

MEASURE INFORMATION ABOUT THE MEDICARE SPENDING PER BENEFICIARY, CALCULATED FOR THE 2018 VALUE MODIFIER AND 2016 ANNUAL QRURs

A. Measure Names

Medicare Spending Per Beneficiary (MSPB)

B. Measure Description

The Medicare Spending Per Beneficiary (MSPB) Measure evaluates solo practitioners and groups on their efficiency and is specialty-adjusted to account for their specialty mix. Solo practitioners and groups are identified by their Medicare Taxpayer Identification Number (TIN). Specifically, the MSPB Measure assesses the cost to Medicare of services performed by TINs during an MSPB episode, which comprises the period immediately prior to, during, and following a patient's hospital stay.

C. Rationale

Medicare is transforming from a system that rewards volume of service to one that rewards efficient, effective care and reduces delivery system fragmentation. To advance this transformation, the Centers for Medicare & Medicaid Services (CMS) provides financial incentives to hospitals based on their performance on selected quality measures. By measuring the cost of care through the MSPB Measure, CMS aims to reward TINs that can provide efficient care at a lower cost to Medicare.

CMS uses the Per Capita Cost for All Attributed Beneficiaries Measure in combination with the MSPB and Per Capita Costs for Beneficiaries with Specific Conditions Measures to determine each TIN's relative cost of care. Information on TINs' performance on this measure is included in the 2016 Annual and Mid-Year Quality and Resource Use Reports (QRURs) and used in the calculation of the 2018 Value Modifier.

The information in this document was used to calculate this measure for the 2018 Value Modifier (based on calendar year 2016 data) as shown in the 2016 Annual QRUR.

D. Measure Outcome (Numerator)

The numerator for a TIN's specialty-adjusted MSPB Measure is the TIN's average MSPB Amount, which is defined as the sum of standardized, risk-adjusted spending across all of a TIN's eligible episodes divided by the number of episodes for that TIN. This ratio is multiplied by the national average standardized episode cost. An MSPB episode includes all Medicare Part A and Part B claims with a start date falling between 3 days prior to an Inpatient Prospective Payment System (IPPS) hospital admission (also known as the "index admission" for the episode) and 30 days after hospital discharge.

E. Population Measured (Denominator)

The denominator for a TIN's MSPB Measure is the specialty-adjusted MSPB expected cost based on the national specialty-specific expected cost of the specialties represented by the TIN's eligible professionals (EPs). The methodology for specialty-adjustment is discussed in the "Specialty-adjustment" section below.

The beneficiary populations eligible to be included in the MSPB Measure are made up of beneficiaries who were enrolled in both Medicare Parts A and B for the period from 93 days prior to IPPS hospital admission until 30 days after discharge from a short-term acute care hospital stay, where the stay occurs during the period of performance. Defining the population in this manner ensures that each beneficiary's claims record contains sufficient fee-for-service (FFS) data both for measuring spending levels and for risk adjustment purposes.

Only claims for beneficiaries admitted to subsection (d) hospitals during the period of performance are included in the calculation of the MSPB Measure. Subsection (d) hospitals are hospitals in the 50 States and D.C. other than: psychiatric hospitals, rehabilitation hospitals, hospitals whose inpatients are predominantly under 18 years old, hospitals whose average inpatient length of stay exceeds 25 days, and hospitals involved extensively in treatment for or research on cancer. The claims for inpatient admissions to subsection (d) hospitals are grouped into "stays" by beneficiary, admission date, and provider.

F. Exclusions

Beneficiary populations excluded from the MSPB calculation are those with episodes where at any time from 93 days before admission through 30 days after discharge, the beneficiary is enrolled in a Medicare Advantage plan or Medicare is the secondary payer. Episodes where the beneficiary becomes deceased during the episode are also excluded. Regarding beneficiaries whose primary insurance becomes Medicaid during an episode because of the exhaustion of Medicare Part A benefits, Medicaid payments made for services rendered to these beneficiaries are excluded; however, all Medicare Part A payments made before benefits are exhausted and all Medicare Part B payments made during the episode are included.

Further, any episode in which the index admission inpatient claim has a \$0 actual payment or a \$0 standardized payment is excluded. In addition, acute-to-acute transfers (where a transfer is defined based on the claim discharge code) are not considered index admissions. In other words, these cases do not generate new MSPB episodes; neither the hospital that transfers a patient to another subsection (d) hospital nor the receiving subsection (d) hospital will have an index admission or associated MSPB episode attributed to them.

With the exception of Maryland hospitals, admissions to hospitals that Medicare does not reimburse through the IPPS system (e.g., cancer hospitals, critical access hospitals) are not considered index admissions and are therefore not eligible to begin an MSPB episode. Although hospitals in Maryland are not reimbursed through the IPPS system, Maryland hospitals are now

eligible to begin MSPB episodes for the 2018 Value-Based Payment Modifier.¹ If an acute-to-acute hospital transfer or a hospitalization in a Prospective Payment System (PPS)–exempt hospital happens during the 30 days following discharge from an index admission, however, these post-discharge costs will count toward the measure.

G. Data Collection Approach and Measure Collection

The MSPB Measure is calculated from all Medicare Parts A and B claims during the performance period that include inpatient hospital; outpatient; skilled nursing facility; home health; hospice; durable medical equipment, prosthetics, orthotics, and supplies (DMEPOS); and Medicare Part B carrier (non-institutional physician) claims. The measure also uses Medicare beneficiary enrollment data. This measure does not require any additional measure submission by groups. Medicare Part A and B claims are used to attribute beneficiaries to groups for this measure, as described below. Part D–covered prescription drug costs are not included in the calculation of the MSPB Measure.

H. Methodological Information and Measure Construction

Episode definition. An MSPB episode includes all Medicare Part A and Part B claims with a start date falling between 3 days prior to an IPPS hospital admission (index admission) and 30 days after hospital discharge. An episode includes the 30 days after a hospital discharge in order to emphasize the importance of care transitions and care coordination in improving patient care. Only discharges occurring at least 30 days before the end of the performance period are counted as index admissions. Admissions that occur within 30 days of discharge from another index admission are not considered to be index admissions.

Payments made by Medicare and the beneficiary (i.e., allowed charges) are counted in the MSPB episode as long as the start of the claim falls within the episode window of 3 days prior to the index admission through 30 days after hospital discharge. IPPS outlier payments (and outlier payments in other provider settings) are also included in the calculation of the MSPB Measure.

Attribution. Each MSPB episode is attributed to the one TIN responsible for the plurality of Part B carrier (PB) services, as measured by Medicare allowed amounts, performed by EPs during the episode’s index hospitalization. PB services are defined as all physician services that are billed on non-institutional claims. PB services during the episode’s index hospitalization is the period between the admission date and discharge date of the hospital stay, inclusive. We consider any PB services billed by EPs on the admission date and in a hospital setting, with place of service restricted to inpatient, outpatient, or emergency room hospitals; or during the index hospital stay, regardless of place of service; or on the discharge date and in an inpatient hospital.²

¹ [CY 2016 PFS Rule](#).

² There is no place of service restriction for the time during the index admission because a beneficiary may need to receive specialty services in other locations. This is rare but occurs when certain services are not available at the admitting hospital (e.g., MRI in a nearby outpatient hospital or dialysis in an ESRD facility).

If more than one TIN has the plurality of PB services and the same count of services during a given episode's index hospitalization, the MSPB episode is randomly attributed to one TIN.

Measure construction. The MSPB Measure is calculated using the following steps: (1) standardize Medicare payments included in MSPB episode costs, (2) calculate expected payment-standardized episode costs, (3) calculate risk-adjusted MSPB Amount, (4) calculate the specialty-adjusted expected cost, and (5) calculate the specialty-adjusted MSPB Measure. Below is a detailed outline of each step.

1. Calculate payment-standardized MSPB episode costs.

Calculate standardized spending during an episode by summing all the standardized Medicare claims payments made during the MSPB episode (i.e., between 3 days prior to the hospital admission and 30 days after discharge). More information about payment standardization is provided in the "Payment standardization" section below.

2. Calculate expected MSPB episode costs.

- a) To estimate the relationship between the independent variables described in the risk adjustment section below (i.e., age, hierarchical condition category (HCC), enrollment status, end-stage renal disease (ESRD) status, comorbidity interactions, long-term care, and Medicare Severity Diagnosis-Related Groups (MS-DRG)) and the standardized episode cost, the MSPB methodology uses an ordinary least squares (OLS) regression. Using a separate model for episodes within each major diagnostic category (MDC), these variables are regressed on standardized episode cost. The MDC is determined by the MS-DRG of the index hospital stay. The predicted values from this regression represent the expected spending for each episode.
- b) To prevent the creation of extreme expected cost values, Winsorize expected values at the 0.5th percentile.^{3,4} In addition, renormalize the expected values to ensure that the average expected episode spending level for each MDC is the same before and after Winsorizing. This renormalization occurs by multiplying the Winsorized expected values by the ratio of the average standardized spending level within each MDC and the average Winsorized expected spending level within each MDC.
- c) Calculate the residual for each episode as the difference between the standardized episode spending level and the Winsorized expected value of spending for that episode.

³ A non-methodological change has been made in terminology from "truncate" to "Winsorize" for the 2017 version of this document. Winsorization is a statistical transformation that limits extreme values in data to reduce the effect of possibly spurious outliers. Thus, all predicted values below the 0.5th percentile are assigned the value of the 0.5th percentile.

⁴ To ensure that the lowest predicted values within an MDC are adjusted even for MDCs with few episodes, this methodology first sets the lowest predicted value within the MDC to the second lowest predicted value within the MDC before Winsorizing at the 0.5th percentile.

- d) Exclude outlier episodes, which are MSPB episodes whose residuals fall above the 99th percentile or below the 1st percentile of the distribution of residuals across all MSPB episodes. Excluding outliers based on residuals eliminates the episodes that deviate most from their expected values in absolute terms. Renormalize the expected values to ensure that the average expected episode spending levels are the same as the average standardized spending levels after outlier exclusions. This renormalization multiplies the expected values after excluding outliers by the ratio of the average standardized spending level and the average Winsorized expected spending level after excluding outliers.

3. Calculate risk-adjusted MSPB Amounts for each TIN.

For each TIN, divide the ratio of the total standardized cost across that TIN's associated, non-outlier episodes by the total expected and renormalized cost across that TIN's non-outlier episodes. More information about the calculation of predicted costs is provided in the "Risk adjustment" section below. Multiplying this ratio by the total standardized cost averaged over the universe of attributed, non-outlier episodes gives the risk-adjusted MSPB Amount for each TIN.

4. Calculate the specialty-adjusted expected cost for each TIN.

Calculate a specialty-adjusted expected cost for each TIN from the national specialty-specific expected costs of all the specialties in the TIN. The methodology for specialty-adjustment calculation is discussed in the "Specialty-adjustment" section below. For each TIN, weight the national specialty-specific expected cost for each of its constituent specialties by those specialties' shares of that TIN's charges incurred by EPs. Summing these weighted specialty-specific costs within each TIN gives a TIN-level specialty-adjusted expected cost.

5. Calculate the specialty-adjusted MSPB Measure.

Calculate the specialty-adjusted MSPB Measure for each TIN by dividing the TIN's MSPB Amount by the TIN's specialty-adjusted expected cost. The ratio of the group's MSPB Amount and the TIN's specialty-adjusted expected cost is multiplied by the average standardized episode cost taken over all attributed, non-outlier episodes to create the TIN's specialty-adjusted MSPB Measure.

Payment standardization. The MSPB Measure is payment standardized to take into account payment factors that are unrelated to the care provided (such as add-on payments for medical education and geographic variation in Medicare payment amounts). The standardized payment methodology achieves the following:

1. Eliminates adjustments made to national allowed payment amounts to reflect differences in regional labor costs and group expenses (measured by hospital wage indexes and geographic practice cost indexes).
-

2. Eliminates payments to hospitals for larger program goals, including graduate medical education and indirect medical education (IME); serving a disproportionate population of poor and uninsured (i.e., disproportionate share payments (DSH)); and payments associated with incentive payment programs.
 3. Substitutes a national amount for services paid on the basis of state fee schedules.
 4. Maintains differences in actual payments resulting from the choice of setting in which a service is provided, the choice of who provides the service, and the choice of whether to provide multiple services in the same encounter.
-

Risk adjustment. To account for case-mix variation and other factors, the MSPB risk adjustment methodology incorporates expected costs that reflect the beneficiary's age and severity of illness. Expected costs are calculated using a model that broadly follows the CMS-HCC risk adjustment methodology, which is derived from Medicare Part A and B claims and is used in the Medicare Advantage program.⁵ Although the Medicare Advantage risk adjustment model includes 24 age/sex variables, the MSPB methodology does not adjust for sex and only includes 12 age categorical variables. Severity of illness is measured using 79 HCC indicators derived from the beneficiary's claims during the period 90 days prior to the start of the episode, an indicator of whether the beneficiary recently required long-term care, and the MS-DRG of the index hospitalization. The 79 HCC indicators are specified in Version 22 (V22) of the HCC model, and the HCC V22 model includes a mapping of ICD-9 diagnosis codes to CCs and ICD-10 diagnosis codes to condition categories (CCs). As described above, episodes where the beneficiary is not enrolled in both Medicare Part A and Medicare Part B for the 90 days prior to the episode are excluded. This "look back period" captures beneficiaries' comorbidities for use in risk adjustment. The MSPB risk adjustment methodology also includes status indicator variables for whether the beneficiary qualifies for Medicare through disability or age and ESRD. In addition, the model accounts for disease interactions by including interactions between HCCs and/or enrollment status variables that are included in the Medicare Advantage model. Interaction terms are included because the presence of certain comorbidities increases costs in a greater way than predicted by the HCC indicators alone.⁶ The MSPB risk adjustment method does not control for the beneficiary's sex and race. Tables 1 through 6 in Section K present the final set of risk adjustment variables.

Specialty-adjustment. Specialty-adjustment accounts for TIN-level differences in specialty mix that can affect medical costs, regardless of the care provided. The MSPB Measure is specialty-adjusted so that TINs can be compared more fairly with their peers. Specialty-adjusted costs for a TIN with a disproportionate number of specialists with high-cost beneficiaries will be

⁵ Centers for Medicare and Medicaid Services, Office of the Actuary. "Announcement of Calendar Year (CY) 2014 Medicare Advantage capitation rates and Medicare Advantage and Part D payment policies and final call letter." April 2013. <https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Announcement2014.pdf>.

⁶ Centers for Medicare and Medicaid Services. *Medicare Managed Care Manual*, Chapter 7 – Risk Adjustment, Section 70.2.7 – Disease and Disabled Interactions. 2014. <https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/mc86c07.pdf>.

lower than the group’s non–specialty-adjusted costs because the specialists with high-cost beneficiaries will generate expected costs that exceed the average cost across all TINs; similarly, specialty-adjusted costs will be higher than non–specialty-adjusted costs for TINs that have a disproportionate number of specialists with low-cost beneficiaries. The specialty-adjustment methodology uses three steps:

1. Compute national specialty-specific expected costs for each specialty.

The national specialty-specific expected cost for each specialty is calculated as the weighted average of the MSPB Amount, where the weight for each TIN is that specialty’s share of EPs in the TIN multiplied by the specialty’s number of EPs in the TIN and number of episodes in the TIN.

2. Compute the specialty-adjusted expected cost for each TIN.

For each TIN, the specialty-specific expected costs (calculated in Step 1) for each of its constituent specialties are weighted by those specialties’ shares of the TIN’s charges incurred by EPs. Summing these weighted specialty-specific expected costs within each TIN gives a TIN-level specialty-adjusted expected cost.

3. Compute the specialty-adjusted MSPB Measure for each TIN.

The ratio of the TIN’s MSPB Amount and the TIN’s specialty-adjusted expected cost is multiplied by the average standardized episode cost taken over all attributed, non-outlier episodes to calculate the specialty-adjusted MSPB Measure.

I. For Further Information

More information about the 2016 QRURs and 2018 Value Modifier is available at: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeedbackProgram/2016-QRUR.html>.

J. References

Final details of MSPB episode construction and application in the Hospital Value-Based Purchasing (VBP) Program are in the [FY 2012 IPPS/LTCH PPS Final Rule](#) (76 FR 51618 through 51626) and the [FY 2013 IPPS/LTCH Final Rule](#) (77 FR 53583 through 53596).

K. Tables

The following tables present the final set of risk adjustment variables used to calculate expected MSPB episode costs, as referenced in Section H.

Table 1: Age Variables

Age Range	Description Label
0–34	Age between 0 and 34 years old
35–44	Age between 35 and 44 years old

Age Range	Description Label
45–54	Age between 45 and 54 years old
55–59	Age between 55 and 59 years old
60–64	Age between 60 and 64 years old
65–69	Age between 65 and 69 years old (reference category) ⁷
70–74	Age between 70 and 74 years old
75–79	Age between 75 and 79 years old
80–84	Age between 80 and 84 years old
85–89	Age between 85 and 89 years old
90–94	Age between 90 and 94 years old
95+	Age greater than or equal to 95 years old

Table 2: Severity of Illness Measures (Hierarchical Condition Categories (HCCs) Included in the CMS-HCC Risk Adjustment Model)

Indicator Variable	Description Label
HCC1	HIV/AIDS
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock
HCC6	Opportunistic Infections
HCC8	Metastatic Cancer and Acute Leukemia
HCC9	Lung and Other Severe Cancers
HCC10	Lymphoma and Other Cancers
HCC11	Colorectal, Bladder, and Other Cancers
HCC12	Breast, Prostate, and Other Cancers and Tumors
HCC17	Diabetes with Acute Complications
HCC18	Diabetes with Chronic Complications
HCC19	Diabetes without Complication
HCC21	Protein-Calorie Malnutrition
HCC22	Morbid Obesity
HCC23	Other Significant Endocrine and Metabolic Disorders
HCC27	End-Stage Liver Disease
HCC28	Cirrhosis of Liver
HCC29	Chronic Hepatitis
HCC33	Intestinal Obstruction/Perforation
HCC34	Chronic Pancreatitis
HCC35	Inflammatory Bowel Disease
HCC39	Bone/Joint/Muscle Infections/Necrosis
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease
HCC46	Severe Hematological Disorders
HCC47	Disorders of Immunity
HCC48	Coagulation Defects and Other Specified Hematological Disorders
HCC54	Drug/Alcohol Psychosis
HCC55	Drug/Alcohol Dependence
HCC57	Schizophrenia
HCC58	Major Depressive, Bipolar, and Paranoid Disorders
HCC70	Quadriplegia
HCC71	Paraplegia
HCC72	Spinal Cord Disorders/Injuries
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease

⁷ The 65–69 age indicator variable serves as the reference category and is omitted from the regression.

Indicator Variable	Description Label
HCC74	Cerebral Palsy
HCC75	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy
HCC76	Muscular Dystrophy
HCC77	Multiple Sclerosis
HCC78	Parkinson's Disease and Huntington's Disease
HCC79	Seizure Disorders and Convulsions
HCC80	Coma, Brain Compression/Anoxic Damage
HCC82	Respirator Dependence/Tracheostomy Status
HCC83	Respiratory Arrest
HCC84	Cardio-Respiratory Failure and Shock
HCC85	Congestive Heart Failure
HCC86	Acute Myocardial Infarction
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease
HCC88	Angina Pectoris
HCC96	Specified Heart Arrhythmias
HCC99	Cerebral Hemorrhage
HCC100	Ischemic or Unspecified Stroke
HCC103	Hemiplegia/Hemiparesis
HCC104	Monoplegia, Other Paralytic Syndromes
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene
HCC107	Vascular Disease with Complications
HCC108	Vascular Disease
HCC110	Cystic Fibrosis
HCC111	Chronic Obstructive Pulmonary Disease
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders
HCC114	Aspiration and Specified Bacterial Pneumonias
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage
HCC124	Exudative Macular Degeneration
HCC134	Dialysis Status
HCC135	Acute Renal Failure
HCC136	Chronic Kidney Disease, Stage 5
HCC137	Chronic Kidney Disease, Severe (Stage 4)
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss
HCC161	Chronic Ulcer of Skin, Except Pressure
HCC162	Severe Skin Burn or Condition
HCC166	Severe Head Injury
HCC167	Major Head Injury
HCC169	Vertebral Fractures without Spinal Cord Injury
HCC170	Hip Fracture/Dislocation
HCC173	Traumatic Amputations and Complications
HCC176	Complications of Specified Implanted Device or Graft
HCC186	Major Organ Transplant or Replacement Status
HCC188	Artificial Openings for Feeding or Elimination
HCC189	Amputation Status, Lower Limb/Amputation Complications

Table 3: Enrollment Status Variables

Indicator Variable	Description Label
ORIGDS	Originally Disabled.
ESRD	End-Stage Renal Disease

Table 4: Long-Term Care Variables

Indicator Variable	Description Label
LTC_Indicator	Long-Term Care

Table 5: Variable Interaction Terms

Indicator Variable	Description Label
DISABLED_HCC6	Disabled, Opportunistic Infections
DISABLED_HCC34	Disabled, Chronic Pancreatitis
DISABLED_HCC46	Disabled, Severe Hematological Disorders
DISABLED_HCC54	Disabled, Drug/Alcohol Psychosis
DISABLED_HCC55	Disabled, Drug/Alcohol Dependence
DISABLED_HCC110	Disabled, Cystic Fibrosis
DISABLED_HCC176	Disabled, Complications of Specified Implanted Device or Graft
SEPSIS_CARD_RESP_FAIL	Sepsis*Cardiorespiratory Failure and Shock
CANCER_IMMUNE	Cancer*Immune Disorders
DIABETES_CHF	Diabetes*Congestive Heart Failure
CHF_COPD	Congestive Heart Failure*Chronic Obstructive Pulmonary Disease
CHF_RENAL	Congestive Heart Failure*Renal Failure
COPD_CARD_RESP_FAIL	Chronic Obstructive Pulmonary Disease*Cardiorespiratory Failure and Shock

Table 6: Indicator Variable

Indicator Variable	Description Label
MS-DRGs	For a complete list of all MS-DRGs, see the Table 5 in the download section of this CMS FY2012 Final Rule and Correction Notice webpage .