Quality Payment
PROGRAM

Merit-Based Incentive Payment System (MIPS): Non-Emergent Coronary Artery Bypass Graft (CABG) Measure

Measure Information Form
2020 Performance Period

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1.0 Introduction

This document details the methodology for the Non-Emergent Coronary Artery Bypass Graft (CABG) measure and should be reviewed along with the Non-Emergent Coronary Artery Bypass Graft (CABG) Measure Codes List file, which contains the medical codes used in constructing the measure.

1.1 Measure Name

Non-Emergent Coronary Artery Bypass Graft (CABG) episode-based cost measure

1.2 Measure Description

Episode-based cost measures represent the cost to Medicare for the items and services provided to a patient during an episode of care ("episode"). In all supplemental documentation, "cost" generally means the standardized[1] Medicare allowed amount,[2] and claims data from Medicare Parts A and B are used to construct the episode-based cost measures.

The Non-Emergent CABG episode-based cost measure evaluates a clinician's risk-adjusted cost to Medicare for beneficiaries who undergo a CABG procedure during the performance period. The cost measure score is the clinician's risk-adjusted cost for the episode group averaged across all episodes attributed to the clinician. This procedural measure includes costs of services that are clinically related to the attributed clinician's role in managing care during each episode from 30 days prior to the clinical event that opens, or "triggers," the episode through 90 days after the trigger.

1.3 Measure Rationale

An average of approximately 100,000 Medicare beneficiaries underwent CABG surgery annually between 2000 and 2012.[3] More than 13 percent of CABG patients are readmitted within 30 days,[4] and each 30-day readmission for CABG resulted in additional costs up to $13,256.[5] The Non-Emergent CABG episode-based cost measure was recommended for development by an expert clinician committee—the Cardiovascular Disease Management Clinical Subcommittee—because of its high impact in terms of patient population and Medicare spending, and the opportunity for incentivizing cost-effective, high-quality clinical care in this

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[1] Claim payments are standardized to account for differences in Medicare payments for the same service(s) across Medicare providers. Payment standardized costs remove the effect of differences in Medicare payment among health care providers that are the result of differences in regional health care provider expenses measured by hospital wage indexes and geographic price cost indexes (GPCIs) or other payment adjustments such as those for teaching hospitals. For more information, please refer to the "CMS Price (Payment) Standardization - Basics" and "CMS Price (Payment) Standardization - Detailed Methods" documents posted on the Payment Standardization QualityNet webpage. (https://www.qualitynet.org/inpatient/measures/payment-standardization)

[2] Cost is defined by *allowed amounts* on Medicare claims data, which include both Medicare trust fund payments and any applicable beneficiary deductible and coinsurance amounts. Claims data from Medicare Parts A and B are used to construct the episode-based cost measures.

[3] McNeely, Christian, Stephen Markwell, and Christina Vassileva. "Trends in Patient Characteristics and Outcomes of Coronary Artery Bypass Grafting in the 2000 to 2012 Medicare Population." The Annals Of Thoracic Surgery 102, no. 1 (2016): 132-38.

[4] Li, Zhongmin, Ehrin J. Amstrong, Joseph P. Parker, Beate Danielsen, and Patrick S. Romano. "Hospital Variation in Readmission after Coronary Artery Bypass Surgery in California." Circulation: Cardiovascular Quality and Outcomes (2012).

[5] Birkmeyer, J.D., Gust, C., Baser, O., Dimick, J.B., Sutherland, J.M., and Skinner J.S. "Medicare Payments for Common Inpatient Procedures: Implications for Episode-Based Payment Bundling." Health Serv Res 45, no. 6 Pt 1 (2010): 1783-95.

area. Based on the initial recommendations from the Clinical Subcommittee, the subsequent measure-specific workgroup provided extensive, detailed input on this measure.

1.4 Measure Numerator

The cost measure numerator is the sum of the ratio of observed to expected[6] payment-standardized cost to Medicare for all Non-Emergent CABG episodes attributed to a clinician. This sum is then multiplied by the national average observed episode cost to generate a dollar figure.

1.5 Measure Denominator

The cost measure denominator is the total number of episodes from the Non-Emergent CABG episode group attributed to a clinician.

1.6 Data Sources

The Non-Emergent CABG cost measure uses the following data sources:

- Medicare Parts A and B claims data from the Common Working File (CWF)
- Enrollment Data Base (EDB)
- Long Term Care Minimum Data Set (LTC MDS)[7]

1.7 Care Settings

Methodologically, the Non-Emergent CABG cost measure can be triggered based on claims data from the following settings: acute inpatient (IP) hospitals.

1.8 Cohort

The cohort for this cost measure consists of patients who are Medicare beneficiaries enrolled in Medicare fee-for-service and who undergo a CABG procedure that triggers a Non-Emergent CABG episode.

The cohort for this cost measure is also further refined by the definition of the episode group and measure-specific exclusions (see Appendix A).

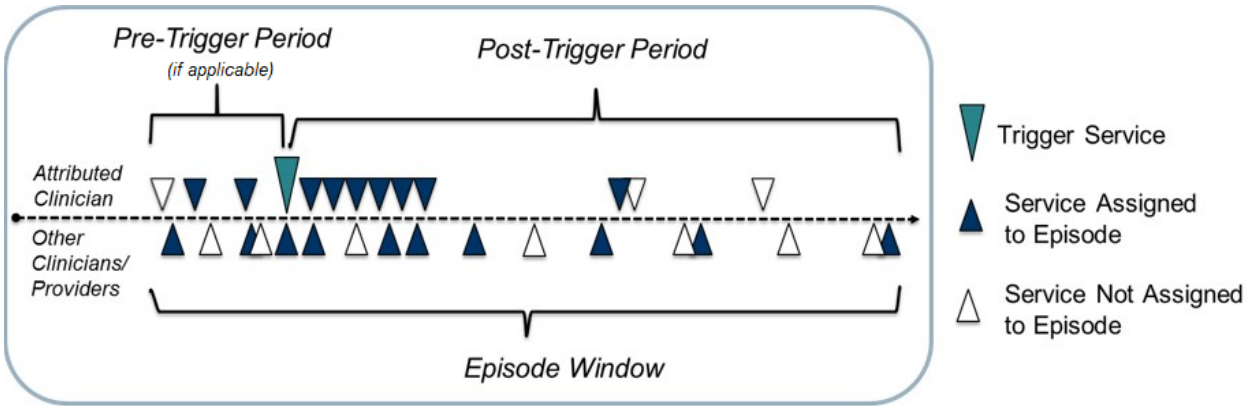
[6] Expected costs refer to costs predicted by the risk adjustment model. For more information on expected costs and risk adjustment, please refer to Section A.5.
[7] For information on how LTC MDS data are used in risk adjustment, please refer to Section A.5.

2.0 Methodology Steps

There are two overarching processes in calculating episode-based cost measure scores: episode construction (Steps 1-3) and measure calculation (Steps 4-6). This section provides a brief one-page summary of these processes for the Non-Emergent CABG cost measure, and Appendix A describes the processes in detail.

1. **Trigger and define an episode**: Episodes are defined by billing codes that open, or "trigger," an episode. The episode window starts 30 days before the trigger and ends 90 days after the trigger. To enable meaningful clinical comparisons, episodes are placed into more granular, mutually exclusive sub-groups based on clinical criteria. Some episodes may also be excluded based on other information available at the time of the trigger.
2. **Attribute the episode to a clinician**: For this procedural episode group, an attributed clinician is any clinician who bills a trigger code for the episode group during the inpatient stay during which the procedure occurs.
3. **Assign costs to the episode and calculate the episode observed cost**: Clinically related services occurring during the episode window are assigned to the episode. The cost of the assigned services is summed to determine each episode's standardized observed cost.

Figure 1. Diagram Showing an Example of a Constructed Episode



4. **Exclude episodes**: Exclusions remove unique groups of patients from cost measure calculation in cases where it may be impractical and unfair to compare the costs of caring for these patients to the costs of caring for the cohort at large.
5. **Calculate expected costs for risk adjustment**: Risk adjustment aims to isolate variation in clinician costs to only the costs that clinicians can reasonably influence (e.g., accounting for beneficiary age, comorbidities and other factors). A regression analysis is run using the risk adjustment variables as covariates to estimate the expected cost of each episode. Then, statistical techniques are applied to reduce the effect of extreme outliers on measure scores.
6. **Calculate the measure score:** For each episode, the ratio of standardized total observed cost (from step 3) to risk-adjusted expected cost (from step 5) is calculated and averaged across all of a clinician or clinician group's attributed episodes to obtain the average episode cost ratio. The average episode cost ratio is multiplied by the national average observed episode cost to generate a dollar figure for the cost measure score.

3.0 Measure Specifications Quick Reference

This section provides a quick, at-a-glance reference for the Non-Emergent CABG episode-based cost measure specifications. More details on each component can be found in Appendix A, and the full list of codes and logic used to define each component can be found within the Measure Codes List file.

Episode Window: *During what time period are costs measured?*

Pre-Trigger Window: 30 days Post-Trigger Window: 90 days

Triggers: *Patients receiving what medical care are included in the measure?*

- Procedure code for heart artery bypass, when (i) accompanied by Medicare Severity Diagnosis-Related Group (MS-DRG) code for coronary bypass (MS-DRG 231, 232, 233, 234, 235, 236) and (ii) no other cardiac-related CPT/HCPCS codes occur at the same time as the trigger procedure code for heart artery bypass, or
- Procedure code for heart artery bypass, when (i) accompanied by MS-DRG code for cardiac valve and other major cardiothoracic procedures with and without cardiac cath (MS-DRG 216, 217, 218, 219, 220, 221), and (ii) accompanied by procedure code for replacement of aortic valve or replacement and enlargement of left lower heart valve (CPT/HCPCS 33405, 33406, 33410, 33411), and (iii) no other cardiac-related CPT/HCPCS codes occur at the same time as the initial trigger procedure code for heart artery bypass

Sub-Groups: *What are the mutually exclusive types of episodes?*

1. CABG with Concurrent Aortic Valve Replacement
2. Isolated CABG

Service Assignment: *Which clinically related costs are included in the measure?*

Assigned services generally fall within the following clinical themes:

- Renal Failure
- Preoperative Work-Up
- Postoperative Labs
- Imaging after CABG
- Rehabilitation
- Wound Care and Surgical Site Infection (SSI)
- Coronary Disease (MI and CAD)
- Cardiovascular Care, Other
- Readmissions / ED Visits, Other
- Pleural Effusions and Pericardial Effusions

Risk Adjustors: *Which risk factors are accounted for in the risk adjustment model?*

- Comorbidities captured by 79 Hierarchical Condition Category (HCC) codes that map with over 9,500 ICD-10-CM codes
- Interaction variables accounting for a range of comorbidities
- Beneficiary age category
- Beneficiary disability status
- Beneficiary ESRD status
- Recent use of institutional long-term care
- Measure-specific risk adjustors including but not limited to antiplatelet therapy, anticoagulant use, recent MI or PCI, and smoking.
- For the full list of standard and measure-specific risk adjustment variables, please reference the “RA” and “RA_Details” tabs of the Measure Codes List file.

Exclusions: *Which populations are excluded from measure calculation?*

- The beneficiary has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the trigger day.
- The beneficiary was not enrolled in Medicare Parts A and B for the entirety of the lookback period plus episode window, or was enrolled in Part C for any part of the lookback plus episode window.
- No main clinician is attributed the episode.
- The beneficiary's date of birth is missing.
- The beneficiary's death date occurred before the episode ended.
- The episode trigger claim was not performed in an IP hospital based on its place of service.
- The IP facility is not a short-term stay acute hospital as defined by subsection (d).[8]
- Measure-specific exclusions including but not limited to shock, emergent CABG, and procedures that occur during an unrelated inpatient stay. For the full list of measure-specific exclusions, please reference the "Exclusions" and "Exclusions_Details" tabs of the Measure Codes List file.

[8] For more information on short-term stay acute hospitals as defined by subsection (d), please refer to Section A.4.

Appendix A. Detailed Measure Methodology

This section contains the technical details for the two overarching processes in calculating episode-based cost measure scores in more detail: Sections A.1 through A.3 describe episode construction and Sections A.4 through A.6 describe measure calculation.

A.1 Trigger and Define an Episode

Non-Emergent CABG episodes are defined by Current Procedural Terminology / Healthcare Common Procedure Coding System (CPT/HCPCS) codes on Part B Physician/Supplier (Carrier) claims that open, or trigger, an episode. For the codes and logic relevant to this section please see the "Triggers" and "Triggers_Details" tabs of the Non-Emergent CABG Measure Codes List.

The steps for defining an episode for the Non-Emergent CABG episode group are as follows:

- **Identify** Part B Physician/Supplier claim lines with positive standardized payment that have a trigger code.
- **Trigger** an episode if all the following conditions are met for an identified Part B Physician/Supplier claim line:
    - It was billed by a clinician of a specialty that is eligible for MIPS.
    - It does not have a post-operative modifier code.[9]
    - It is the highest cost claim line across all claim lines identified in the above bullets and that have any Non-Emergent CABG trigger code billed for the beneficiary on that day. If multiple Part B Physician/Supplier claim lines with a trigger code occur on different days within a concurrent IP stay, an episode will be triggered by the claim line with the earliest expense date during the IP stay.
- **Identify** episodes that have a concurrent IP stay by identifying the first IP stay with a relevant Medicare Severity Diagnosis-Related Group (MS-DRG) code for the beneficiary that is concurrent to the expense date for the trigger Part B Physician/Supplier claim line.
- **Establish** the episode window as follows:
    - Establish the episode trigger date as the expense date of the trigger claim line identified in the "Trigger an episode" bullet above.
    - Establish the episode start date as 30 days prior to the episode trigger date.
    - Establish the episode end date as 90 days after the episode trigger date.

Once a Non-Emergent CABG episode is triggered, the episode is placed into one of the episode sub-groups to enable meaningful clinical comparisons. Sub-groups represent more granular, mutually exclusive patient populations defined by clinical criteria (e.g., information available on the beneficiary's claims at the time of the trigger). Sub-groups are useful in ensuring clinical comparability so that the corresponding cost measure fairly compares clinicians with a similar patient case-mix.

Codes used to define the sub-groups can be found in the "Sub_Groups_Details" tab of the Non-Emergent CABG Measure Codes List file. This cost measure has two sub-groups:

- CABG with Concurrent Aortic Valve Replacement
- Isolated CABG

[9] Post-operative modifier codes indicate that a clinician billing the service was not involved in the main procedure but was involved in the post-operative care for that procedure, and as such the post-operative clinician would not be responsible for the trigger.

A.2 Attribute Episodes to a Clinician

Once an episode has been triggered and defined, it is attributed to one or more clinicians of a specialty that is eligible for MIPS. Clinicians are identified by Taxpayer Identification Number (TIN) and National Provider Identifier (NPI) pairs (TIN-NPI), and clinician groups are identified by TIN. Only clinicians of a specialty that is eligible for MIPS or clinician groups where the triggering clinician is of a specialty that is eligible for MIPS are attributed episodes. For codes relevant to this section, please see the "Attribution" tab of the Non-Emergent CABG Measure Codes List.

The steps for attributing a Non-Emergent CABG episode are as follows:

- **Identify** claim lines with positive standardized payment for any trigger codes that occur during the IP stay concurrent with the trigger.
- **Designate** a TIN-NPI as a main clinician if the following conditions are met:
    - No assistant modifier code is found on one or more claim lines billed by the clinician.
    - No exclusion modifier code is found on the same claim line.
- **Designate** a TIN-NPI as an assistant clinician if the following conditions are met:
    - The TIN-NPI was not designated as a main clinician.
    - An assistant modifier code is found.
    - No exclusion modifier code is found.
- **Attribute** an episode to any TIN-NPI designated as a main or assistant clinician.
- **Attribute** episodes to the TIN by aggregating all episodes attributed to NPIs that bill to that TIN. If the same episode is attributed to more than one NPI within a TIN, the episode is attributed only once to that TIN.

Future attribution rules may benefit from the implementation of patient relationship categories[10] and codes.[11] As required by section 101(f) of MACRA, CMS will consider how to incorporate the patient relationship categories into episode-based cost measurement methodology as clinicians and billing experts gain experience with them.[12]

A.3 Assign Costs to an Episode and Calculate Total Observed Episode Cost

Services, and their Medicare costs, are assigned to an episode only when clinically related to the attributed clinician's role in managing patient care during the episode. Assigned services may include treatment and diagnostic services, ancillary items, services directly related to treatment, and those furnished as a consequence of care (e.g., complications, readmissions, unplanned care, and emergency department visits). Unrelated services are not assigned to the

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[10] The MACRA Patient Relationship Categories aim to distinguish the relationship and responsibility of a clinician with a patient at the time of furnishing an item or service, thereby facilitating the attribution of patients and episodes to one or more clinicians for purposes of measure score calculations. For more information on Patient Relationship Categories, please refer to the Patient Relationship Categories and codes operational list. (https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/CMS-Patient-Relationship-Categories-and-Codes.pdf)

[11] The MACRA Patient Relationship Codes are Healthcare Common Procedure Coding System (HCPCS) Level II modifier codes that clinicians report on claims to identify their patient relationship category. For the Patient Relationship Codes, please see Table 27 of the CY 2018 Physician Fee Schedule final rule. (https://www.federalregister.gov/d/2017-23953/p-2203)

[12] For more information on the Patient Relationship Categories and Codes, please download the Patient Relationship Categories and Codes FAQ. (https://qpp-cm-prod-content.s3.amazonaws.com/uploads/236/Patient-Relationship-Categories-and-Codes-webinar-FAQ.pdf)

episode. For example, the cost of care for a chronic condition that occurs during the episode but is not related to the clinical management of the patient relative to the CABG procedure would not be assigned.

To ensure that only clinically related services are included, services during the episode window are assigned to the episode based on a series of service assignment rules, which are listed in the "Service_Assignment" tab of the Non-Emergent CABG Measure Codes List file.

For the Non-Emergent CABG episode group, only services performed in the following service categories are considered for assignment to the episode costs:

- Emergency Department (ED)
- Outpatient (OP) Facility and Clinician Services
- IP - Medical
- IP - Surgical
- Inpatient Rehabilitation Facility (IRF) - Medical
- Durable Medical Equipment, Prosthetics, Orthotics, and Supplies (DME)
- Home Health (HH)

In addition to service category, service assignment rules may be modified based on the service category in which the service is performed, as listed above. Service assignment rules may also be defined based on specific (i) service information alone or service information combined with diagnosis information, (ii) prior incidence of service, and/or (iii) the timing of the service, as detailed below.

- Services may be assigned to the episode based on the following service information combinations:
    - High level service code alone
    - High level service code combined with first three digits of the International Classification of Diseases – Tenth Revision diagnosis code (3-digit ICD-10 diagnosis code)
    - High level service code combined with full ICD-10 diagnosis code
    - High level service code combined with more specific service code
    - High level service code combined with more specific service code and with 3-digit ICD-10 diagnosis code
    - High level service code combined with more specific service code and with full ICD-10 diagnosis code
- Assigned services may be further refined by prior incidence of service or diagnosis:
    - Services may be assigned unconditionally (regardless of prior incidence of the service in patient's recent claims history)
    - Services may be assigned if newly occurring
    - Services may be assigned in combination with a diagnosis if the service is newly occurring
    - Services may be assigned in combination with a diagnosis if the diagnosis is newly occurring
    - Services may be assigned in combination with a diagnosis if either the service OR the diagnosis are newly occurring
    - Services may be assigned in combination with a diagnosis if both the service AND the diagnosis are newly occurring
- Services as defined by the applicable combinations and incidence options above may be assigned with only specific timing:

- Services may be assigned based on whether or not the service occurs before the trigger (in the pre-trigger window) and/or after the trigger (in the post-trigger window)
- Services may be assigned only if they occur within a particular number of days from the trigger within the episode window, and services may be assigned for a period shorter than the full duration of the episode window

The steps for assigning costs are as follows:

- **Identify** all services on claims with positive standardized payment that occur within the episode window.
- **Assign** identified services to the episode based on the types of service assignment rules described above.
- **Assign** skilled nursing facility (SNF) claims based on the following criteria:
  - Identify SNF claims for which both (i) the SNF claim's qualifying IP stay is the IP stay during which the trigger occurs, if an IP stay is found, and (ii) the SNF claim occurs during the episode window.
  - For those identified SNF claims, assign the percentage of the claim amount proportional to the portion of the SNF claim that overlaps with the episode window.
- **Assign** all claims with trigger codes occurring during the trigger day/stay.
- **Assign** all physician claims and DME claims occurring during concurrent IP stay.
- **Assign** all inpatient E&M claims during IP stays in the post-trigger window assigned to episode.
- **Sum** standardized Medicare allowed amounts for all claims assigned to each episode to obtain the standardized total observed episode cost.

Service Assignment Example

- Clinician A performs a CABG procedure for Patient K. This service triggers a Non-Emergent CABG episode, which is attributed to Clinician A.
- Clinician B provides care for a sternal wound infection for the patient, which is considered a clinically related service, during the episode window.
- Because care for a sternal wound infection during the episode window is considered to be clinically related to the initial CABG procedure, the cost of the care for a sternal wound infection will be assigned to Clinician A's Non-Emergent CABG episode.

A.4 Exclude Episodes

Before measure calculation, episode exclusions are applied to remove certain episodes from measure score calculation. Certain exclusions are applied across all procedural episode groups, and other exclusions are specific to this measure, based on consideration of the clinical characteristics of a homogenous patient cohort. The measure-specific exclusions are listed in the "Exclusions" and "Exclusions_Details" tabs in the Non-Emergent CABG Measure Codes List file.

The steps for episode exclusion are as follows:

- **Exclude** episodes from measure calculation if:
  - The beneficiary has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the trigger day.
  - The beneficiary was not enrolled in Medicare Parts A and B for the entirety of the lookback period plus episode window, or was enrolled in Part C for any part of the lookback plus episode window.
  - No main clinician is attributed the episode.
  - The beneficiary's date of birth is missing.
  - The beneficiary's death date occurred before the episode ended.
  - The episode trigger claim was not performed in an IP hospital based on its place of service.
  - The IP facility is not a short-term stay acute hospital as defined by subsection (d) when an IP stay concurrent with the trigger is found.[13]
- **Apply** measure-specific exclusions, which check the beneficiary's Medicare claims history for certain billing codes (as specified in the Measure Codes List file) that indicate the presence of a particular procedure, condition, or characteristic.

A.5 Estimate Expected Costs through Risk Adjustment

Risk adjustment is used to estimate expected episode costs in recognition of the different levels of care beneficiaries may require due to comorbidities, disability, age, and other risk factors. The risk adjustment model includes variables from the CMS Hierarchical Condition Category Version 22 (CMS-HCC V22) 2016 Risk Adjustment Model,[14] as well as other standard risk adjustors (e.g., beneficiary age) and variables for clinical factors that may be outside the attributed clinician's reasonable influence. A full list of risk adjustment variables can be found in the "RA" and "RA_Details" tabs of the Non-Emergent CABG Measure Codes List file.

Steps for defining risk adjustment variables and estimating the risk adjustment model are as follows:

- **Define** HCC and episode group-specific risk adjustors using service and diagnosis information found on the beneficiary's Medicare claims history in the 120-day period prior to the episode trigger day (or the timing specified in the "RA_Details" tab of the Measure Codes List file) for certain billing codes that indicate the presence of a procedure, condition, or characteristic.
- **Define** other risk adjustors that rely upon Medicare beneficiary enrollment and assessment data as follows:

[13] Only stays at IP facilities that are paid under a short-term stay acute hospital as defined by subsection (d) will be included. 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. For details on the identification of these hospitals, please refer to the CCN definitions for Short-term (General and Specialty) Hospitals facility types in Section 2779A1 of Chapter 2 of the CMS State Operation Manual. (https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/som107c02.pdf)

[14] CMS uses an HCC risk adjustment model to calculate risk scores. The HCC model ranks diagnoses into categories that represent conditions with similar cost patterns. Higher categories represent higher predicted healthcare costs, resulting in higher risk scores. There are over 9,500 ICD-10-CM codes that map to one or more of the 79 HCC codes included in the CMS-HCC V22 model.

    - Identify beneficiaries who are originally “Disabled without end-stage renal disease (ESRD)” or “Disabled with ESRD” using the original reason for joining Medicare field in the Medicare beneficiary enrollment database (EDB).
    - Identify beneficiaries with ESRD if their enrollment indicates ESRD coverage, ESRD dialysis, or kidney transplant in the Medicare beneficiary enrollment database in the lookback period.
    - Identify beneficiaries who have spent at least 90 days in a long-term care institution without having been discharged to the community for 14 days, based on MDS assessment data.
- **Drop** risk adjustors that are defined for less than 15 episodes nationally for each sub-group to avoid using very small samples.
- **Categorize** beneficiaries into age ranges using their date of birth information in the Medicare beneficiary enrollment database. If an age range has a cell count less than 15, collapse this in the next adjacent age range category towards the reference category (65-69).
- **Include** the MS-DRG of the episode’s trigger IP stay, if an IP stay is found, as a categorical risk adjustor.
- **Run** an ordinary least squares (OLS) regression model to estimate the relationship between all the risk adjustment variables and the dependent variable, the standardized observed episode cost, to obtain the risk-adjusted expected episode cost. A separate OLS regression is run for each episode sub-group nationally.
- **Winsorize**[15] expected costs as follows.
    - Assign the value of the 0.5th percentile to all expected episode costs below the 0.5th percentile.
    - Renormalize[16] values by multiplying *each episode's winsorized expected cost* by *the sub-group's average expected cost*, and dividing the resultant value by *the sub-group's average winsorized expected cost*.
- **Exclude**[17] episodes with outliers as follows. This step is performed separately for each sub-group.
    - Calculate each episode's residual as the difference between *the re-normalized, winsorized expected cost computed above* and *the observed cost*.
    - Exclude episodes with residuals below the 1st percentile or above the 99th percentile of the residual distribution.
    - Renormalize the resultant expected cost values by multiplying *each episode’s winsorized expected costs after excluding outliers* by *the sub-group's average standardized observed cost across all episodes originally in the risk adjustment model*, and dividing by *the sub-group's average winsorized expected cost after excluding outliers*.

[15] Winsorization aims to limit the effects of extreme values on expected costs. Winsorization is a statistical transformation that limits extreme values in data to reduce the effect of possible outliers. Winsorization of the lower end of the distribution (i.e., bottom coding) involves setting extremely low predicted values below a predetermined limit to be equal to that predetermined limit.

[16] Renormalization is performed after adjustments are made to the episode’s expected cost, such as bottom-coding or residual outlier exclusion. This process multiplies the adjusted values by a scalar ratio to ensure that the resulting average is equal to the average of the original value.

[17] This step excludes episodes based on outlier residual values from the calculation and renormalizes the resultant values to maintain a consistent average episode cost level.

A.6 Calculate Measure Scores

Measure scores are calculated for a TIN or TIN-NPI as follows:

- Calculate the ratio of observed to expected episode cost for *each* episode attributed to the clinician/clinician group.
- Calculate the *average* ratio of observed to expected episode cost across the *total* number of episodes attributed to the clinician/clinician group.
- Multiply the average ratio of observed to expected episode cost by the national average observed episode cost to generate a dollar figure representing risk-adjusted average episode cost.

The clinician-level or clinician group practice-level risk-adjusted cost for any attributed clinician (or clinician group practice) "j" can be represented mathematically as:

$$Measure\ Score_j = \left(\frac{1}{n_j}\sum_{i \in I_j}\frac{Y_{ij}}{\widehat{Y_{ij}}}\right)\left(\frac{1}{n}\sum_{j}\sum_{i \in \{I_j\}} Y_{ij}\right)$$

where:

Y_{ij}	is the standardized payment for episode *i* and attributed clinician (or clinician group practice) *j*
$\widehat{Y_{ij}}$	is the expected standardized payment for episode *i* and clinician (or clinician group practice) *j*, as predicted from risk adjustment
n_j	is the number of episodes for clinician (or clinician group practice) *j*
n	is the total number of TIN/TIN-NPI attributed episodes nationally
$i \epsilon \{I_j\}$	is all episodes *i* in the set of episodes attributed to clinician (or clinician group practice) *j*

A diagram demonstrating a visual depiction of an example measure calculation can be found in Appendix B.

A lower measure score indicates that the observed episode costs are lower than or similar to expected costs for the care provided for the particular patients and episodes included in the calculation, whereas a higher measure score indicates that the observed episode costs are higher than expected for the care provided for the particular patients and episodes included in the calculation.

Appendix B. Measure Calculation Example

The diagram below provides an illustrated example of measure calculation, using an example measure where the clinician has only four attributed episodes for demonstration purposes. For more details on measure calculation, please refer to Section A.6.