## CBE ID

0369

## Title

Standardized Mortality Ratio for Dialysis Facilities

## Project

Advanced Illness and Post-Acute Care

## Endorsement Status

Endorsed

## Is Under Review

No

## Next Maintenance Cycle

Fall 2030

## Previous Endorsement Cycle

Fall 2025

## Initial Endorsement

Wed, 05/14/2008 - 20:00

## Steward

Centers for Medicare & Medicaid Services

## 1.0 New or Maintenance

Maintenance

## 1.1 Measure Structure

Single Measure

## 1.3 Electronic Clinical Quality Measure (eCQM)

No

## 1.6 Measure Description

The Standardized Mortality Ratio (SMR) is defined as the ratio of the number of deaths that occur for Medicare ESRD dialysis patients (both Fee For Service and Medicare Advantage) treated at a particular facility to the number of deaths that would be expected given the characteristics of the dialysis facility's patients and the national event rate for dialysis facilities. This measure is calculated as a ratio but can also be expressed as a rate.

When used for public reporting, the measure calculation will be restricted to facilities with at least

three expected deaths in the reporting year. This restriction is required to ensure patients cannot be identified due to small cell size.

### 1.6a Material Specification Change(s)

No

### 1.7 Measure Type

Outcome

### 1.8 Level of Analysis

Facility

### 1.9 Care Setting

Other

### 1.9b Other Care Setting

Dialysis Facility

### 1.10 Measure Rationale

For individuals with chronic kidney failure (end stage renal disease), regular dialysis treatments are life-sustaining when performed properly. However, the demanding technical environment creates numerous opportunities for life-threatening complications, including infections related to vascular access care and water treatment, air embolism, cardiovascular events related to stress of treatment, rapid electrolyte shifts, and acute volume depletion. In addition, inadequate treatment of chronic volume excess and ESRD-related mineral and bone disease can increase long-term cardiovascular risk associated with vascular calcification and critical organ arterial supply, as well as, contribute to left ventricular hypertrophy, all associated with the markedly increased risk of long-term cerebrovascular and cardiovascular complications and death from these dialysis-related complications. Quality measures that evaluate the large facility-level differences in patient mortality in dialysis facilities provide essential information for consumers about effectiveness of this life-sustaining therapy and facility-level differences in prevention of life-threatening complications of the treatment. Dialysis facilities also benefit from the information included in the SMR, which provides an overall benchmark of their success in preventing avoidable death for their patients. Preventing avoidable deaths also avoids some of the costs of treating the life-threatening complications (indirectly), and may allow more patients to survive long enough to receive a kidney transplant, further benefitting the patient and society.

Mortality rates among ESRD patients on chronic dialysis decreased in the US between 2012 to 2019, and mortality rates among ESRD patients increased during the COVID-19 pandemic from 2020-2022. Individuals receiving dialysis had a far lower number of expected remaining years of life relative to age-matched individuals in the general population [1]. In addition, mortality among ESRD dialysis patients varies across dialysis facilities, even after adjustment for patients' characteristics. An adjusted facility-level mortality, which accounts for differences in patients' characteristics, is one of several important health outcomes used by providers, health consumers,

and insurers to evaluate the quality of care provided in dialysis facilities.

Reference:

[1] United States Renal Data System. 2024 USRDS annual data report: Epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2024.

## 1.13 Data Dictionary

Attached

## 1.13a Attach Data Dictionary

SMR_DataDictionary_Final_Oct-2025.xlsx

## 1.14 Numerator

Number of deaths among Medicare ESRD dialysis patients at the facility during the time period.

## 1.14a Numerator Details

Information on death is obtained from several sources which include the CMS ESRD Program Medical Management Information System, the Death Notification Form (CMS Form 2746), and the Social Security Death Master File. The number of deaths that occurred among eligible dialysis patients during the time period is calculated. This count includes only Medicare patients, as detailed below.

## 1.15 Denominator

The denominator is the number of deaths that would be expected among Medicare ESRD dialysis patients at the facility during the time period, given the national average mortality rate and the patient mix at the facility.

## 1.15a Denominator Details

Assignment of Patients to Facilities

The ESRD Quality Reporting System (EQRS), including CMS Medical Evidence Form (Form CMS-2728) and Death Notification Form (Form CMS-2746) is the primary basis for placing patients at dialysis facilities. Outpatient dialysis claims are used as an additional source when needed. We create a complete history of the status, location, and dialysis treatment modality of an ESRD patient from the date of the first ESRD service until the patient dies or the data collection cutoff date is reached.  A new record is created each time a patient changes facilities or dialysis treatment modality; therefore, each record represents a time period associated with a specific modality and dialysis facility. Information regarding first ESRD service date, death and transplant is obtained from additional sources including the CMS Enrollment Database (EDB), transplant data from the Organ Procurement and Transplant Network (OPTN), and the Social Security Death Master File.

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

General Inclusion Criteria for Dialysis Patients

Patients are included in the measure only after they have had ESRD for greater than 90 days. This minimum 90-day period assures that patients are eligible for Medicare, either as their primary or secondary insurer, and that follow-up is complete. Thus, the measure excludes deaths during the first 90 days of ESRD as well as patients who recover kidney function during that time period.

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

Identifying Facility Treatment Histories for Each Patient

For each patient, we identify the dialysis provider at each point in time. Starting with day 91 after onset of ESRD, we attribute patients to facilities according to the following rules. A patient is attributed to a facility once the patient has been treated there for at least 60 days. When a patient transfers from one facility to another, the patient continues to be attributed to the original facility for 60 days and then is attributed to the destination facility from day 61. In particular, a patient is attributed to their current facility on day 91 of ESRD if that facility has treated them for at least 60 days. If on day 91, the facility has not treated a patient for at least 60 days, we wait until the patient reaches day 60 of continuous treatment at that facility before attributing the patient to that facility. When a patient is not treated in a single facility for a span of 60 days (for instance, if there were two switches within 60 days of each other), we do not attribute that patient to any facility. Patients are removed from a facility's analysis upon receiving a transplant. Patients who withdrew from dialysis or recovered renal function remain assigned to their treatment facility for 60 days after withdrawal or recovery.

If a period of one year passes with neither Medicare dialysis claims nor EQRS information to indicate that a patient was receiving dialysis treatment and if there is no earlier evidence of transfer, recovery, or death, we consider the patient lost to follow-up and do not include that patient in the analysis. If evidence of dialysis reappears, the patient is entered into analysis after

60 days of continuous therapy at a single facility. All EQRS records noting continuing dialysis are extended until the appearance of any evidence of recovery, transfer, or death. Lost to follow-up periods are not created in these cases since the instructions for EQRS only require checking patient data for continued accuracy, but do not have a requirement for updating if there are not any changes.

Days at Risk for Each Patient-Record

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

The number of days at risk in each of the six time-intervals listed above is used to calculate the expected number of deaths for the patient during that period. The SMR for a facility is the ratio of the total number of observed deaths to the total number of expected deaths during all time periods at the facility.

## 1.15b Denominator Exclusions

Exclusions that are implicit in the denominator definition include time at risk while a patient has had ESRD for 90 days or less. In addition, the measure does not include deaths from non-prescription drug overdose or accidents unrelated to treatment as indicated on CMS form 2746, since these deaths are unlikely to be related to care at the dialysis facility.

## 1.15c Denominator Exclusions Details

See 1.15a Denominator Details, above

## 1.15d Age Group

Children (0-17 years), Adults (18-64 years), Older Adults (65 years and older)

## 1.16 Type of Score

Ratio

## 1.17 Measure Score Interpretation

Better performance = Lower score

## 1.18 Calculation of Measure Score

See **SMR Flowchart_Final_Oct 2025._508** PDF, attached to 1.18a

## 1.18a Attach measure score calculation diagram

SMR-Flowchart_Final_Oct-2025._508.pdf

## 1.19 Measure Stratification Details

N/A

## 1.20 Types of Data Sources

Administrative Data, Claims Data, Registries

## 1.21a Data Collection Tool URL(s)

http://example.com

## 1.25 Data Source Details

Data are derived from the EQRS patient-specific clinical and administrative data, including ESRD patient list, CMS-2728 Medical Evidence Form, CMS-2746 Death Notification Form, and patient admission and discharge data, from all Medicare certified dialysis facilities, the Medicare Enrollment Database (EDB), and Medicare claims data.

In addition, the database includes transplant data from the Scientific Registry of Transplant Recipients (SRTR), data from the Nursing Home Minimum Dataset, and the provider and survey and certification data from the Internet Quality Improvement and Evaluation System (iQIES) data.

Information on hospitalizations is obtained from Medicare inpatient and skilled nursing claims Standard Analysis Files (SAFs), and past-year comorbidity data are obtained from multiple claim types (inpatient, home health, hospice (Part A only), skilled nursing facility claims).

Fee-for-service (FFS) Medicare Part A (inpatient) and Part B (outpatient and physician supply) claims for dialysis patients are included in the current database; additionally, the measure now incorporates Part C Medicare Advantage (MA) data for the MA enrollees. This ensures that hospital, outpatient dialysis, and other billable services under Medicare – whether FFS or MA – are captured.

## 1.26 Minimum Sample Size

There is not a minimum sample size needed to calculate the performance score. Public reporting of this measure on Dialysis Facility Care Compare (DFCC) would be restricted to facilities with at least three expected deaths for the measure to comply with restrictions on reporting of potentially patient identifiable information related to small cell size.

## 2.1 Attach Logic Model

SMR-Logic-Model_Final_Oct-2025_508.pdf

## 2.2 Evidence of Measure Importance

*Note: This Evidence Summary was modified from the 2019-2020 Evidence Form submitted to the CBE. We performed an updated PUBMED Literature search using multiple search strategies for the years 2017-present. The search results were initially reviewed by one investigator to remove duplicates and off-topic citations. The resulting set of citations was independently reviewed by two investigators with clinical dialysis training and experience. Of the 174 references reviewed, 23 were identified with consensus agreement. We have included selected recent references and updated the Evidence Summary with these additional citations in the summary and reference list below.*

All-cause mortality for ESRD patients on chronic dialysis far exceeds age matched controls in the general and Medicare populations [1]. Mortality rates across dialysis facilities vary, even after controlling for multiple patient characteristics and comorbidities [2, 41]. Selection of dialysis modality, sometimes the result of dialysis facility practices, likely influences mortality [3]. Furthermore, mortality is associated with certain conditions resulting from kidney failure and chronic dialysis care, including uremic toxin accumulation, volume overload/hypertension and its treatment, bone/mineral disease, and infections related to dialysis access, have been described in detail [4-6, 40, 44].

Specific dialysis practices have been identified for several of these ESRD-related conditions that can improve patient survival and morbidity, including provision of adequate small solute clearance [7], control of total body volume while guarding against rapid ultrafiltration [8-11, 50-52], control of electrolytes, particularly potassium [46, 47], and appropriate management of mineral and bone disorders [12-14, 43, 45, 53-59]. In addition, improved infection prevention efforts by dialysis providers can result in reduced infection-related hospitalization and mortality [15-20].

Additional studies have bolstered the importance of fluid management in improving patient survival [24, 26, 37]. Rescheduling missed dialysis treatments [21], as well as providing longer treatment times at dialysis initiation [33], while being mindful to preserve residual kidney function [30] all have the potential to reduce patient mortality. Nutrition counseling, and how the interdisciplinary team manages potassium [38, 43, 45], phosphorus [31], and encourages healthy eating habits with fruits/vegetables [39] also impact patient outcomes. Sustained efforts at influenza vaccinations can impact mortality [32]. Lastly, in the midst of a national opioid epidemic, dialysis patients are at particularly increased risk of adverse outcomes related to mis-use of analgesic and sedative drugs. Careful attention is needed to avoid excess mortality [25, 42].

Although the basic technology of hemodialysis has not changed dramatically in the last two decades, overall mortality of individuals on chronic dialysis has improved, both in absolute and relative terms [48, 49]. The trend towards reduced mortality is temporally correlated with the

introduction of public reporting of the Standardized Mortality Ratio (SMR) in the early 2000's. Much of the observed reduction in mortality was likely driven by changes in dialysis facility practice patterns (e.g. less aggressive erythropoietic stimulating agent [ESA], increased use of home dialysis modalities, broader attention to the risks of aggressive fluid removal during dialysis and more holistic approaches to overall volume management, and introduction of additional medical options for treatment of mineral and bone disease). Despite these modest gains, mortality is far too common for patients receiving chronic dialysis and continued public reporting of this important health outcome is necessary to incentivize additional improvement over the coming years.

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## 2.4 Performance Gap

The average SMR remained stable across years and during the 2020-2023 period. The average SMR varied from 0.93 to 1.05. However, within any given year, there was a substantial gap in performance as SMR varied widely across facilities, with the 10th decile being as low as 0.50 and the 90th decile being as high as 1.57.

Distribution of SMRs of all facilities by year (2020-2023):

2020: Facilities = 6,521, Mean SMR = 0.98, Standard Deviation = 0.41, 10th =0.50, 25th = 0.70, 50th = .95, 75th = 1.22, 90th = 1.52

2021: Facilities = 7,074, Mean SMR = 1.05, Standard Deviation =0 .41, 10th = 0.58, 25th = 0.77, 50th = 1.00, 75th = 1.27, 90th = 1.57

2022: Facilities =7,091, Mean SMR = 0.98, Standard Deviation = 0.38, 10th = 0.54, 25th = 0.73, 50th = .95, 75th = 1.20, 90th = 1.47

2023: Facilities = 7,026, Mean SMR = 0.93, Standard Deviation = 0.37, 10th = 0.50, 25th =0.68, 50th = .90, 75th = 1.14, 90th = 1.39

Across the 4-year SMR (2020-2023): Facilities = 7,824, Mean SMR = 0.99, Standard Deviation = 0.27, 10th = 0.68, 25th = 0.81, 50th = 0.97, 75th = 1.14, 90th = 1.32

See **SMR_2.4 Table 1_Revised Nov 2025_508** PDF, attached to 2.4a, for Table 1 data and caption.

## 2.4a Attach Performance Gap Results

SMR_2.4-Table-1_Revised-Nov-2025_508.pdf

## 2.6 Meaningfulness to Target Population

There are several studies indicating that patients with kidney failure who require dialysis value an assessment of mortality rates at the dialysis facility level [1,2]. Interestingly, patients tend to place an even higher value on issues related to quality of life compared to longevity.  In comparison with patients, dialysis providers and administrators place an even higher value on a mortality relative to other measures [2].

References:

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### 3.1 Contributions Towards Closing Care Gaps

This field is optional for Fall 2025.

### 4.1a Data Structure and Availability

All the data incorporated into this measure come from structured data. Data collection for this measure is accomplished via data sources including EQRS, a web-based and electronic batch submission platform maintained and operated by CMS contractors, Medicare Claims, and other supplemental data sources (see Section 1.25 Data Source Details). Publicly reported measures like this one are reviewed on a regular basis by dialysis facility providers and rare instances of inaccurate or missing data are present (based on comments received during facility previews).

### 4.1b Implementation Costs and Burden

As the data required for this measure is already part of routine data collection, no additional costs or burden are anticipated.

### 4.1c Confidentiality

Public reporting of this measure on Dialysis Facility Care Compare (DFCC) would be restricted to facilities with at least three expected deaths for the measure to comply with restrictions on reporting of potentially patient identifiable information related to small cell size.

### 4.3 Feasibility Informed Final Measure

No changes were made.

### 4.4 Proprietary Information

Not a proprietary measure and no proprietary components

### 5.1.1 Data Used for Testing

Data from 2020-2023 were used to calculate SMR. Please refer to Section 1.25 Data Source Details for information on data sources.

### 5.1.1a Dates of Testing Data

2020-2023

### 5.1.2 Differences in Data

None

### 5.1.3 Characteristics of Measured Entities

See **SMR_5.1.3_Final_Oct 2025_508** PDF, attached in Section 7.1 Supplemental Attachment, for full response to this question

### 5.1.4 Characteristics of Units of the Eligible Population

Please see **SMR_5.1.4_Final_Oct 2025_508** PDF, which is attached in Section 7.1 Supplemental Attachment, for full response to this question

### 5.2.1 Level(s) of Reliability Testing Conducted

Accountable entity level (i.e., measure score) (e.g., signal-to-noise analysis)

### 5.2.2 Method(s) of Reliability Testing

The reliability of the Standardized Mortality Ratio (SMR) was assessed using data among ESRD dialysis patients during 2020-2023. If the measure were a simple average across individuals in the facility, the usual 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 total variation of a measure that is attributable to the between-facility variation. The SMR, 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. A small IUR (near 0) reveals that most of the variation of the measures between facilities is driven by random noise, indicating the measure would not be a good characterization of the differences among facilities, whereas a large IUR (near 1) indicates that most of the variation between facilities is due to the real difference between facilities.

Here we describe our approach to calculating IUR. Let $T_1,\ldots,T_N$ be the SMR for these facilities. Within each facility, select at random and with replacement $B$ (say 100) bootstrap samples. That is, if the $i$th facility has $n_i$ subjects, randomly draw with replacement $n_i$ subjects from those in the same facility, find their corresponding $SMR_i$ and repeat the process B times. Thus, for the $i$th facility, we have bootstrapped SMRs of $T^*_{i,1}$, … $T^*_{i,B}$ Let $S_i^{*2}$ be the sample variance of this bootstrap sample. From this it can be seen that

$$S_{t,w}^2 = \Sigma^N_{i=1}[(n_i-1)\, S_i^{*2}]/\, \Sigma^N_{i=1}(n_i-1).$$

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

$$S_t^2 = \Sigma^N_{i=1}[n_i\, (T_i - \check{T})^2]/\, [n'(N-1)],$$

where

$$\check{T} = Sn_i T_{i\,/}\, Sn_i$$

is the weighted mean of the observed SMR and

$$n' = (Sn_i - Sn_i^2/Sn_i)/(N-1)$$

is approximately the average facility size (number of patients per facility). Note that $S_t^2$ is the total variation of SMR and is an estimate of $\sigma_b^2 + \sigma_{t,w}^2$, where $\sigma_b^2$ is the between-facility variance, the true signal reflecting the differences across facilities. Thus, the estimated IUR, which is defined by

$$IUR = \sigma_b^2/(\, \sigma_b^2 + \sigma_{t,w}^2),$$

can be estimated with $(S_t^2 - S_{t,w}^2)/S_t^2$.

The SMR calculation only included facilities with at least 3 expected deaths for each year.

### 5.2.3 Reliability Testing Results

The overall IUR for the four-year SMR (2020-2023) is 0.47, which means that a little less than half of the variation in the 4-year SMR can be attributed to the between-facility variation. The SMR measure IUR is similar to previous cycles, and has been endorsed and re-endorsed for the last several cycles. Please see **SMR_5.2.3a Table 2 and IUR Reliability_Revised Nov 2025_508** PDF attached to Section 5.2.3a for additional information, but to summarize:

- Dialysis facilities are extremely small compared to other health care entities (e.g. hospitals, nursing homes) such that risk adjusted measures do not have a large enough facility size to achieve an IUR of 0.6
- Determining if a facility is “worse than expected” uses statistical hypothesis testing to mitigate the risk of inappropriately flagging small facilities.  Specifically, smaller facilities need to have an SMR farther from the median to be flagged compared to larger facilities.
- Star Ratings for dialysis facilities combine information across multiple measures to reduce random noise so that even a measure with a low IUR can contribute to raising the overall reliability of the combined measure set.
- The Quality Incentive Program (QIP) uses a small-facility adjuster (generally applied to facilities with 25 or fewer eligible patients), which helps mitigate the low IURs that would otherwise contribute to payment reductions.
- The number of preventable events, even for facilities in the lower IUR decile groups, is generally >3, suggesting the potential for improvement at a given facility.

### 5.2.3a Attach Additional Reliability Testing Results

SMR_5.2.3a-Table-2-and-IUR-Reliability_Revised-Nov-2025_508.pdf

### 5.2.4 Interpretation of Reliability Results

This value of IUR indicates a moderate degree of reliability. When stratified by facility size, we find that, as expected, larger facilities have greater IUR.

See **SMR_5.2.3a Table 2 and IUR Reliability_Revised Nov 2025_508** PDF, attached to Section 5.2.3a, for Table 2 data and caption.

### 5.3.1 Level(s) of Validity Testing Conducted

Accountable entity level (i.e., measure score) (e.g., criterion validity)

### 5.3.2 Type of Accountable Entity Level Validity Testing Conducted

Empirical validity testing at the accountable entity-level (e.g., criterion validity, construct validity, known groups analysis)

### 5.3.3 Method(s) of Validity Testing

We have assessed the validity of the measure through various comparisons of this measure with other quality performance measures in use, using Spearman correlations.

Negative Relationships

- Vascular Access: Standardized Fistula Rate (SFR) – We expect a negative association between SFR and SMR. 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 adverse events, like infection that can increase the risk of patient mortality. Higher rates of the facility level SFR will be negatively associated with mortality as measured by SMR.
- Kt/V ≥ 1.2: We expect a negative association between the facility percentage of patients with Kt/V>= 1.2 and SMR. 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 adverse outcomes. 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 mortality. Higher rates of the facility level percentage of patients with adequate dialysis (facility percentage Kt/V> 1.2) will be negatively associated with SMR.

Positive Relationships

- Vascular Access: Long-term catheter rate (catheter in use >=3 continuous months) – We expect a positive association between the long-term catheter rate and SMR. Long-term catheters put patients at increased risk for infection and other complications. Additionally, a high long-term catheter rate also indicates a higher patient comorbidity burden at the facility level such that sicker patients who have a long-term catheter may be at higher risk of mortality. Higher long-term catheter rates will be positively associated with SMR.
- Standardized Hospitalization Ratio (SHR): We expect a positive association between SHR and SMR. Patients who require acute medical care in the hospital represent an at-risk population for mortality since they likely have greater acute medical needs or complications from chronic comorbid conditions that put them at higher risk for death.
- Standardized Readmission Ratio (SRR): We expect a positive association between SRR and SMR. Both hospitalization and readmission are a reflection of hospital utilization and increased comorbidity burden. Additionally, patients readmitted after a recent discharge indicates they still require acute medical attention or experience other post-discharge complications placing them at higher risk for mortality.
- Standardized Transfusion Ratio (STrR): We expect a positive association between STrR and SMR. Patients with severe anemia may require hospitalization and blood transfusion, placing them at risk for other adverse events and potentially higher risk for mortality.

### 5.3.4 Validity Testing Results

Please see **SMR_5.3.4a_Final_Oct 2025_508** attachment in 5.3.4a for full response to this

question

### 5.3.4a Attach Additional Validity Testing Results

SMR_5.3.4a_Final_Oct-2025_508.pdf

### 5.3.5 Interpretation of Validity Results

SMR is correlated with each of the quality performance measures in the expected direction. All correlations are statistically significant. As expected, the SMR is positively correlated for each individual year with the SHR-Admissions, SRR-Readmissions, and the STrR. The SMR is negatively correlated with the percent of hemodialysis patients with Kt/V>=1.2, in the direction expected indicting lower SMRs are associated with a higher percentage of patients receiving adequate dialysis dose. The SMR is negatively correlated with the percentage of patients in the facility with an AV Fistula as measured by SFR indicating lower standardized mortality rates are associated with a higher standardized fistula rate. On the other hand, the SMR is positively correlated with long-term catheter rates indicating that higher values of SMR are associated with higher rates of long-term catheters.

### 5.4.1 Methods Used to Address Risk Factors

Statistical risk adjustment model with risk factors

### 5.4.2 Conceptual Model Rationale

The methods for development of the risk factor models have been published and documented previously (Wolfe 1992; Wolfe 2001). The final risk adjustment is based on a Cox or relative risk model. In this model, covariates are taken to act multiplicatively on the death rate and the adjustment model is fitted with facility defining strata so as to provide valid estimates even if the distribution of adjustment variables differs across facilities. Relevant references are Cox (1972) and Kalbfleisch and Prentice (2002). All analyses are performed using SAS.

The denominator of SMR for a facility is the expected number of deaths from the patient-records meeting the inclusion criteria, based on the number of days attributed to that facility (the assignment rule will be detailed later), if the facility conforms to the national norm. Specifically, the expectation is calculated using a two-stage model. At Stage 1, we fit a Cox model [1] stratified by facility and adjusted for patient age, race, ethnicity, sex, diabetes, duration of ESRD, nursing home status, patient comorbidities at incidence, prevalent comorbidities, body mass index (BMI) at incidence, Medicare Advantage status, and calendar year. This stratified model allows each facility to have a distinct baseline survival function while retaining the same regression coefficients of all the adjusters across all the facilities. Stratification by facility avoids estimating facility effects directly and also reduces computational burden. A linear predictor using the estimates of regression coefficients will be computed for each patient and will be used as the offset term in the Stage 2 modeling. At Stage 2, we fit an unstratified Cox model, which includes the offset term from Stage 1 model as well as the race-specific age-adjusted state population death rates. The baseline hazard or survival function of this model has national norm

interpretations. With the fitted model at Stage 2, we compute the expected probability of death for each patient based on the aforementioned adjusters and the number of days assigned to a facility. The denominator of SMR for a facility is then the summation of expected probabilities of death from all the patients assigned to that facility.

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

- Age: Age is included as a piecewise continuous variable with different coefficients based on whether the patient is 0-13 years old, 14-60 years old, or 61+ years old.
- Sex
- Race: White, Black, Asian/PI, Native American or other
- Ethnicity: Hispanic, non-Hispanic or unknown
- Diabetes as cause of ESRD
- Duration of ESRD:
    - Less than one year
    - 1-2 years
    - 2-3 years
    - 3+ years
- Nursing home status in previous 365 days:
    - None (0 days)
    - Short term (0-89 days)
    - Long term >=90 days)
- BMI at ESRD incidence:
    - BMI < 18.5
    - .5 ≤ BMI < 25
    - 25≤ BMI < 30
    - BMI ≥30
- Comorbidities at ESRD incidence:
    - Atherosclerotic heart disease
    - Cardiac disease
    - Diabetes other than as primary cause of ESRD (all types including diabetic retinopathy)
    - Congestive heart failure
    - Inability to ambulate
    - Chronic obstructive pulmonary disease
    - Inability to transfer
    - Malignant neoplasm, cancer
    - Peripheral vascular disease
    - Cerebrovascular disease, CVA, TIA
    - Tobacco use (current smoker)
    - Alcohol dependence
    - Drug dependence
    - No Medical Evidence (CMS-2728) Form
    - At least one of the comorbidities listed
- A set of prevalent comorbidities based on Medicare inpatient claims (individual

comorbidities categorized into 90 groups – see below)
    - Includes an adjustment for Less than 6 Medicare covered months in prior calendar year
- Calendar year
- Medicare Advantage coverage

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

- Age and Race: Black
- Ethnicity and Race: Non-White
- Diabetes as cause of ESRD and Race
- Diabetes as cause of ESRD and Duration of ESRD
- Duration of ESRD: less than or equal to 1 year and Race
- Sex and Race: Black

Below we discuss how factors were considered for inclusion in the statistical risk model.

Risk adjustment factors were selected for testing based on several considerations, specifically clinical criteria, expert input, factors identified in the literature as associated with mortality, and data availability. We began with a large set of patient demographics, comorbidities (at ESRD incidence and prevalent), anthropometrics, and other characteristics. Facility characteristics were also considered.  Risk factors were evaluated for appropriateness of the adjustment. For instance, it is important not to adjust for factors that reflect the results of treatment. Factors considered appropriate and supported in the literature were then investigated with statistical models, including interactions between sets of adjusters, to determine if they were empirically related to mortality. Risk factors were also evaluated for face validity as potential predictors of mortality.

Consideration of prevalent comorbidities as risk adjusters, in addition to incident comorbidities, is in part a response to stakeholder interest to adjust for more current (prevalent) comorbidities to reflect the current health status of dialysis patients, and conditions associated with mortality. CMS contracted with UM-KECC to convene a Technical Expert Panel (TEP) to consider the addition of prevalent comorbidities in the SMR and SHR risk adjustment models. The summary report for the TEP can be found here: https://dialysisdata.org/content/esrd-measures. Specific objectives of this TEP and a detailed description of the evaluation process and criteria for identifying appropriate comorbidities for adjustment are provided above.

This process resulted in the TEP recommending a list of 210 individual ICD-9 diagnosis codes for inclusion as risk adjustors. The TEP further recommended that: (1) comorbidities for inclusion as risk-adjusters in a particular year should be present in Medicare claims in the preceding calendar year; and (2) determination of a prevalent comorbidity required at least two outpatient claims or one inpatient claim.  With the expansion of diagnostic codes that accompanied the transition from

ICD-9 to ICD-10 in 2015, the original list of 210 comorbidities grew to over 1000 ICD-10 codes. The 210 individual ICD-9 codes were collapsed into 91 clinical groups using the AHRQ CCS categories as the framework for grouping the selected prevalent comorbidities. Using a crosswalk, the ICD-10 codes were then mapped to the 91 clinical comorbidity groups that are included in the SMR risk adjustment model (comorbidity groups are listed in the model results table in the section below). The decision to group the comorbidities was to achieve greater model parsimony.

Ascertainment of prevalent comorbidities is based on both outpatient (OP, SN, HH, HS, and PS claim types) and inpatient (IN claim types) Medicare claims, including those from Part C.

A patient is considered to have a particular prevalent comorbid condition if one of the ICD-10 codes for that condition (see SMR_DataDictionary_Final_Oct 2025.xlsx for list of codes) appears on a claim for the patient in the prior year. If no such claim is found, the patient is considered to not have the condition. If a patient has less than 6 months of Medicare coverage in the prior year, we consider the prevalent comorbidity information to be missing. This requirement is intended to allow us to distinguish between a patient who does not have a particular comorbidity from one who does not have claims during enough of the year to determine whether the condition is present or not.

Finally, SDS/SES factors were evaluated based on appropriateness (whether related to disparities in care), empirical association with the outcome, and support in published literature.

References:

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### 5.4.2a Attach Conceptual Model

SMR-Conceptual-Model_Final_Oct-2025_508.pdf

### 5.4.3 Variable Distribution Across Measured Entities

Please see **SMR_5.4.3_Final_Oct 2025_508**, attached to 5.4.3a, for full response to this question

### 5.4.3a Attach Descriptive Statistics for Risk/Case-mix Variables

SMR_5.4.3_Final_Oct-2025_508.pdf

### 5.4.4 Risk/Case-Mix Adjustment Modeling and/or Stratification Results

Please see **SMR_5.4.4_Final_Oct 2025_508**, attached to Section 7.1 Supplemental Attachment, for full response to this question

### 5.4.4a Attach Risk/Case-mix Adjustment Modeling and/or Stratification Specifications

SMR_5.4.4a_Final_-Oct-2025_508.pdf

### 5.4.5 Calibration and Discrimination

To assess model performance, we evaluated discrimination using the C-statistics. The C-statistics quantifies the model's ability to discriminate between outcomes based on the included risk factors. Specifically, the SMR model is a time-to-event model, for which the C-statistics measures the concordance between the observed mortality rates and the model-based predicted rates.

The C-statistic for SMR is 0.68, which indicates moderate model discrimination, reflecting the model's ability to distinguish high-risk from low-risk subjects.

Note: this text is also uploaded as an attachment to 5.4.5a since that is a required field.

### 5.4.5a Attach Calibration and Discrimination Testing Results

SMR_5.4.5a_Final_Oct-2025_508.pdf

### 5.4.6 Interpretation of Risk/Case-mix Factor Findings

In addition to clinical factors, we evaluated patient- and area-level SDS/SES social risk factors as risk adjusters. These were in addition to the current inclusion of race, ethnicity, and sex included in the currently endorsed and implemented SMR as described in the 2016 submission.

The relationships among individual SDS factors, socioeconomic disadvantage and mortality is well-established in the general population [18] [23] [24]. Further, individual- and market- or area-level measures of deprivation have been shown to contribute independently to higher mortality [19].

The relationship between race and mortality, Hispanic ethnicity and mortality, as well as both race and area-level SES factors and mortality in the dialysis population, is also well documented [1] [5] [7] [8] [10] [11] [12] [15] [16] [20] [28] [29]. However, the direction of the relationship between race and mortality is inverted relative to the general population, with lower observed mortality in blacks on chronic dialysis compared to whites, although the relationship is mediated by sociodemographic and clinical factors [13] [14] [3].

Given these observed linkages we tested these 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 the analyses.  In total, we tested the following variables:

Patient level:

- Employment status 6 months prior to ESRD
- Sex
- Race
- Ethnicity
- Medicare dual eligible
- ZIP code level – Area Deprivation Index (ADI) from Census data (2009-2013). Based on patient zip-code. We use the publicly available Area Deprivation Index (ADI) originally developed by Singh and colleagues at the University of Wisconsin. We applied the updated ADI based on 2009-2013 census data [22]. The ADI reflects a full set of SES characteristics, including measures of income, education, and employment status, measured at the ZIP code level.

Our fully risk-adjusted model includes all but two of the SDS factors listed above. The Medicare Dual Eligibility covariate was noted to have a very small hazard ratio estimate and was not significantly associated with mortality when other SDS and clinical risk factors were included. The ADI variable was significantly associated with mortality, but the parameter estimate was extremely small. Each 10-point increase in ADI is associated with only a 1% increase in the risk of mortality. In addition, otherwise fully risk adjusted models that either included or excluded the dual eligible and ADI covariates resulted in very similar dialysis facility-level flagging. Given these results we chose to exclude these two socioeconomic covariates to contribute to model parsimony. We did consider whether stratified reporting could be used, but the extremely limited contribution of these two variables did not justify that approach, in our opinion. In addition, the small numbers of patients treated in most U.S. facilities, results in suppression of stratified results for a relatively large percentage of facilities, based on the small cell size rules utilized in federal public reporting and other federally supported programs.

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### 5.4.7 Final Approach to Address Risk Factors

Statistical risk adjustment model with risk factors

### 6.1.1 Current Status

In use

### 6.1.2 Current or Planned Use(s)

Public Reporting

### 6.1.3 Program Details

Name of the program and sponsor
Dialysis Facility Care Compare, Centers for Medicare and Medicaid Services
URL of the program
https://www.medicare.gov/care-compare
Purpose of the program

Dialysis Facility Compare helps patients find detailed information about Medicare-certified dialysis facilities. Patients can compare the services and the quality of care that facilities provide.

Geographic area and percentage of accountable entities and patients included

United States. All Medicare-certified dialysis facilities who are eligible for the measure and have at least 3 expected deaths are included in the measure calculation for the program. For the October 2024 Dialysis Facility Compare refresh, 7,324 U.S. dialysis facilities serving a total of 2,090,013 patients treated in the 4-year period from 2020-2023 had SMR results reported.

Applicable level of analysis and care setting

Facility level, Dialysis Facilities

### 6.2.1 Actions of Measured Entities to Improve Performance

There are a number of actions that dialysis facility providers can take to help improve patient mortality.  Examples include:

- Optimize dialysis adequacy:  Ensuring that adequate small solute clearance is achieved by measuring Kt/V regularly and making appropriate dialysis prescription adjustments.  In addition, encouraging patients to complete the full duration of their treatments along with not missing treatments is also important.

- Managing cardiovascular risk factors:  Controlling blood pressure and optimizing fluid management to avoid chronic volume overload is central to reducing cardiovascular morbidity.  Attention to ultrafiltration rates during treatment can also impact cardiovascular outcomes.
- Infection prevention:  Monitoring and reducing blood-stream infections, particularly those that are dialysis catheter related is a cornerstone.  In addition, promoting and administering vaccinations with influenza, pneumococcal, and hepatitis B.
- Nutrition and Metabolic support:  Managing mineral and bone disorder (MBD) with control of hyperphosphatemia, avoidance of hypercalcemia, and treatment of hyperparathyroidism can all impact patient mortality.
- Improve vascular access by avoiding long-term catheters when possible.
- Enhance care coordination:  Reconcile medications when patients return from hospital.
- Encourage kidney transplantation which has improved patient survival compared to long-term dialysis.

### 6.2.2 Feedback on Measure Performance

For DFCC, feedback can be provided any time through contacting the dialysisdata.org helpdesk. Preview periods allow for specific times for facilities review and comment on measure calculations, and provide an opportunity to request a patient list.

Comments received during DFC preview periods tend to be technical in nature, asking for clarification on how the SMR is calculated for particular facilities, including questions about patient assignment and application of exclusion and risk adjustment criteria.

### 6.2.3 Consideration of Measure Feedback

The revisions made to the measure specifications during this maintenance review were not directly in response to specific feedback received during public reporting (which, as described above, was more general in nature).

Based on enrollment information from the Medicare Enrollment Database (EDB), the percentage of ESRD dialysis beneficiaries enrolled in Medicare Advantage (MA) has steadily increased over time. From 12% in 2010, the proportion rose to 22% by 2020. Prior to 2020, there was an annual increase of approximately 1%. However, since 2021, the annual increase has been more than 5%.

The growth in ESRD beneficiaries joining MA plans carries significant implications for the metrics used to assess dialysis facility performance. Contrary to the data from Fee-For-Service (FFS) Medicare beneficiaries, MA outpatient encounters and administrative records have not been readily available for the purposes of analyzing facility quality, except for internal CMS use in risk adjustment and performance assessment.

### 6.2.4 Progress on Improvement

Mortality rates from 2020-2023 may be difficult to interpret because of the COVID-19 pandemic effects, but mortality rates are lower in 2023 (reference year) as evidenced by the hazard ratios for calendar year from the SMR model. The risk of mortality for 2020 was 5% higher compared to 2023 (p-value<0.0001). The risks of mortality in 2021 and 2022 were 12% and 6% higher, respectively, compared to 2023 (p-value <0.0001 for each year).

2020:  Coefficient = 0.05, Hazard Ratio= 1.05, P-value = <0.0001

2021: Coefficient = 0.11, Hazard Ratio= 1.12, P-value = <0.0001

2022: Coefficient = 0.05, Hazard Ratio= 1.06, P-value = <0.0001

2023: Reference Category

### 6.2.5 Unexpected Findings

None

### 7.1 Supplemental Attachment

Section-7.1-Supplemental-Attachments_Revised-Nov-2025.zip

### Developer POC email

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### Measure Developer POC

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Ann Arbor, MI
United States

### The measure developer is different from the measure steward

Yes

### Steward Address

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Baltimore, MD
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### Steward Organization

Centers for Medicare & Medicaid Services

## Steward Organization URL

https://www.cms.gov/

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