the TEP agreed that observation stays should be included in an ED measure. Ultimately, the TEP indicated that creating a measure of ED use within 30 days of hospital discharge would complement the existing SRR measure while providing a more complete picture of care coordination in the outpatient setting. Finally, in June 2017 a final model that included extensive risk adjustment for prevalent comorbidities was

presented to the TEP for review. The TEP voted unanimously in support of the final fully risk adjusted ED30 measure. See the section on risk adjustment for further detail on prevalent comorbidity risk adjustment.

Empirical validity testing - validation of performance measure scores: We assessed empirical validity of the measure by calculating Spearman correlations. Spearman correlation was selected because the data are rank-ordered (non-parametric data). Correlations were calculated to assess the association of ED30 with clinical and intermediate outcome quality measures expected to be markers of quality care. The measures selected are fully developed and NQF endorsed, and represent an important subset of core clinical quality measures for this patient population. The measures used are vascular access type (fistula use and catheter $\geq$ 90 days), dialysis adequacy (Kt/V $\geq$1.2), mortality (Standardized Mortality Ratio - SMR), and dialysis facility level 30-day hospital readmission (SRR). We also included the Standardized Emergency Department Ratio (SEDR) which is currently being submitted for endorsement as a companion measure to ED30. We expected the following correlations of ED30 to the above quality measures:

- Vascular Access: Fistula – We anticipated this would be a negative correlation since successfully creating an AVF is generally seen as representing a robust process to coordinate care outside of the dialysis facility, and potentially reduces the likelihood of patients at such facilities returning to the ED within 30 days of a hospital discharge. Therefore higher rates of facility level AVF would be inversely related to outpatient ED visits within 30 days of discharge.
- Vascular Access: Catheter – We were agnostic about the direction of the correlation. A high vascular catheter rate could represent lack of facility care processes needed to create an AVF in which case the relationship to ED30 would be positive. A high catheter rate could also represent a higher burden of comorbidity at the facility level such that AVF placement is more challenging. In this scenario, sicker patients who have a long-term catheter may be more likely to be readmitted to the hospital versus have an outpatient only ED encounter, in which case the relationship with ED30 would be would be a negative correlation.
- Kt/V $\geq$ 1.2: We anticipated this would be a negative correlation with ED30. Facilities that have a high proportion of patients with adequate small solute clearance may also have processes of care in place that would likely avoid ED encounters after hospital discharge. In addition, patients who are unable to achieve a Kt/V of 1.2 may be morbidly obese, use a catheter for vascular access, or be non-adherent to treatment recommendations such that they may be at higher risk for ED use.
- SMR: We anticipated a positive correlation with mortality since patients who return to the ED after hospitalization may be more ill, and at higher risk of death, than those who do not require acute care in the 30 days following hospital discharge. We anticipate the strength of the association to be weak since patients who go to the ED and are not admitted are likely to be less sick than those admitted.
- SRR: We were agnostic about the direction of the correlation since ED30 and SRR target different subpopulations of dialysis patients in the post-hospitalization period. For facilities that have a higher burden of comorbidities, patients may be more likely to be readmitted versus have an outpatient only ED encounter, thus the correlation with SRR would be negative. However if facilities do not have processes in place to assist with post-hospitalization management, it is possible both ED30 and SRR would increase together, and yield a positive correlation.
- SEDR: We anticipated this would be a positive correlation since both measures are a reflection of outpatient ED use.

2b2.3. Statistical Results from Validity Testing

Results of the Spearman correlations testing the association between ED30 and vascular access type, hemodialysis adequacy, Standardized Mortality Ratio (SMR), Standardized Readmission Ratio (SRR), and, SEDR, respectively are presented in Table 2.

Table 2. Spearman Correlation of ED30 and Related Measures, 2013-2014

	Correlation	P-value
Vascular Access: Fistula	-0.03	0.0354
Vascular Access: Catheter >90 days	-0.06	<0.0001
Kt/V ≥ 1.2	-0.02	0.1072
SMR	0.06	<0.0001
SRR	-0.05	0.0002
SEDR	0.51	<0.0001

2b2.4. Interpretation

The results as expected demonstrate the ED30 measure is associated with several dialysis facility processes and outcomes that are commonly thought to be related to quality of care. Higher rates of arteriovenous fistula use are associated with lower emergency department utilization in the 30 days that follow hospital discharge. The magnitude of the association is in the expected direction and is statistically significant ($p<0.05$), although the strength of the association is weak. The result suggests that facilities with processes of care to provide optimal vascular access may have other processes in place to help coordinate post-hospital care and thus avoid needing the ED for unscheduled acute care. However, a similar result (negative association) was also seen with long-term dialysis catheter use. It may be that ED providers have a lower threshold to (re)admit patients with a catheter in the post-hospitalization period rather than treat them in the ED outpatient setting. Facilities with higher percentages of patients with Kt/V ≥ 1.2 was only weakly associated with less ED use in the 30 days after hospital discharge however, the result was not statistically significant. It may be that patients with poor dialysis adequacy are sicker and more likely to be seen in the ED after hospital discharge, but also more likely to be readmitted, which would attenuate the strength of this association since ED30 and SRR target different subpopulations of dialysis patients in the post-hospitalization period.

Higher ED utilization was weakly associated with higher facility mortality rates, while it was associated with lower readmissions (SRR). ED30 focuses on outpatient use of ED services whereas SRR captures inpatient readmissions and ED use that results in readmission, therefore the ED30 measure likely captures dialysis patients that have a lower acuity of illness than the SRR. The weak association also indicates the competing risks of an outpatient ED visit versus a readmission, as only outpatient ED visits are included in the ED30. A patient that has an ED encounter will either be discharged from the ED (and encounter will be counted in ED30) or be (re)admitted (and admissions will be counted in SRR) therefore the encounter can only be counted in one measure, not both.

Lastly, we assessed the correlation between the ED30 and the Standardized Emergency Department Ratio (SEDR) measure, which is also being submitted for consideration of NQF endorsement. The SEDR describes emergency department encounter rates with reference to the totality of patients being treated by a given facility. Since ED encounters that are measured in the ED30 are also captured in the

SEDR, these two measures demonstrate a strong degree of correlation while assessing complementary elements of care.

2b3—Exclusion Analysis

2b3.1. Method of Testing Exclusion

A total of 335,536 hospital discharges among 94,338 unique patients were excluded. The number and percentage of excluded discharges are as follows:

Discharges for which the patient:

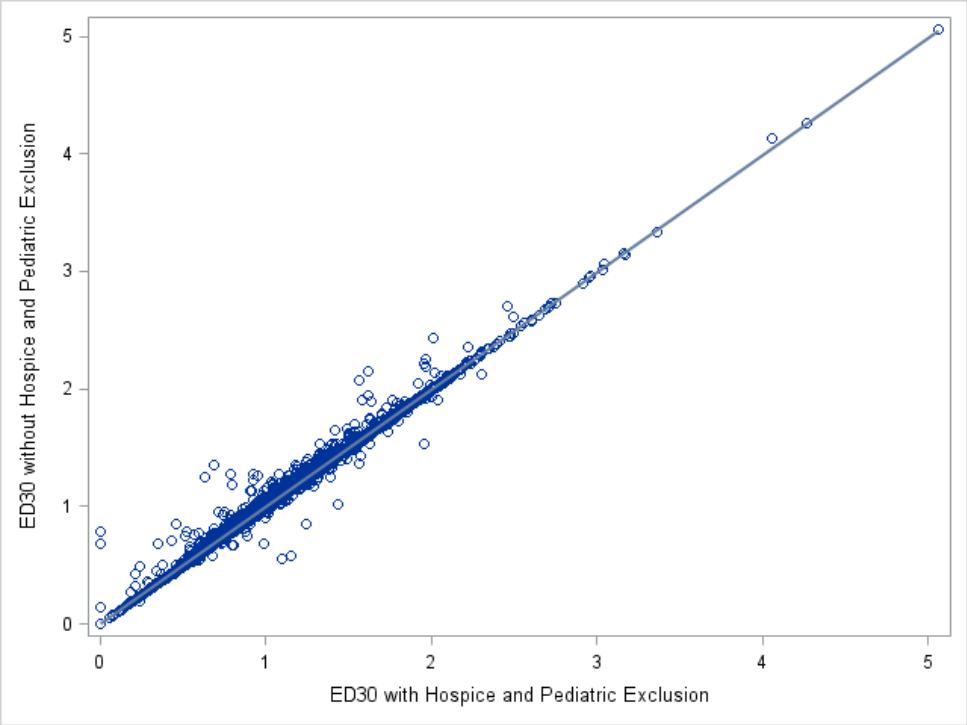
1. Has had ESRD for 90 days or less at time of discharge (*n* =132,950 ; 11.1%)
2. Is less than 18 years of age at the time of discharge (*n* = 2,523 ; 0.2%)
3. Is actively enrolled in hospice at time of discharge (*n* = 25,268; 2.1%)

Additionally, we exclude hospital discharges that:

4. Do not result in a live discharge (*n* =51,792; 4.3%)
5. Result in a patient dying, receiving a transplant, recovering kidney function, discontinuing dialysis, or becoming lost-to-follow-up within 30 days with no emergency department encounter or hospitalization (*n* =30,361 ; 2.5%)
6. Are against medical advice (*n* =17,995; 1.5%)
7. Include a primary diagnosis for cancer, mental health or rehabilitation (*n* =25,927; 2.2%)
8. Are from a PPS-exempt cancer hospital (*n* = 299; 0.03%)
9. Result in another hospitalization within four days of discharge (n=48,421; 4.1%)

As shown in Figure 1, we compared each facility's ED30 with and without the hospice and pediatric exclusions and found the two measures to be highly correlated (overall Pearson correlation coefficient [r] = 0.9953p-value <0.0001).

Figure 1. Correlation between ED30 with and without the hospice and pediatric exclusions (2013-2014)



Overall Correlation=0.9953p-value <0.0001

2b3.3. Interpretation

The measure with and without the hospice and pediatric exclusions is highly correlated suggesting the overall impact on the measure's validity is not substantial. However, these exclusions are necessary to account for any differences in the proportion of hospice and pediatric patients between facilities.

2b4—Risk Adjustment or Stratification

2b4.1. Method of controlling for differences

Statistical risk model with 88 risk factors

2b4.2. Rationale why Risk Adjustment is not Needed

N/A

2b4.3. Conceptual, Clinical, and Statistical Methods

Selection of clinical factors: The list of covariates considered was based on CMS' Standardized Readmission Ratio for Dialysis Facilities (NQF 2496) and separate empirical evaluation of prevalent comorbidities associated with risk of an ED encounter. Therefore, ED30 includes a different set of comorbidities than SRR as the comorbidities associated with high risk of readmission occurred at a very low frequency among patients with an outpatient ED encounter only.

Methodology for prevalent comorbidity selection: We began the selection process with the 283 AHRQ CCS groupers for calendar year 2015. We eliminated the following 32 groupers either due to a possible association with facility care, a reflection of underlying kidney disease, or because they were not appropriate adjusters for our analysis.

AHRQ CCS Groupers Excluded	Description
2	Septicemia
123	Influenza
156	Nephritis / Nephrosis
157	Acute Kidney Failure
158	Chronic Kidney Disease
254	Rehabilitation care; fitting of prostheses; and adjustment of devices
255	Administrative/social admission
256	Medical examination/evaluation
257	Other aftercare
258	Other screening for suspected conditions
259	Residual codes; unclassified
E-Codes	21 Groupers total

Next, five categories of specific ICD-9 codes were removed from the remaining 251 AHRQ CCS groupers. These codes, listed in the Appendix, can be associated with dialysis facility care and include diagnoses such as secondary hyperparathyroidism, fluid overload, hyperkalemia, and vascular access infections. Once these specific ICD-9 codes were excluded, the 251 CCS groupers were consolidated down to 130 groupers by combining similar categories that had specificity beyond what was needed for our risk adjustment.

The selection of prevalent comorbidities was derived using a boosting variable selection method that was applied to the 130 AHRQ CCS groupers to identify a subset of prevalent comorbidities based on their ability to predict outpatient ED encounters. This process is more selective than traditional forward step-wise model building in selecting covariates. The boosting method [1] included the following steps:

1. Use forward stage-wise regression to iteratively detect comorbidities. That is, given the inclusion of some comorbidities, this method identifies additional comorbidity predictors to add to the analysis model.

2. Randomly draw bootstrapped samples and repeatedly apply the boosting procedure on each bootstrapped sample. The variables are ranked based on their selection frequencies.

3. Apply an empirical Bayes false discovery rate (FDR) controlling procedure [2,3] to effectively control the fraction of false discoveries. This procedure is able to control the FDR at a preselected level $0 < q < 1$ (FDR-controlling parameter). For instance, if $q = 0{:}1$ and 10 variables are selected with an estimated FDR less than q, at most 1 of these 10 variables would be expected to be a false positive. This is an equivalent process to assessing the statistical significance of the association between the predictor variable and an emergency department encounter.

The boosting method resulted in a set of 67 CCS groupers that were predictive of an ED encounter.

This list of prevalent comorbidities was presented to the ED TEP in June 2017 and received unanimous support for inclusion in the SEDR and ED-30 measures.

Selected References:

1. Friedman, J.H. (2001). Greedy function approximation: A gradient boosting machine. Annals of Statistics, 29(5), 1189-1232.

2. Benjamini, Y., and Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. Journal of the Royal Statistical Society. Series B (Methodological), 57, 289-300.

3. Efron, B. (2012). Large-Scale Inference: Empirical Bayes Methods for Estimation, Testing, and Prediction Institute of Mathematical Statistics Monographs, Cambridge University Press.

We fit the model adjusting for factors (listed above in 2b4.1.1) that were included in the SRR model, other than discharged with a high-risk condition, and checked for statistical significance.

We conducted all analyses in R and SAS. The analyses presented here are based on ICD-9 codes.

Consideration of SDS/SES risk factors: SDS/SES factors were evaluated based on appropriateness (whether related to differences in outcomes), empirical association with the outcome (ED visits within 30 days of a hospital discharge), and as supported in published literature.

The relationship among patient-level SDS, socioeconomic disadvantage, access to care, and acute care utilization such as hospitalization and emergency department use is well-established in the general population and has received considerable attention over the years (AHRQ Reports, 2011; 2012; 2013; 2014; 2015). There is also overlap between patient-level SDS factors such as race, and area level SES. For example, race may interact with lower income, neighborhood poverty, residential segregation, levels of educational attainment, and unemployment levels that jointly influence key health outcomes related to morbidity and acute care use (Williams 2006; Williams and Collins, 2001).

Race, insurance status, younger age, and SES have been shown to be predictors of emergency department utilization in the general population (Capp et al., 2015; Colligan et al., 2016; LaCalle et al., 2010; Zuckerman and Shen 2004; Hastings et al., 2008). For example, a study by Zuckerman and Shen (2004) reported that black adults had higher odds than whites of being occasional users compared to non-ED users. This difference between blacks and whites was larger when comparing frequent-users to non-users (Zuckerman and Shen, 2004, pg. 178). However they also found few differences in the likelihood of frequent ED use when comparing patient that are privately insured versus uninsured while frequent ED use was more likely among those with public insurance (i.e., Medicaid) (Zuckerman and Shen 2004). Those with lower income also had higher odds of being occasional and frequent ED users, while individuals with some college had lower odds of being an occasional or frequent user of the ED, compared to those with no high school diploma. An analysis by Cunningham et al (2016) of frequent ED use at two urban hospitals, found that frequent ED use was associated with younger age, and that frequent users were more likely to be black. However there was no significant difference in primary access between infrequent and frequent users, suggesting that access to care did not explain variation in ED utilization. In addition to younger age, another study reported that those who were single/divorced, single-parents, had high school education or less, and had lower income were more likely to be frequent users of the ED (Sun et al., 2003). Among dual-eligible patients that receive care from a Federally

Qualified Health Center (FQHC), relative rates of ED use were lower compared to dual-eligibles that did not receive care from an FQHC (Wright et al., 2015), suggesting the importance of access to primary care. Finally, trends in ED use show differences by sex (female), age 45-64), and geography (the Midwest) and in large central metropolitan areas (Skinner et al., 2014, pg 2-3).

Emergency department utilization after a post-acute or acute visit are associated with age and insurance type. For example, Hastings et al., report that Medicare beneficiaries that had a return ED visit or other acute care encounter were associated with older age, and Medicaid status, along with higher chronic health burden (Hastings et al, 2008). Chu and Pei (1999, pg. 220) found that in addition to clinical risk factors, socioeconomic characteristics of patient were predictive of early emergency readmission among elderly patient population.

In the ESRD population, low health literacy (a proxy of SES) was found to be a predictor of ED use in one study (Green et al., 2013), as well as SDS/SES factors of younger age, female sex, black race, and public insurance (Medicaid) while lower ED use was associated with private insurance (Lovasik et al., 2016). ESRD patients discharged from a skilled nursing facility that had a subsequent emergency department encounter within 30 days were more likely to be of black race, have dual Medicare-Medicaid status, along had higher comorbidity (Hall et al., 2015). In ESRD patients that received a transplant, higher risk of ED use was associated with younger age, female sex, black race, Hispanic ethnicity, and public insurance (Medicaid) (Schold et al., 2016). Treatment adherence was also found to be a risk factor for emergency department visits (Chan et al., 2014). This suggests that there may be related SDS/SES or community level factors that adversely impact patient adherence to dialysis treatment.

Area-level factors, typically operating as proxies of patient level factors, have also been found to influence acute care use, such as readmission (Herrin et al., 2015; Kind et al, 2014) as well as ED use (Skinner et al., 2014, pg 2-3). Additionally, area-level SES have been observed to be associated with poor outcomes in ESRD patients (e.g., Almachraki et al 2016).

Given these observed linkages we tested available patient- and area-level SDS/SES variables based on the conceptual relationships as described above and demonstrated in the literature, as well as the availability of data for analysis.

In our analyses assessing the impact on facility level emergency department use by ESRD patients, we use the publicly available Area Deprivation Index (ADI) developed by Singh and colleagues at the University of Wisconsin. The ADI reflects a full set of SES characteristics, including measures of income, education, and employment status, measured at the ZIP code level. Singh (2003) has applied the index in a variety of contexts, including analysis of county-level mortality rates. Singh found area differences in mortality associated with low SDS. Over the period studied, mortality differences widened because of slower mortality reductions in more deprived areas. More recently, the ADI has been applied to the calculation of risk-adjusted rates of hospital readmission (Kind et al 2014).

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2b4.4. Statistical Results

In Table 3 below, we list results from the adjusted model described above.

Table 3. Baseline ED 30 Model Coefficients and Odds Ratios – Data Years 2013-2014

Covariate	Coefficient	Odds Ratio	P-value
Sex			
Female	0.0158	1.01589	0.2566
Male	**Reference**		
Age			
18-24	0.5834	1.79213	<0.0001
25-44	0.4054	1.49997	<0.0001
45-59	0.1767	1.19328	<0.0001
60-74	**Reference**		
75+	-0.0737	0.92894	<0.0001
Cause of ESRD			
Diabetes	-0.0166	0.98350	0.2500
BMI			
Underweight	-0.0052	0.99480	0.4541
Normal weight	**Reference**		
Overweight	-0.0264	0.97399	0.0008
Obese	-0.0427	0.95817	<0.0001
Time on ESRD			
91 days-6 months	0.0925	1.09690	<0.0001
6 months-1 year	0.0065	1.00653	0.2479
1-2 years	**Reference**		
2-3 years	0.0600	1.0618	<0.0001
3-5 years	0.1099	1.11618	<0.0001
5+ years	0.1142	1.12101	<0.0001
Length of Hospital Stay (Q1 – Shortest stay)			
Length of Stay (Q1)	**Reference**		
Length of Stay (Q2)	-0.0660	0.93612	<0.0001
Length of Stay (Q3)	-0.0843	0.91918	<0.0001
Length of Stay (Q4)	-0.0719	0.93064	<0.0001
Prevalent comorbidity groupers			
HIV infection	0.0359	1.03656	0.0062
Hepatitis	0.0826	1.08610	<0.0001
Viral infection	0.0388	1.03961	0.0042
Fluid and electrolyte disorders	0.0391	1.03988	0.0001
Epilepsy; convulsions	-0.1285	0.87939	<0.0001
Headache; including migraine	-0.0145	0.98561	0.0105
Other nervous system disorders	0.0217	1.02192	0.3016
Essential hypertension	0.0365	1.03715	0.0012

Covariate	Coefficient	Odds Ratio	P-value
Hypertension with complications and secondary hypertension	-0.1387	0.87051	0.0053
Nonspecific chest pain	0.1109	1.11730	<0.0001
Pulmonary heart disease	0.0551	1.05668	<0.0001
Other and ill-defined heart disease	0.2492	1.28298	<0.0001
Other circulatory disease	0.2248	1.25213	<0.0001
Other lower respiratory disease	0.0229	1.02316	0.0161
Other upper respiratory disease	0.2211	1.24742	<0.0001
Esophageal disorders	-0.0161	0.98404	0.0548
Anal and rectal conditions	0.0705	1.07310	<0.0001
Peritonitis and intestinal abscess	0.0165	1.01668	0.0024
Pancreatic disorders (not diabetes)	0.0424	1.04333	<0.0001
Gastrointestinal hemorrhage	0.0204	1.02059	<0.0001
Noninfectious gastroenteritis	0.0875	1.09149	<0.0001
Other gastrointestinal disorders	0.0141	1.01417	0.0005
Urinary tract infections	0.1401	1.15036	<0.0001
Calculus of urinary tract	0.0446	1.04562	<0.0001
Other diseases of kidney and ureters	0.0873	1.09120	<0.0001
Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease)	0.0057	1.00570	0.1023
Other non-traumatic joint disorders	0.0323	1.03286	<0.0001
Spondylosis; intervertebral disc disorders; other back problems	0.0448	1.04586	0.0001
Osteoporosis	-0.0990	0.90579	<0.0001
Sprains and strains	0.0764	1.07940	<0.0001
Complication of device; implant or graft	-0.0074	0.99259	0.0332
Superficial injury; contusion	0.0817	1.08518	<0.0001
Other injuries and conditions due to external causes	0.0423	1.04317	<0.0001
Syncope	0.0348	1.03540	<0.0001
Gangrene	0.0709	1.07349	<0.0001
Shock	0.0009	1.00093	0.0851
Nausea and vomiting	0.0217	1.02196	<0.0001
Abdominal pain	-0.0388	0.96194	<0.0001
Malaise and fatigue	0.1664	1.18106	<0.0001
Allergic reactions	0.1151	1.12195	<0.0001
Anxiety disorders	0.1488	1.16040	<0.0001
Attention-deficit, conduct, and disruptive behavior disorders	0.0781	1.08124	<0.0001
Developmental disorders	-0.0061	0.99395	0.3707
Mood disorders	0.1083	1.11435	<0.0001
Personality disorders	-0.0606	0.94118	<0.0001
Schizophrenia and other psychotic disorders	-0.0940	0.91024	<0.0001
Alcohol-related disorders	0.1984	1.21945	<0.0001
Suicide and intentional self-inflicted injury	0.2463	1.27930	<0.0001
Screening and history of mental health and substance abuse codes	0.0848	1.08854	<0.0001

Covariate	Coefficient	Odds Ratio	P-value
Miscellaneous mental health disorders	0.0396	1.04036	<0.0001
Other infections; including parasitic; Sexually transmitted infections (not HIV or hepatitis)	0.0725	1.07516	<0.0001
Phlebitis; thrombophlebitis and thromboembolism	0.0698	1.07229	0.0014
Acute myocardial infarction	0.1171	1.12426	<0.0001
Conduction disorders; Cardiac dysrhythmias	0.0226	1.02288	0.2337
Acute and chronic tonsillitis; Acute bronchitis; Other upper respiratory infections	0.0795	1.08277	0.0001
Chronic obstructive pulmonary disease and bronchiectasis; Asthma	0.1001	1.10528	<0.0001
Disorders of teeth and jaw; Diseases of mouth; excluding dental	0.1063	1.11215	<0.0001
Digestive track disorders	0.0877	1.09167	0.0001
Male genital disorders	0.0763	1.07931	<0.0001
Skin disorders	0.1145	1.12136	<0.0001
Other connective tissue disease; Other bone disease and musculoskeletal deformities	0.0673	1.06967	<0.0001
Melanomas of skin; Other non-epithelial cancer of skin	0.1410	1.15145	<0.0001
Poisoning	0.0200	1.02018	0.1529
Benign neoplasm of uterus; Other and unspecified benign neoplasm	0.0846	1.08828	<0.0001
Diabetes mellitus without complication; Diabetes mellitus with complications	0.0970	1.10181	<0.0001
Meningitis (except that caused by tuberculosis or sexually transmitted disease); Encephalitis (except that caused by tuberculosis or sexually transmitted disease)	-0.0838	0.91958	<0.0001
Ear and sense organ disorders	0.1322	1.14137	<0.0001
Year 2013	-0.0386	0.96210	<0.0001

2b3.4b. Describe the analyses and interpretation resulting in the decision to select social risk factors *(e.g. prevalence of the factor across measured entities, empirical association with the outcome, contribution of unique variation in the outcome, assessment of between-unit effects and within-unit effects.)* **Also describe the impact of adjusting for social risk (or not) on providers at high or low extremes of risk.**

Using hierarchical binary logistic regression, we fit an additional model for ED30 to 2013 and 2014 hospitalization data, including covariates from the original ED30 model and adding several SES/SDS indicators as well as patients' race, and ethnicity. Table 4 shows effects from these selected additional covariates in the SES/SDS model.

Table 4. Coefficients and Odds Ratios for Baseline Model and Model with Additional SDS/SES Adjustors: 2013-2014

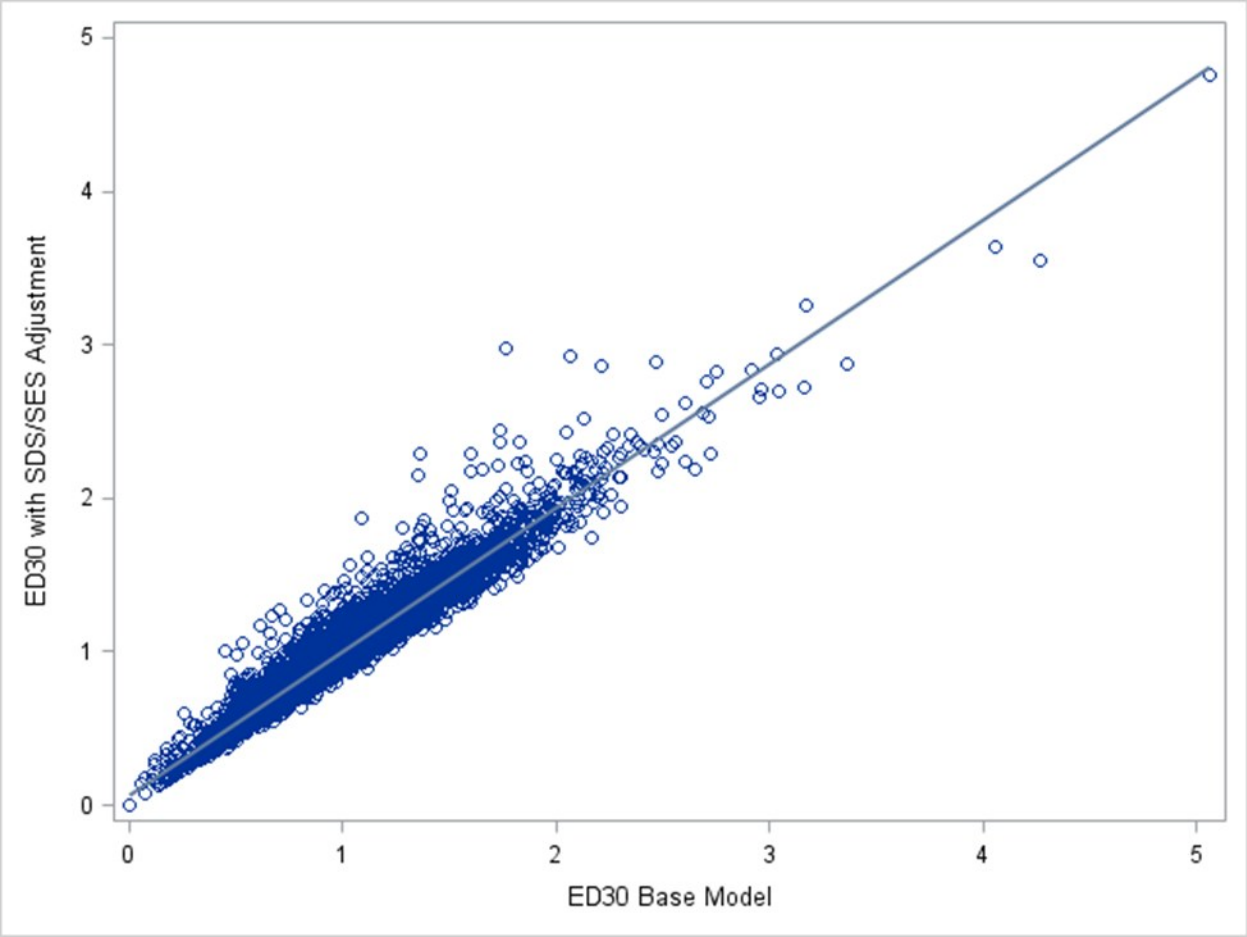
Covariate	Coefficient	Odds Ratio	P-value
Sex			
Female	-0.0117	0.98837	0.0685
Male	Reference		
Age			
18-24	0.4694	1.59901	<0.0001
25-44	0.2797	1.32267	<0.0001
45-59	0.1036	1.10920	<0.0001
60-74	Reference		
75+	-0.0249	0.97541	0.0016
Cause of ESRD			
Diabetes	0.0131	1.01316	0.0512
BMI			
Underweight	0.0036	1.00358	0.4287
Normal weight	Reference		
Overweight	-0.0269	0.97346	0.0021
Obese	-0.0367	0.96398	<0.0001
Time on ESRD			
91 days-6 months	0.0928	1.09722	<0.0001
6 months-1 year	0.0272	1.02761	0.0348
1-2 years	Reference		
2-3 years	0.0217	1.02194	0.0400
3-5 years	0.0224	1.02260	0.0183
5+ years	0.0126	1.01266	0.1677
Length of Hospital Stay (Q1 – Shortest stay)			
Length of Stay (Q1)	Reference		
Length of Stay (Q2)	-0.0668	0.93541	<0.0001
Length of Stay (Q3)	-0.0869	0.91682	<0.0001
Length of Stay (Q4)	-0.0553	0.94619	<0.0001
ADI	0.0442	1.04518	0.1513
Race			
White	Reference		
Native American/Alaskan Native	-0.0305	0.96992	0.0934
Asian/Pacific Islander	-0.0477	0.95338	0.0224
Black	0.1118	1.11832	<0.0001
Other/Unknown	0.0334	1.03391	0.3632
Ethnicity			
Hispanic	0.0403	1.04114	0.0005
Non-Hispanic	Reference		
Unknown	0.0464	1.04753	0.2928
Medicare coverage*			
Medicare primary + Medicaid	0.1187	1.12600	<0.0001
Medicare primary + no Medicaid	Reference		
Medicare secondary/HMO	-1.5960	0.20270	<0.0001
Employment status 6 months prior to ESRD			

Covariate	Coefficient	Odds Ratio	P-value
Employed**	-0.0268	0.97360	0.0228
Unemployed	Reference		
Retired/Other/Unknown***	-0.0402	0.96058	<0.0001
Prevalent comorbidity groupers			
HIV infection	0.0184	1.01861	0.1126
Hepatitis	0.0256	1.02597	0.0044
Viral infection	0.0324	1.03292	0.0173
Fluid and electrolyte disorders	0.0487	1.04990	<0.0001
Epilepsy; convulsions	-0.0929	0.91127	<0.0001
Headache; including migraine	-0.0338	0.96675	0.0018
Other nervous system disorders	0.0075	1.00748	0.2567
Essential hypertension	0.0994	1.10451	0.0002
Hypertension with complications and secondary hypertension	-0.0762	0.92663	0.0224
Nonspecific chest pain	0.1001	1.10530	<0.0001
Pulmonary heart disease	0.0662	1.06848	<0.0001
Other and ill-defined heart disease	0.1243	1.13239	<0.0001
Other circulatory disease	0.1726	1.18841	0.0001
Other lower respiratory disease	0.0341	1.03464	<0.0001
Other upper respiratory disease	0.2130	1.23744	<0.0001
Esophageal disorders	0.0016	1.00157	0.4205
Anal and rectal conditions	0.0437	1.04468	<0.0001
Peritonitis and intestinal abscess	0.0361	1.03673	<0.0001
Pancreatic disorders (not diabetes)	0.0169	1.01702	0.0213
Gastrointestinal hemorrhage	0.0484	1.04958	<0.0001
Noninfectious gastroenteritis	0.0974	1.10230	<0.0001
Other gastrointestinal disorders	0.0252	1.02554	<0.0001
Urinary tract infections	0.0947	1.09935	<0.0001
Calculus of urinary tract	0.0468	1.04794	<0.0001
Other diseases of kidney and ureters	0.0894	1.09350	<0.0001
Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease)	0.0083	1.00831	0.1561
Other non-traumatic joint disorders	0.0462	1.04724	<0.0001
Spondylosis; intervertebral disc disorders; other back problems	0.0657	1.06786	<0.0001
Osteoporosis	-0.0750	0.92777	<0.0001
Sprains and strains	0.0748	1.07770	<0.0001
Complication of device; implant or graft	-0.0194	0.98075	0.0088
Superficial injury; contusion	0.0822	1.08562	<0.0001
Other injuries and conditions due to external causes	0.0399	1.04075	<0.0001
Syncope	0.0458	1.04682	<0.0001
Gangrene	0.0290	1.02941	<0.0001
Shock	0.0303	1.03078	0.0003
Nausea and vomiting	0.0321	1.03264	<0.0001
Abdominal pain	-0.0420	0.95885	0.0003
Malaise and fatigue	0.1667	1.18144	<0.0001
Allergic reactions	0.0505	1.05176	<0.0001
Anxiety disorders	0.1348	1.14428	<0.0001
Attention-deficit, conduct, and disruptive behavior disorders	0.0307	1.03118	<0.0001
Developmental disorders	-0.0017	0.99830	0.4157

Covariate	Coefficient	Odds Ratio	P-value
Mood disorders	0.0918	1.09613	<0.0001
Personality disorders	-0.0504	0.95081	<0.0001
Schizophrenia and other psychotic disorders	-0.0716	0.93090	<0.0001
Alcohol-related disorders	0.15360	1.16600	<0.0001
Suicide and intentional self-inflicted injury	0.2190	1.24488	<0.0001
Screening and history of mental health and substance abuse codes	0.0637	1.06580	<0.0001
Miscellaneous mental health disorders	0.0664	1.06862	<0.0001
Other infections; including parasitic; Sexually transmitted infections (not HIV or hepatitis)	0.0778	1.08090	<0.0001
Phlebitis; thrombophlebitis and thromboembolism	0.1217	1.12943	<0.0001
Acute myocardial infarction	0.1150	1.12189	<0.0001
Conduction disorders; Cardiac dysrhythmias	0.0214	1.02158	0.0004
Acute and chronic tonsillitis; Acute bronchitis; Other upper respiratory infections	0.1322	1.14128	<0.0001
Chronic obstructive pulmonary disease and bronchiectasis; Asthma	0.0744	1.07727	<0.0001
Disorders of teeth and jaw; Diseases of mouth; excluding dental	0.1307	1.13965	<0.0001
Digestive track disorders	0.1093	1.11553	<0.0001
Male genital disorders	0.0575	1.05916	<0.0001
Skin disorders	0.1027	1.10820	<0.0001
Other connective tissue disease; Other bone disease and musculoskeletal deformities	0.0692	1.07166	<0.0001
Melanomas of skin; Other non-epithelial cancer of skin	0.1506	1.16252	<0.0001
Poisoning	0.0207	1.02087	0.0918
Benign neoplasm of uterus; Other and unspecified benign neoplasm	0.0319	1.03244	<0.0001
Diabetes mellitus without complication; Diabetes mellitus with complications	0.0842	1.08779	<0.0001
Meningitis (except that caused by tuberculosis or sexually transmitted disease); Encephalitis (except that caused by tuberculosis or sexually transmitted disease)	-0.0515	0.94980	<0.0001
Ear and sense organ disorders	0.0822	1.08572	<0.0001
Year 2013	-0.0382	0.96254	<0.0001

*Patients without Medicare coverage or with unknown coverage type were excluded from the model.
**Employed includes patients who are full-time employed, part-time employed, or students.
***Other/Unknown includes patients who are on medical leave of absence, retired due to age or disability, homemakers, or those with no employment status information available.

Figure 2. Correlation between ED30 with and without SDS/SES adjustment, 2013-2014.



Overall Correlation coefficient rho=0.97 (p <0.0001)

We did a sensitivity analysis comparing the baseline ED30 measure to results that included adjustment for SDS/SES factors.

Patient-level SDS: There was no difference between males and females in odds of experiencing an emergency department encounter within 4-30 days of discharge (OR=0.99, p=0.0685). Compared with non-Hispanics, Hispanics had 4% higher odds of an emergency department encounter within 4-30 days of discharge (OR=1.04; p=0.0005). The odds of an ED encounter for patients of Native American race was slightly lower compared to whites however these were not statistically significant (OR=0.97, p=0.0934). The risk was 5% lower for Asian/PI patients compared to whites (OR=0.95, p=0.0224). Notably, compared to whites, black patients had 12% higher odds (OR=1.12, p<0.0001) of an emergency department encounter within 4-30 days of discharge. The results for these patient-level SDS factors are consistent with prior studies both in the respective chronic dialysis setting and general population

indicating black race and Hispanic ethnicity as potential SDS risk factors for ED use.

Patient-level SES: Compared with Medicare-only patients, dually-eligible patients with both Medicare and Medicaid (OR=1.13; p <0.0001) had 13% higher odds of visiting the emergency department within 4-30 days after an inpatient discharge. In striking contrast, patients with Medicare as secondary payer/Medicare HMO (OR=0.20, p <0.0001) had 80% lower odds of having an emergency department encounter within 4-30 days. The result for dually-eligible patients having higher odds of an emergency department encounter is consistent with prior studies demonstrating that this insurance category, on average, represents an at-risk group.

Patients who were employed prior to ESRD incidence had slightly lower odds of having an emergency department encounter within 4-30 days but this was only marginally significant (OR=0.97; 0.0228) compared to unemployed patients. However, employment information is obtained only at ESRD incidence, therefore we are unable to capture changes to patients' employment status over time and whether that corresponds with changes in emergency department use.

Area-level SES: While higher area-level deprivation (ADI) increased the odds of an emergency department encounter (OR=1.04, p=0.1513), the effect was not significant. This could indicate more granular measures of SES may be needed to better assess the impact of SES on ED use.

We also examined how the different modeling approaches without and with SDS/SES adjustment changed how facilities were flagged in terms of their expected ED30 performance. As shown in Table 5, the flagging rates changed nominally between the original ED30 measure and the sensitivity model that includes SDS/SES.

Table 5. Flagging rates, baseline ED30 and ED30 adjusted for SDS/SES, 2013-2014

Baseline ED30	**ED30 with SDS/SES**			**Total**
	Better than Expected	As Expected	Worse than Expected	
Better than Expected	55	128	0	**2.93%(183)**
As Expected	29	5753	76	**93.67%(5858)**
Worse than Expected	1	49	163	**3.41%(213)**
Total	**1.36%(85)**	**94.82%(5930)**	**3.82%(239)**	6254

These results show that facility profiling changes nominally with the addition of these selected patient- or area-level SDS/SES factors. A larger percentage of facilities are flagged as worse than expected and a lower percentage are flagged as better than expected in the model adjusting for SDS/SES. Specifically, 239 (3.82%) facilities are flagged as worse than expected and 85 (1.36%) facilities are flagged as better than expected in the model adjusting for SDS/SES versus the ED30 baseline model where 213 (3.41%) facilities are flagged as worse than expected and 183 (2.93%) facilities are flagged as better than expected. This empirical finding demonstrating nominal differences in flagging when adjusting for SDS/SES, coupled with the risk of reducing patients' access to high quality care supports the decision to not adjust ED30 for the selected SDS/SES factors.

2b4.5. Method Used to Develop the Statistical Model or Stratification Approach

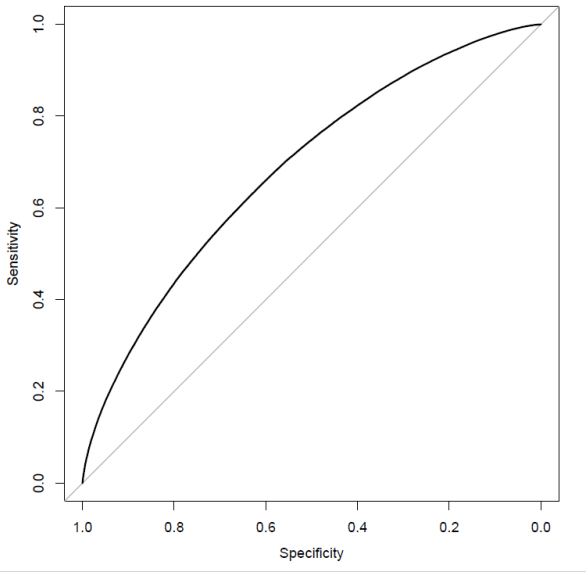
Risk factors were selected for the final model based on the magnitude of the coefficients, evaluation of their statistical significance, and the model C-statistic. The C-statistic measures the discriminative power of the regression model with considered risk factors.

The model's fit is demonstrated in Figure 4 below, which compares the observed rates with the model-based predictions. We bin all observations into 20 groups based on their model-based predicted values and compute the observed emergency department encounter proportion for each group. We then apply the logit transformation to each group's observed emergency department encounter proportion and plot it against the same group's average linear prediction. The 45-degree line would represent a perfect match between the observed values and the model-based predictions. In general, the closer the observed values are to this line the better the model fit.

2b4.6. Statistical Risk Model Discrimination Statistics (e.g., c-statistic, R^2)

The C-statistic measures the discriminative power of the regression model with considered risk factors. As the ROC curve demonstrates, the model's accuracy is good (Figure 3); C-statistic = 0.685.

Figure 3. ROC Curve for Model (2013-2014)

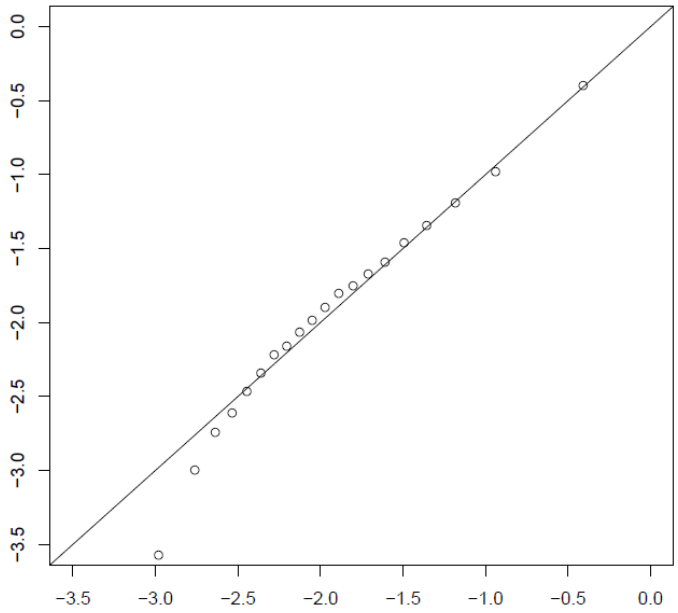


2b4.7. Statistical Risk Model Calibration Statistics (e.g., Hosmer-Lemeshow statistic)

N/A

2b4.8. Statistical Risk Model Calibration—Risk decile plots or calibration curves

Figure 4. Logit of the observed proportion of ED encounters against the model estimated probabilities.



2b4.9. Results of Risk stratification Analysis

N/A

2b4.10. Interpretation

As Figure 4 shows, the observed values are spaced fairly equally and lie very close to the 45-degree line. This suggests that the model fit is reasonably good and therefore adequately adjusts for patient characteristics (case mix).

2b4.11. Optional Additional Testing for Risk Adjustment

N/A

2b5—Identification of statistically significant and clinically meaningful differences

2b5.1. Method for determining

To test the null hypothesis that the ED30 for a given facility is statistically different from the national average, we use a simulation method to calculate the nominal p-value as the probability that the observed number of emergency department encounters should be at least as extreme as that expected. This calculation is based on the supposition that, having adjusted for case mix, this facility has a true ED30 rate corresponding to the average facility. Our approach captures the most important aspects of the variability in the ED30. It also avoids difficulties with more traditional methods based on estimates and standard errors. Methods are described in detail in He et al. (2013).

To address the problem of simultaneously monitoring a large number of facilities and to take account of the intrinsic unexplained variation among facilities, we used the approach described in Kalbfleisch and Wolfe (2013). This method is based on the empirical null as described in Efron (2004, 2007). The p-value for each facility is converted to a Z-score, stratified into three groups based on numbers of discharges within each facility. The empirical null corresponds to a normal curve that is fitted to the center of each

Z-score histograms using a robust M-estimation method. The standard deviation of empirical null distribution is then used for a reference distribution (with mean 0) to identify outlier facilities. This method aims to separate underlying intrinsic variation in facility outcomes from variation that might be attributed to poor (or excellent) care. Without empirical null methods, a large number of facilities will be flagged, including many larger facilities with a relatively small difference between the rates of emergency department encounters. In contrast, the methods based on the empirical null make appropriate adjustments for overdispersion. Using this method, facilities are flagged if they have outcomes that are extreme when compared to the variation in outcomes for other facilities of a similar size.

References:

Efron B. Large-scale simultaneous hypothesis testing: the choice of a null hypothesis. J Am Stat Assoc. 2004; 99:96–104

Efron B. (2007). Size, power and false discovery rates. Ann. Statist. 35(4):1351-1377.

2b5.2. Statistical Results

Table 6 shows the number of facilities classified as extreme using the method described in the prior sub-section. We find 183 (2.93%) facilities with ED30 that are better than expected and 213 (3.41%) that are worse than expected.

Table 6. Percentage and Number of facilities by classification of ED30, 2013-2014

Better than Expected	As Expected	Worse than Expected	Total Facilities
2.93% (183)	93.67% (5858)	3.41% (213)	6,254

2b5.3. Interpretation

Without empirical null methods, a large number of facilities will be flagged. In contrast, the methods based on the empirical null, used here, make appropriate adjustments for overdispersion. Using this method, facilities are flagged if they have outcomes (excessive emergency department encounters in the 4-30 days after hospital discharge) that are extreme when compared to the variation in outcomes for other facilities of a similar size. Overall, most are flagged as expected (93.67%), while 2.93% are better than expected, and 3.41% are flagged as worse than expected. This analysis demonstrates both practical and statistically significant differences in performance across facilities based on their proportion of patients who are seen in the ED within 30 days after hospital discharge.

2b6—Comparability of performance scores

2b6.1. Method of testing conducted to demonstrate comparability

N/A

2b6.2. Statistical Results

N/A

2b6.3. Interpretation
N/A

2b6. MISSING DATA ANALYSIS AND MINIMIZING BIAS

2b6.1. Describe the method of testing conducted to identify the extent and distribution of missing data (or nonresponse) and demonstrate that performance results are not biased due to systematic missing data (or differences between responders and nonresponders) and how the specified handling of missing data minimizes bias (*describe the steps—do not just name a method; what statistical analysis was used*)

Since many data elements can be obtained from multiple sources, missing data occur only rarely. However, we exclude index discharges that have missing data on age or sex from the analysis. If the reported BMI value on the 2728 medical evidence form is missing, we impute the value by using the corresponding average BMI of the patients of the same age, sex, race, and diabetes status.

2b6.2. What is the overall frequency of missing data, the distribution of missing data across providers, and the results from testing related to missing data? (*e.g., results of sensitivity analysis of the effect of various rules for missing data/nonresponse; if no empirical sensitivity analysis, identify the approaches for handling missing data that were considered and pros and cons of each*)

N/A

2b6.3. What is your interpretation of the results in terms of demonstrating that performance results are not biased due to systematic missing data (or differences between responders and nonresponders) and how the specified handling of missing data minimizes bias**?** (i.*e., what do the results mean in terms of supporting the selected approach for missing data and what are the norms for the test conducted; if no empirical analysis, provide rationale for the selected approach for missing data*)

N/A

Feasibility

3a.1. How are the data elements needed to compute measure scores generated
Generated or collected by and used by healthcare personnel during the provision of care (e.g., blood pressure, lab value, diagnosis, depression score)

3b.1. Are the data elements needed for the measure as specified available electronically

ALL data elements are in defined fields in a combination of electronic sources

3b.3. If this is an eMeasure, provide a summary of the feasibility assessment
N/A

3c.1. Describe what you have learned or modified as a result of testing
N/A

3c.2. Describe any fees, licensing, or other requirements
N/A

Usability and Use

4a.1. Program, sponsor, purpose, geographic area, accountable entities, patients
N/A

4a.2. If not publicly reported or used for accountability, reasons
Development of the measure was recently completed so there has not been an opportunity for public reporting or use in another accountability application.

4a.3. If not, provide a credible plan for implementation
CMS will consider implementing the SEDR measure as part of CMS' Dialysis Facility Compare (DFC) public reporting program, whose purpose is to help dialysis patients and their caregivers understand the quality of care provided by dialysis facilities and to be able to compare selected aspects of care between dialysis facilities. All Medicare-certified dialysis facilities that treat dialysis patients in the U.S. are reported on DFC.

4b.1. Progress on improvement
N/A

4b.2. If no improvement was demonstrated, what are the reasons
The measure is not yet implemented in a public report program, so improvement could not be evaluated. CMS anticipates future implementation of the ED30 (SEDR) measures into a public reporting program. Once implemented, facility performance on the measure can be evaluated to determine if the measure has supported and detected quality improvement in reducing emergency department visits

4a2.1.1. Describe how performance results, data, and assistance with interpretation have been provided to those being measured or other users during development or implementation.
How many and which types of measured entities and/or others were included? If only a sample of measured entities were included, describe the full population and how the sample was selected.
N/A

4a2.1.2. Describe the process(es) involved, including when/how often results were provided, what data were provided, what educational/explanatory efforts were made, etc.
N/A

4a2.2.1. Summarize the feedback on measure performance and implementation from the measured entities and others described in 4d.1.
Describe how feedback was obtained.
N/A

4a2.2.2. Summarize the feedback obtained from those being measured.
N/A

4a2.2.3. Summarize the feedback obtained from other users
N/A

4a2.3. Describe how the feedback described in 4a2.2.1 has been considered when developing or revising the measure specifications or implementation, including whether the measure was modified and why or why not.
N/A

Related and Competing Measures

5—Relation to Other NQF-Endorsed Measures

5.1a. The measure titles and NQF numbers are listed here
1463 : Standardized Hospitalization Ratio for Dialysis Facilities

2505 : Emergency Department Use without Hospital Readmission During the First 30 Days of Home Health

5.1b. If the measures are not NQF-endorsed, indicate the measure title 5a—
Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge (ED30) (currently undergoing endorsement review with SEDR).

Harmonization
5a.1. Are the measure specifications completely harmonized
No

5a.2. If not completely harmonized, identify the differences rationale, and impact
These measures are not completely harmonized. Each measure assesses different outcomes as reflected in certain differences across the measure specifications. The proposed Standardized Emergency Department Encounter Ratio (SEDR) for Dialysis Facilities and Standardized Ratio of Emergency Department Encounters Occurring Within 30 Days of Hospital Discharge (ED30) for Dialysis Facilities measures both focus on dialysis facilities' ED use, but they measure different aspects of ED use. The SEDR measures the overall rate of ED use while the ED30 focuses on ED use closely following a hospitalization. Both SEDR and ED30 apply to the same target population - adult Medicare-covered dialysis patients who have had ESRD for more than 90 days. The SEDR and SHR are both intended to encourage appropriate management of acute conditions but measure two different acute care outcomes. SEDR measures outpatient acute care services while SHR measure inpatient acute care services. SEDR is harmonized with SHR and ED30 in several aspects. All are harmonized to the population they measure (Medicare-covered ESRD patients); however SHR also includes pediatric patients. All three measures have risk adjustment for prevalent comorbidities while only SEDR and SHR also adjust for incident comorbidities taken from CMS form 2728. Exclusions: 1) Only SEDR and ED30 exclude hospice patients; 2) ED30 includes additional exclusions based on discharge type, that are not part of SEDR or SHR; 3) ED30 adjusts for discharging hospital, acknowledging that for ED encounters after a hospital discharge, that hospitals also bear accountability for properly coordinating care with the dialysis facility. SEDR and NQF measure 2505: Emergency Department Use without Hospital Readmission During the First 30 Days of Home Health have the same focus (emergency department encounters). Differences: 1) Home Health is focused on emergency department use within the first 30 days of home health; 2) each measure has distinct target populations; 3) risk adjustment factors; and 4) model type (2-stage Cox model vs multinomial logistic model). For example, the Home Health 30 measure adjusts for over 400 covariates that were statistically significantly predictive of acute care hospitalization or emergency use (without

admission). SEDR currently adjusts for a set of comorbidities present at ESRD incidence and for a set of prevalent comorbidities. Because of the different care settings and comorbidity profile of Home Health patients, different risk adjustment approaches are justified.

5b—Competing measures
N/A

5b.1 Describe why this measure is superior to competing measures
N/A

Co.1 Measure Steward (Intellectual Property Owner): Centers for Medicare and Medicaid Services

Co.2 Point of Contact: Sophia, Chan, sophia.chan@cms.hhs.gov

Co.3 Measure Developer if different from Measure Steward: University of Michigan Kidney Epidemiology and Cost Center

Co.4 Point of Contact: Jennifer, Sardone, jmsto@med.umich.edu, 734-936-5711-

Additional Information

Ad.1 Workgroup/Expert Panel involved in measure development

Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.

According to the CMS Measure Management System Blueprint, TEPs are advisory to the measure contractor. In this advisory role, the primary duty of the TEP is to suggest candidate measures and related specifications, review any existing measures, and determine if there is sufficient evidence to support the proposed candidate measures.

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Forum of ESRD Networks

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Vice President/Chair of Public Policy
American Association of Kidney Patients (AAKP)
New Carrollton, MD

Measure Developer/Steward Updates and Ongoing Maintenance

Ad.2 Year the measure was first released: 2018

Ad.3 Month and Year of most recent revision: 04, 2018

Ad.4 What is your frequency for review/update of this measure? Annually

Ad.5 When is the next scheduled review/update for this measure? 04, 2019

Ad.6 Copyright statement:

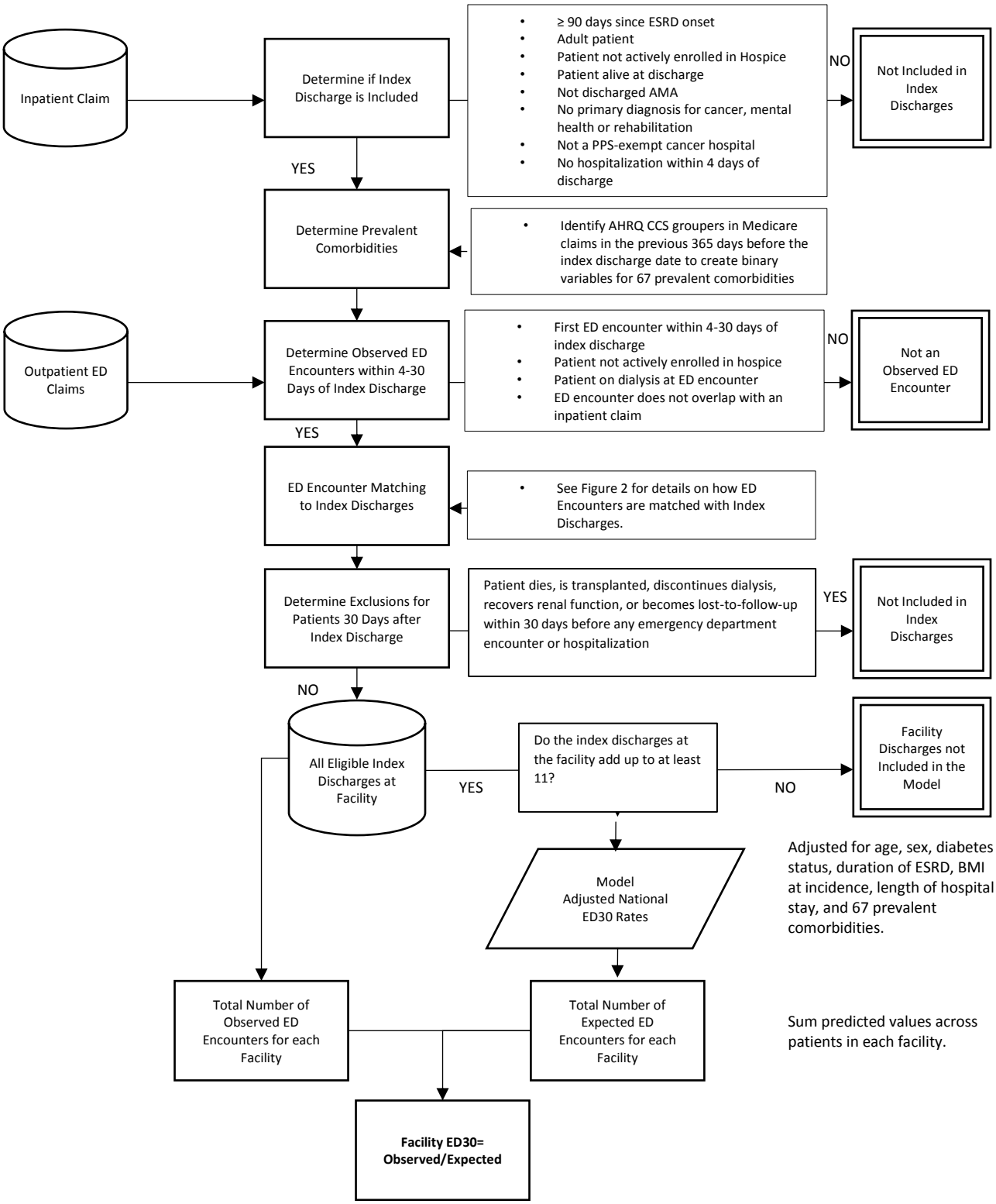
Ad.7 Disclaimers:

Ad.8 Additional Information/Comments:

Appendix

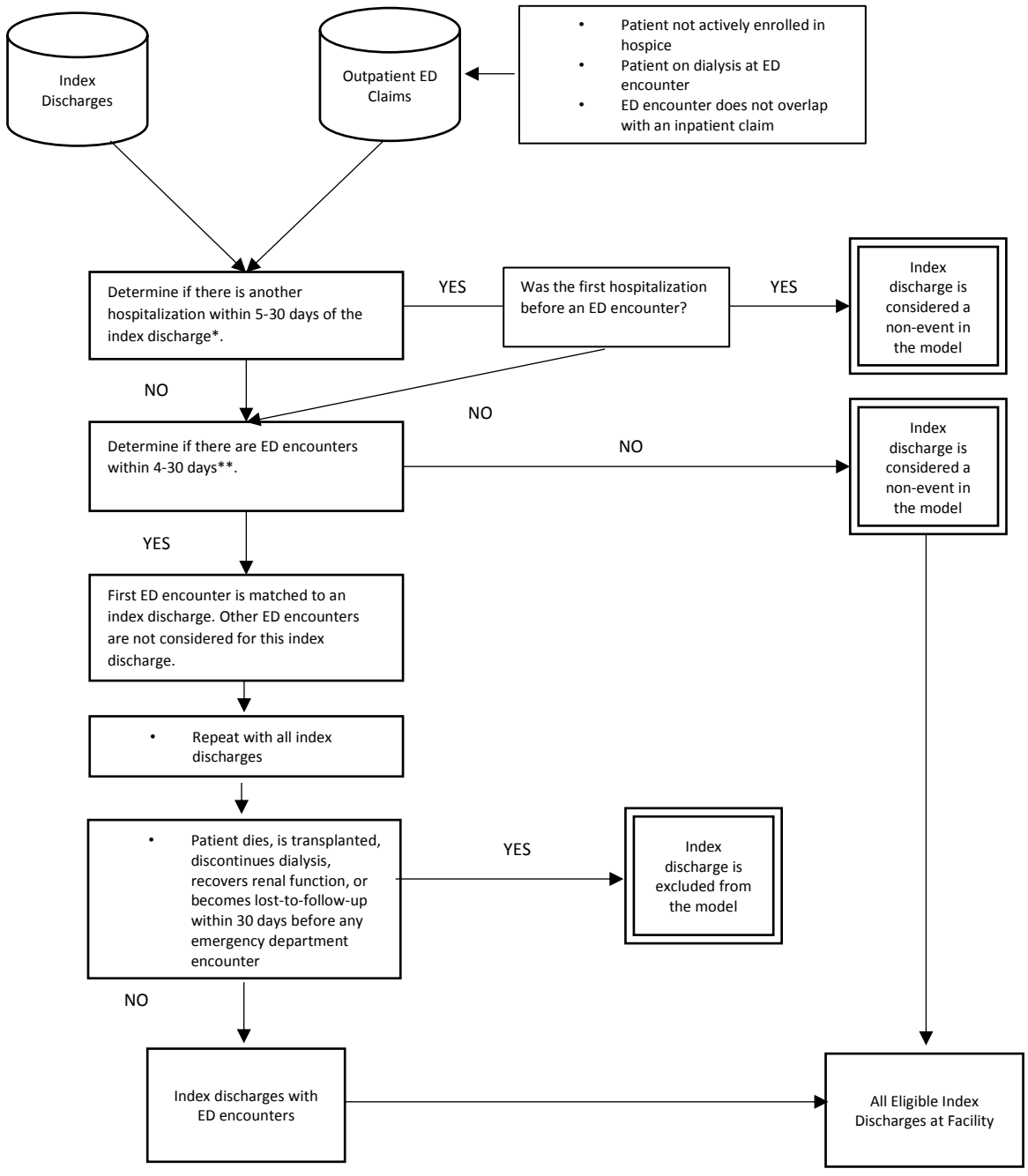
S.14. Calculation Algorithm/Measure Logic

Figure 1: Calculation Algorithm/Measure Logic Diagram



*Multiple data sources include CMS Consolidated Renal Operations in a Web-enabled Network (CROWNWeb), the CMS Annual Facility Survey (Form CMS-2744), 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 Dialysis Facility Compare (DFC) and the Social Security Death Master File.

Figure 2: Emergency Department Merging with Index Discharge Criteria



* We have already excluded index discharges with hospitalizations 1-4 days after discharge.

** ED encounters that occur before the 4th day after index discharge are not considered.

*** An index discharge is considered day 0.

1b.2. Provide performance scores

Deciles of performance scores for ED30 for 2013-2014 can be found in Table 1.

Table 1. Deciles of ED30, 2013-2014

Deciles	N	Minimum	Maximum
1	626	0.00	0.58
2	625	0.58	0.73
3	626	0.73	0.83
4	625	0.83	0.92
5	625	0.92	1.00
6	626	1.00	1.08
7	625	1.08	1.17
8	626	1.17	1.29
9	625	1.29	1.47
10	625	1.47	5.06

2b3.1.1 If using a statistical risk model, provide detailed risk model specifications, including the risk model method, risk factors, coefficients, equations, codes with descriptors, and definitions.

Below we list the groupers used for identification of prevalent comorbidities in the SEDR risk adjustment model (Table 2), along with the list of ICD-9 codes that were excluded from specific groupers because may be associated with dialysis facility care and include diagnoses such as secondary hyperparathyroidism, fluid overload, hyperkalemia, and vascular access infections (Table 3).

Table 2: Prevalent Comorbidity Adjustment Definitions

Prevalent Comorbidity	AHRQ CCS Grouper(s)
HIV infection	5
Hepatitis	6*
Viral infection	7
Other infections including parasitic and sexually transmitted infections (not HIV or hepatitis)	8-9
Melanomas of skin; Other non-epithelial cancer of skin	22-23
Benign neoplasm of uterus; Other and unspecified benign neoplasm	46-47
Diabetes mellitus with or without complications	49-50
Fluid and electrolyte disorders	55*
Encephalitis, Meningitis and other CNS infections	76-78
Epilepsy; convulsions	83
Headache; including migraine	84
Otitis, Dizziness, and other ear and sense organ disorders	92-94
Neuropathy, pain syndromes, and other neurologic disorders	95
Essential hypertension	98
Secondary hypertension and hypertensive complications	99
Acute myocardial infarction and atherosclerotic heart disease	100-101
Nonspecific chest pain	102
Pulmonary embolism and other pulmonary heart disease	103
Other and ill-defined heart disease	104
Conduction disorders; Cardiac dysrhythmias	105-106
Other circulatory disease	117
Phlebitis; thrombophlebitis and thromboembolism	118,119,121
Acute and chronic tonsillitis; Acute bronchitis; Other upper respiratory infections	124-126
Chronic obstructive pulmonary disease and bronchiectasis; Asthma	127-128
Other lower respiratory disease	133*
Other upper respiratory disease	134
Disorders of teeth, jaw and mouth	136-137
Esophageal disorders	138
Digestive track disorders (gastritis, gastric ulcers, and other disorders of stomach; appendicitis)	139-142

Prevalent Comorbidity	AHRQ CCS Grouper(s)
Anal and rectal conditions	147
Peritonitis and intestinal abscess	148
Pancreatic disorders (not diabetes)	152
Gastrointestinal hemorrhage	153
Noninfectious gastroenteritis	154
Other gastrointestinal disorders	155
Urinary tract infections	159
Calculus of urinary tract	160
Other diseases of kidney and ureters (e.g. ureteral stricture or reflux; excludes renal calculus)	161*
Prostate hyperplasia, prostatitis and other male genital disorders	164-166
Skin disorders: cellulitis, ulcers, inflammatory and others	197-200
Infective arthritis and osteomyelitis	201
Other non-traumatic joint disorders	204
Spondylosis; intervertebral disc disorders; other back problems	205
Osteoporosis	206
Other connective tissue disease; Other bone disease and musculoskeletal deformities	211-212
Sprains and strains	232
Complication of device; implant or graft	237*
Superficial injury; contusion	239
Poisoning by medications or nonmedicinal substances	241-243
Other injuries and conditions due to external causes	244
Syncope	245
Gangrene	248
Shock	249
Nausea and vomiting	250
Abdominal pain	251
Malaise and fatigue	252
Allergic reactions	253
Anxiety disorders	651
Attention-deficit, conduct, and disruptive behavior disorders	652
Developmental disorders	654
Mood disorders	657
Personality disorders	658
Schizophrenia and other psychotic disorders	659
Alcohol-related disorders	660
Suicide and intentional self-inflicted injury	662
Screening and history of mental health and substance abuse codes	663
Miscellaneous mental health disorders	670

* Not all ICD-9 codes associated with the grouper(s) were included. See table of exclusions below.

Table 3: ICD-9 Code Exclusions for Prevalent Comorbidities

Prevalent Comorbidity	ICD-9 Codes Excluded	
Hepatitis (CCS 6)	0702	HEPATITIS B WITH COMA (Begin 1980 End 1991)
	07020	VRL HEPAT B CM W/O DELTA (Begin 1991)
	07021	VRL HEPAT B CM W DELTA (Begin 1991)
	07022	CHR HEPAT COMA W/O DELTA (Begin 1994)
	07023	CHR HEPAT COMA W/ DELTA (Begin 1994)
	0703	HEPATITIS B W/O COMA (Begin 1980 End 1991)
	07030	VRL HPT B W/O CM W/O DLT (Begin 1991)
	07031	VRL HPT B W/O CM W DELTA (Begin 1991)
	07032	CHR HEPAT W/O COMA W/O DELTA (Begin 1994)
	07033	CHR HEPAT W/O COMA W/ DELTA (Begin 1994)
Fluid and electrolyte disorders (CCS 55)	2760	HYPEROSMOLALITY
	2761	HYPOSMOLALITY
	2762	ACIDOSIS
	2763	ALKALOSIS
	2764	MIXED ACID-BASE BAL DIS
	2765	HYPOVOLEMIA (End 2005)
	27650	VOLUME DEPLETION NOS (Begin 2005)
	27651	DEHYDRATION (Begin 2005)
	27652	HYPOVOLEMIA (Begin 2005)
	2766	FLUID OVERLOAD (end 2010)
	27669	FLUID OVERLOAD NEC (Begin 2010)
	2767	HYPERPOTASSEMIA
	2768	HYPOPOTASSEMIA
	2769	ELECTROLYT/FLUID DIS NEC
Other lower respiratory disease (CCS 133)	5184	ACUTE LUNG EDEMA NOS
Other diseases of kidney and ureters (CCS (161)	58881	SEC HYPERPARATHYRD-RENAL (Begin 2004)
Complication of device; implant or graft (CCS 237)	99668	INFXN PERITON DIALY CATHET (Begin 1998)
	99931	INFECT d/t CENT VEN CATH (Begin 2007)
	99932	BLOOD INFECTION d/t CEN VEN CATH
	99933	LOCAL INFECTION d/t CEN VEN CATH