

Asthma/Chronic Obstructive Pulmonary Disease (COPD) Measure

Cost Measure Methodology

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1.0 Introduction

This document details the methodology for the Asthma/Chronic Obstructive Pulmonary Disease (COPD) measure. It is part of a set of documents that together contain the measure specifications:

- Cost Measure Methodology document (this document);
- Cost Measure Methodology Appendices document, which contains additional details on the measure construction framework; and
- Measure Codes List file, which contains the medical codes used in the measure.

1.1 Measure Name

Asthma/COPD 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, the term “cost” generally means the standardized¹ Medicare allowed amount,² and claims data from Medicare Parts A, B, and D³ are used to construct this episode-based cost measure.

The Asthma/COPD episode-based cost measure evaluates a clinician’s or clinician group’s risk-adjusted cost to Medicare for patients receiving medical care to manage and treat asthma or COPD. This chronic condition measure includes the costs of services that are clinically related to the attributed clinician’s role in managing care during an Asthma/COPD episode.

1.3 Measure Rationale

Research has shown that both asthma and COPD are highly prevalent, costly conditions within the United States population, and their overall disease burden and financial impact continue to

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 or other payment adjustments such as those for teaching hospitals. For more information, please refer to the “CMS Part A and Part B Price (Payment) Standardization - Basics” and “CMS Part A and Part B Price (Payment) Standardization - Detailed Methods” documents posted on the [CMS Price \(Payment\) Standardization Overview](https://www.resdac.org/articles/cms-price-payment-standardization-overview) page (<https://www.resdac.org/articles/cms-price-payment-standardization-overview>).

Claim payments from Part D are payment standardized to allow resource use comparisons for providers who prescribe the same drug, even if the drug products are covered under varying Part D plans, produced by different manufacturers, or dispensed by separate pharmacies. For more information, please refer to the “CMS Part D Price (Payment) Standardization” document posted on the [CMS Price \(Payment\) Standardization Overview](https://www.resdac.org/articles/cms-price-payment-standardization-overview) page. (<https://www.resdac.org/articles/cms-price-payment-standardization-overview>).

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.

³ Part D branded drug costs are also adjusted to account for post-point of sale drug rebates; more information can be found in the Methodology for Rebates in Part D Standardized Amounts on the [MACRA Feedback Page](https://www.cms.gov/Medicare/Quality-Payment-Program/Quality-Payment-Program/Give-Feedback) (<https://www.cms.gov/Medicare/Quality-Payment-Program/Quality-Payment-Program/Give-Feedback>).

rise.^{4,5} COPD is the third leading cause of death in the United States.⁶ In 2014, 15.7 million Americans were diagnosed with COPD, yet this number could be an underestimation since many people with low lung function are not aware they have COPD.⁷ The Centers for Disease Control and Prevention estimated that COPD-related costs grew by nearly \$17 billion in the past decade in the United States, equating to an overall increase of 53%.^{8,9} Specifically, Medicare paid 51% of these COPD-related costs.¹⁰ One study found that the mean total health care costs were \$20,500 higher among Medicare patients with COPD compared to those without COPD.¹¹ Among the many factors that contribute to rising health care costs associated with COPD, increasing hospitalization and readmission rates are among the highest cost drivers.¹² COPD is the fourth leading cause of 30-day readmissions, where nearly one-fifth of patients hospitalized for an acute exacerbation of COPD were readmitted within 30 days of discharge.^{13,14, 15}

More than 25 million Americans live with asthma,¹⁶ and it has been estimated that 5% of all Medicare patients have an asthma diagnosis.¹⁷ The total cost incurred for treatment of asthma was \$81.9 billion in 2013.¹⁸ Recent estimates attribute more than 10 million lost work days among employed adults and nearly 2 million emergency department (ED) visits over a single year to asthma.¹⁹ Much like COPD, the burden of asthma falls heavily on adults aged 65 years and older, who have the highest mortality rate for the condition compared to any other age group.

⁴ Centers for Disease Control and Prevention. "Basics About COPD." <https://www.cdc.gov/copd/basics-about.html>.

⁵ Asthma and Allergy Foundation of America. "Cost of Asthma on Society." <https://www.aafa.org/cost-of-asthma-on-society/>.

⁶ American Lung Association. "How Serious Is COPD." <https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/copd/learn-about-copd/how-serious-is-copd.html>.

⁷ Centers for Disease Control and Prevention. "Basics About COPD." <https://www.cdc.gov/copd/basics-about.html>.

⁸ Ford, Earl S., Louise B. Murphy, Olga Khavjou, Wayne H. Giles, James B. Holt, and Janet B. Croft. "Total and State-Specific Medical and Absenteeism Costs of COPD among Adults Aged 18 Years in the United States for 2010 and Projections Through 2020." *CHEST* 147, no. 1 (2015): 31-45.

⁹ Centers for Disease Control and Prevention. "COPD Costs." <https://www.cdc.gov/copd/infographics/copd-costs.html>.

¹⁰ Ibid.

¹¹ Menzin, Joseph, Luke Boulanger, Jeno Marton, Lisa Guadagno, Homa Dastani, Riad Dirani, Amy Phillips, and Hemal Shah. "The Economic Burden of Chronic Obstructive Pulmonary Disease (COPD) in a U.S. Medicare Population." *Respiratory Medicine* 102, no. 9 (2008): 1248-56.

¹² Parikh, Raj, Trushil G. Shah, and Rajive Tandon. "COPD Exacerbation Care Bundle Improves Standard of Care, Length of Stay, and Readmission Rates." *International Journal of Chronic Obstructive Pulmonary Disease* 11 (2016): 577-83.

¹³ Ibid.

¹⁴ Jencks, Stephen F., Mark V. Williams, and Eric A. Coleman. "Rehospitalizations Among Patients in the Medicare Fee-for-Service Program." *The New England Journal of Medicine* 360, no. 14 (2009): 1418-28.

¹⁵ Ibid.

¹⁶ Asthma and Allergy Foundation of America. "Asthma Facts and Figures." <https://www.aafa.org/asthma-facts/>.

¹⁷ Centers for Medicare & Medicaid Services. "Health Disparities in the Medicare Population: Asthma." <https://www.cms.gov/files/document/2016-05-cms-omh-data-snapshot-asthma-508pdf>.

¹⁸ Nurmagambetov, Tursynbek, Robin Kuwahara, and Paul Garbe. "The Economic Burden of Asthma in the United States, 2008–2013." *Annals of the American Thoracic Society* 15, no. 3 (2018): 348-56.

¹⁹ American Lung Association. "Asthma in Adults Fact Sheet." <https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/learn-about-asthma/asthma-adults-facts-sheet.html>.

Despite the differences in etiology, symptoms, and responses to therapy between asthma and COPD, these diseases overlap in disease presentation and pathophysiologic characteristics.^{20,21} There is also a substantial 15 to 20% overlap in the reported prevalence of comorbid cases of asthma and COPD.²² This overlapping relationship places an important role on clinicians to follow appropriate guidelines and utilize proper management strategies to classify and treat patients accurately.²³ Given the high impact in terms of patient population and Medicare spending, the Asthma/COPD measure represents an opportunity for improvement on overall cost performance.

The Asthma/COPD episode-based cost measure was recommended for development by an expert clinician committee—the Chronic Condition and Disease Management Clinical Subcommittee—because of its high impact in terms of patient population, clinician coverage, and Medicare spending, and the opportunity to build a complex, yet feasible, chronic condition measure that would address a condition not captured by other cost measures. Based on the initial recommendations from the Clinical Subcommittee, the subsequent Asthma/COPD Clinician Expert Workgroup provided extensive, detailed input on this measure.

1.4 Measure Numerator

The measure numerator is the weighted average ratio of the winsorized²⁴ annualized standardized observed cost to the annualized expected²⁵ cost for all Asthma/COPD episodes attributed to a clinician, where each ratio is weighted by each episode's number of days assigned to a clinician. This sum is then multiplied by the national average winsorized annualized observed episode cost to generate a dollar figure.

1.5 Measure Denominator

The measure denominator is the total number of days from Asthma/COPD episodes assigned to the clinician across all patients.

1.6 Data Sources

The Asthma/COPD measure uses the following data sources:

- Medicare Parts A, B, and D claims data from the Common Working File (CWF),
- Enrollment Database (EDB), and
- Long Term Care Minimum Data Set (LTC MDS).²⁶

²⁰ Guarascio, Anthony J., Shauntá M. Ray, Christopher K. Finch, and Timothy H. Self. "The Clinical and Economic Burden of Chronic Obstructive Pulmonary Disease in the USA." *ClinicoEconomics and Outcomes Research* 5 (2013): 235-45.

²¹ Cukic, Vesna, Vladimir Lovre, Dejan Dragisic, and Aida Ustamujic. "Asthma and Chronic Obstructive Pulmonary Disease (COPD) - Differences and Similarities." *Materia Socio-Medica* 24, no. 2 (2012): 100-05.

²² Global Initiative for Chronic Obstructive Lung Disease. "Diagnosis of Diseases of Chronic Airflow Limitation: Asthma, COPD, and Asthma-Copd Overlap Syndrome (ACOS)." https://goldcopd.org/wp-content/uploads/2016/04/GOLD_ACOS_2015.pdf.

²³ Guarascio, Anthony J., Shauntá M. Ray, Christopher K. Finch, and Timothy H. Self. "The Clinical and Economic Burden of Chronic Obstructive Pulmonary Disease in the USA." *ClinicoEconomics and Outcomes Research* 5 (2013): 235-45.

²⁴ For information on how costs are winsorized, please refer to Section 4.7.

²⁵ Expected costs refer to costs predicted by the risk adjustment model. For more information on expected costs and risk adjustment, please refer to Section 4.7.

²⁶ For information on how LTC MDS data are used in risk adjustment, please refer to Section 4.5.

1.7 Care Settings

The Asthma/COPD measure focuses on the care provided by clinicians practicing in non-inpatient hospital settings for patients with asthma or COPD. The most frequent settings in which an Asthma/COPD episode is triggered include: Office, Skilled Nursing Facility (SNF), and Outpatient Hospital.

1.8 Cohort

The cohort for this cost measure consists of patients who are Medicare beneficiaries enrolled in Medicare fee-for-service that receive care for asthma or COPD.

The cohort for this cost measure is also further refined by the definition of the episode group and measure-specific exclusions (refer to Section 4).

2.0 Methodology Steps

There are 2 overarching processes in calculating chronic condition episode-based cost measure scores: episode construction (Steps 1-5) and measure calculation (Steps 6-8). This section provides a brief summary of these processes and Section 4 describes them in detail.

1. **Identify patients receiving care:** A trigger event identifies the start or continuation of a clinician group's management of a patient's chronic disease. A trigger event is identified by the occurrence of 2 Part B Physician/Supplier (Carrier) claims billed by the same clinician group practice within 180 days of one another. The pair of services must include a trigger claim and a confirming claim. The trigger claim is an initial evaluation and management (E&M) code for outpatient services along with a relevant chronic condition diagnosis. The confirming claim can be either another outpatient services E&M code with a relevant chronic condition diagnosis, or a condition-related Current Procedural Terminology/Healthcare Common Procedure Coding System (CPT/HCPCS) code with a relevant chronic condition diagnosis. Once a trigger event is identified, this opens a one-year attribution window from the point of the trigger claim, in which the patient's chronic disease care will be monitored by a clinician group.
2. **Identify the total length of care between a patient and a clinician group:** Once an attribution window is opened, it continues for 1 year unless there is a service that demonstrates a continuing care relationship, also known as a reaffirming claim. This service is billed during an open attribution window (from Step 1) by the same clinician group that billed the trigger event, and reaffirms and extends a clinician group's responsibility for managing a patient's chronic disease. Similar to a confirming claim, a reaffirming claim is either an outpatient services E&M code with a relevant chronic condition diagnosis, or a condition-related CPT/HCPCS code with a relevant chronic condition diagnosis.²⁷ After a reaffirming claim is identified, the attribution window is extended by 1 year from the point of each reaffirming claim billed during an open attribution window. The total attribution window begins with the trigger claim and concludes 1 year after the final reaffirming claim. Therefore, the total attribution window can span multiple years and vary in length for different patients. This requires that the total attribution window is measured incrementally and periodically across multiple measurement periods.
3. **Define an episode:** Episodes are segments of the total attribution window that are counted in a particular measurement period, allowing clinicians to have their costs for Asthma/COPD episodes assessed for that year. Episodes are assigned to a clinician group (identified by Tax Identification Number [TIN]) or individual clinicians (identified by combination of TIN and National Provider Identifier [TIN-NPI]), and can vary in length between one year (365 days) and two years minus one day (729 days). Episodes are assessed in the measurement period in which they conclude and only attribute days not previously measured in preceding measurement periods, so there is no double counting of episode costs. After episodes are constructed, they are placed into more granular, mutually exclusive and exhaustive sub-groups based on clinical criteria to enable meaningful clinical comparisons.
4. **Attribute the episode to the clinician group and clinician(s):** The episode is attributed to the clinician group that bills the trigger and confirming claims for the total attribution window.

²⁷ While a trigger event requires two claims, a single reaffirming claim is needed to extend a clinician group's responsibility for managing a patient's chronic disease. This is because the Asthma/COPD workgroup favored a less strict reaffirming algorithm, since they felt that once a clinician-patient relationship was established, a single reaffirming claim would be sufficient to extend the attribution window.

To attribute the episode to an individual clinician, we identify any clinician within the attributed clinician group who plays a substantial role in the care for the patient. This is identified as a clinician billing at least 30% of outpatient services E&M codes with a relevant chronic condition diagnosis and/or condition-related CPT/HCPSC codes with a relevant chronic condition diagnosis on Part B Physician/Supplier claim lines during the episode. There are also additional checks to ensure that clinicians are not attributed to an episode before they have their first encounter with the patient and that we capture appropriate specialties through prescription billing patterns.

5. **Assign costs to the episode and calculate the episode annualized observed cost:** Services that are clinically related to the care and management of a patient's chronic disease that occur during the episode are included in the measure. The standardized cost of the assigned services is summed and averaged across the number of days in an episode. This average daily cost is then multiplied by 365 to determine each episode's annualized standardized observed cost.
6. **Exclude episodes:** Exclusions remove unique groups of patients or episodes from cost measure calculation in cases where it may be impractical or unfair to compare the costs of caring for these patients to the costs of caring for the cohort at large.
7. **Calculate the annualized expected cost for risk adjustment:** Risk adjustment predicts the expected costs by adjusting for factors outside of the clinician's or clinician group's reasonable influence (e.g., patient age, comorbidities, dual Medicare and Medicaid eligibility status, and other factors). The episode group's annualized observed costs are winsorized at the 98th percentile for each model to handle extreme observations. A regression is then run using the risk adjustment variables as covariates to estimate the expected cost of each episode. Further statistical techniques are applied to reduce the effects of extreme outliers on measure scores.
8. **Calculate the measure score:** For each episode, the ratio of winsorized annualized standardized observed cost to annualized expected cost (both of which are from Step 7) is calculated. The measure is calculated as a weighted average of these ratios across all of a clinician's or clinician group's attributed episodes, where the weighting is each episode's number of assigned days. The weighted average episode cost ratio is then multiplied by the national average winsorized annualized observed episode cost to generate a dollar figure for the cost measure score.

3.0 Measure Specifications Quick Reference

This page provides a quick, at-a-glance reference for the Asthma/COPD measure specifications. More details on each component can be found in Section 4, and the full list of codes and logic used to define each component can be found within the Asthma/COPD Measure Codes List file.

Episode Window: During what time period are costs measured?

An episode is a segment of time during which clinicians or clinician groups are assessed for the care that they provide to a patient with asthma or COPD.

- The episode window length for the Asthma/COPD measure is between 1 year (365 days) and 2 years minus 1 day (729 days), and can vary in length across patients.

Triggers: How does the measure identify the patient cohort and start of care?

- Patients receiving medical care for treatment of their asthma or COPD are included in the measure.
- The start or continuation of a clinician group's management of a patient's asthma or COPD is identified by the appearance of a pair of services within 180 days of one another. Both services must have one of 35 International Statistical Classification of Diseases and Related Health Problems 10th Revision Clinical Modification (ICD-10-CM) diagnosis codes for asthma or COPD.
- This pair of services includes (i) an initial outpatient services E&M code, and (ii) either:
 - Another outpatient services E&M code, or
 - A condition-related CPT/HCPCS code.

Sub-Group: Is the measure stratified into smaller patient cohorts?

1. Asthma
2. COPD
3. Both Asthma and COPD

Service Assignment: Which asthma- or COPD-related costs are included in the measure?

Assigned services fall within the following 14 clinical themes:

- Asthma/COPD exacerbation; asthma/COPD chronic care; lung surgery; nebulizers and home oxygen; arrhythmias; sepsis; non-specific symptoms
- Pulmonary imaging; home health, physical therapy, occupational therapy, and pulmonary rehabilitation
- Other respiratory complications; other post-acute care
- Outpatient medications for chronic care of asthma/COPD; outpatient medications for asthma/COPD exacerbations; outpatient medications for tobacco cessation

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

- Standard risk adjustors, including 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, patient age category, patient disability status, patient end-stage renal disease (ESRD) status, and recent use of institutional long-term care.
- Chronic condition measure risk adjustors, including patient dual eligibility status and HCC count.

- Risk adjusters for factors specific to this condition, including but not limited to patients who had obstructive sleep apnea, used home oxygen, and had prior intubation for respiratory issue.²⁸
- A separate linear regression is run for each sub-group and Medicare Part D enrollment status combination to ensure fair comparison. The episode group's annualized observed costs are winsorized at the 98th percentile prior to the regression for each model to handle extreme observations.

Exclusions: Which populations are excluded from the measure?

- Standard exclusions to ensure data completeness:
 - The patient has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the episode window.
 - The patient 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.
 - The patient was not found in the Medicare EDB.
 - The patient's death date occurred before the episode end date.
 - The patient resided outside the United States or its territories during the episode window.
 - The patient has an episode window shorter than one year.
- Measure-specific exclusions including but not limited to patients with cystic fibrosis, sickle cell disease, prior lung cancer, and prior lung surgery.²⁹

²⁸ For the full list of standard, chronic condition, and measure-specific risk adjustment variables, please reference the "RA" and "RA_Details" tabs of the Asthma/COPD Measure Codes List file.

²⁹ For the full list of measure-specific exclusions, please reference the "Exclusions" and "Exclusions_Details" tabs of the Asthma/COPD Measure Codes List file.

4.0 Detailed Measure Methodology

This section contains the technical details for the 2 overarching processes in calculating the Asthma/COPD cost measure in more detail: Sections 4.1 through 4.5 describe episode construction and Sections 4.6 through 4.8 describe measure calculation.

4.1 Identify Patients Receiving Asthma or COPD Care

A **trigger event** is used to indicate the start of a clinician group's management of a patient's asthma or COPD and is identified by the occurrence of 2 Part B Physician/Supplier claims billed by the same clinician group practice. There are 2 different sets of CPT/HCPCS codes used to identify a trigger event: outpatient services E&M codes and condition-related CPT/HCPCS codes.

- Outpatient services E&M codes are a specific set of E&M codes for clinician visits in the outpatient setting, clinician's office, nursing facility, or assisted living. The services fall into the following clinical classification categories:
 - Other diagnostic procedures (interview, evaluation, consultation)
- Condition-related CPT/HCPCS codes are procedure codes related to the treatment of asthma or COPD. The services fall into the following clinical classification categories:
 - Laboratory - Chemistry and Hematology
 - Medications (injections, infusions, and other forms)
 - Other diagnostic procedures of respiratory tract and mediastinum
 - Other diagnostic procedures on lung and bronchus
 - Other respiratory therapy
 - Radioisotope pulmonary scan
 - Routine chest X-ray

To identify a trigger event, the following 2 claims must be billed within 180 days of one another:

- A **trigger claim**, which is an outpatient services E&M code with a relevant asthma or COPD diagnosis;
- A **confirming claim**, which is either (i) another outpatient services E&M code with a relevant asthma or COPD diagnosis, or (ii) a condition-related CPT/HCPCS code with a relevant asthma or COPD diagnosis.

See the "Triggers_EM" and "Triggers_CPT_HCPCS" tabs of the Asthma/COPD Measure Codes List file for the list of the CPT/HCPCS codes that identify outpatient services E&M codes and condition-related CPT/HCPCS codes, respectively. Additionally, see the "Triggers_DGN" tab of the Asthma/COPD Measure Codes List file for the list of asthma or COPD diagnoses.

Once the trigger event is identified, this opens an **attribution window**, which is a year-long time period that begins on the date of the trigger claim. The attribution window defines a time period during which the patient's asthma or COPD care will be monitored by a clinician group.

Appendix A contains an illustration of the relationship between a trigger event and an attribution window.

4.2 Identify the Total Length of Care Between a Patient and a Clinician Group

When the beginning of the clinician-patient relationship is identified, there might be evidence of a continuation of this relationship, as identified by reaffirming claims. A **reaffirming claim** is a service billed during an open attribution window by the same clinician group that billed the

trigger event, and it reaffirms and extends a clinician group's responsibility for managing a patient's asthma or COPD.

A reaffirming claim is either:

- An outpatient services E&M code with a relevant asthma or COPD diagnosis, or
- A condition-related CPT/HCPCS code with a relevant asthma or COPD diagnosis.

Each time a reaffirming claim is identified during an open attribution window, the attribution window will be extended by 1 year from the point of the reaffirming claim. The resulting overall time period of responsibility is defined as the **total attribution window**, which begins with the trigger claim and concludes 1 year after the final reaffirming claim. Therefore, the total attribution window can span multiple years and vary in length for different patients. Appendix A contains an illustration of the relationship between a trigger event, reaffirming claims, and a total attribution window.

4.3 Define an Episode

Once the total attribution window has been constructed, it is divided into segments of time, also known as episodes. Episodes allow the measure to be calculated for a given measurement period.³⁰ An **episode** is defined, at a minimum, as a one-year segment of the total attribution window that is assessed in the measurement period in which it ends. Clinicians or clinician groups are measured on a patient at the end of the calendar year if there are at least 365 days' worth of claims data that has not previously been assessed or when the total attribution window ends, ensuring that costs are only assessed once. The episode window lengths may vary depending on the length of the total attribution window and the number of days that have not been assessed in preceding measurement periods.

After the episode windows are constructed, the number of assigned days for each episode is determined and used as a weighting factor in the measure score calculation step. This weighting is done to ensure fair comparison across episodes, where cost is effectively scaled respective to the episode length to allow like comparisons between episodes of similar length. Only days not previously measured in preceding episodes are assigned to an episode. Appendix A contains a simplified example of episode construction, while Appendix C provides a more detailed illustration of episode construction and assignment of days.

1. 365-day episode window, where there are no reaffirming claims during the year-long total attribution window
 - The episode **start date** is set as the start date of the total attribution window.
 - The episode **end date** is set as 365 days after the episode start date.
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.
2. 366- to 729-day episode window, where reaffirming claims extend the total attribution window to greater than one year
 - The episode **start date** is set as the start date of the total attribution window.
 - The episode **end date** is set as either:
 - The end of the total attribution window (which is 366 to 729 days after the episode start date), if the total attribution window ends by December 31 of the next calendar year;

³⁰ A measurement period is a static year-long period (calendar year) in which a clinician or clinician group will be measured.

- December 31 of the next full calendar year (which is 366 to 729 days after the episode start date), if the total attribution window extends beyond December 31 of the next calendar year.
- **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.
- 3. 365-day episode window, where reaffirming events have resulted in a total attribution window that is at least two years in length that can be split into 365-day segments
 - The episode **start date** is set as the beginning of a new calendar year (January 1) if it is a subsequent episode with at least 365 days' worth of claims data not captured in a preceding measurement period.
 - The episode **end date** is set as 365 days after the episode start date, at the end of that calendar year (December 31).
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.
- 4. 365-day episode window, where the total attribution window concludes after a segment was measured in the previous measurement period
 - The episode **start date** is set as 365 days prior to the total attribution window end date if the remaining number of assigned days in the total attribution window is less than 365 days.
 - The episode **end date** is set as the end date of the total attribution window.
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days is smaller than the number of days in the episode, since the episode window would partially overlap with the preceding episode window. Only days not previously measured are assigned to the episode. This is done to ensure there is no double counting of episode costs.

Once an Asthma/COPD episode window is defined, the episode is placed into one of the episode sub-groups to enable meaningful clinical comparisons. Sub-groups represent more granular, mutually exclusive and exhaustive patient populations defined by clinical criteria collected from claims found during a year of the patient's data. Sub-groups are useful in ensuring clinical comparability so that the corresponding cost measure fairly compares clinicians with a similar patient case-mix.

Appendix B contains an illustration of the Asthma/COPD sub-grouping methodology. Codes used to define the sub-groups can be found in the "Sub_Groups" and "Sub_Groups_Details" tabs of the Asthma/COPD Measure Codes List file. This cost measure has 3 sub-groups:

- Asthma
- COPD
- Both Asthma and COPD

4.4 Attribute the Episode to a Clinician Group or a Clinician

Once an episode has been defined, it is attributed to one or more clinicians of a specialty that is eligible for MIPS. The episodes are attributed to clinician groups, who are identified by their unique TIN, and individual clinicians, who are identified by their TIN and NPI pair (TIN-NPI). For codes relevant to this section, please see the "Attribution" tab of the Asthma/COPD Measure Codes List file.

TIN level attribution: An episode is attributed to the clinician group that billed the trigger event (trigger and confirming claims) for the total attribution window. The clinically related costs from the total number of assigned days are attributed to that clinician group.

TIN-NPI level attribution: An episode is attributed to any clinician within the attributed clinician group that billed at least 30% of outpatient services E&M codes with a relevant asthma or COPD diagnosis and/or condition-related CPT/HCPCS codes with a relevant asthma or COPD diagnosis on Part B Physician/Supplier claim lines during the episode.³¹ The measure's attribution methodology also imposes additional checks to ensure that TIN-NPIs are appropriately attributed. Specifically, TIN-NPIs that meet the 30% threshold must have:

- Billed at least one outpatient services E&M code with a relevant asthma or COPD diagnosis or condition-related CPT/HCPCS code with a relevant asthma or COPD diagnosis within 1 year prior to or on the episode start date; and
- Billed at least 2 condition-related prescriptions on different days to 2 different patients during the measurement period plus a one-year lookback period.

Future attribution rules may benefit from the implementation of patient relationship categories³² and codes.³³ As required by section 101(f) of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA), the Centers for Medicare & Medicaid Services (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.³⁴

4.5 Assign Costs to an Episode and Calculate Episode Annualized Observed Costs

Medicare Parts A, B, and D services, and their costs, are assigned to an episode only when clinically related to the management and treatment of the patient's asthma or COPD during the episode. Assigned services may include treatment and diagnostic services, 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 episode. For example, the cost of care for a procedure that occurs during the episode that is not clinically related to the management and treatment of the patient's asthma or COPD (i.e., a knee arthroplasty) would not be assigned to the episode.

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_AB" and "Service_Assignment_D" tabs of the Asthma/COPD Measure Codes List file.

³¹ For the diagram illustrating an example of attribution to a TIN and TIN-NPI, please refer to Appendix D.

³² 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>)

³³ The MACRA Patient Relationship Codes are 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>)

³⁴ For more information on the Patient Relationship Categories and Codes, please download the Patient Relationship Categories and Codes FAQ. (<https://gpp-cm-prod-content.s3.amazonaws.com/uploads/236/Patient-Relationship-Categories-and-Codes-webinar-FAQ.pdf>)

For the Asthma/COPD episode group, services performed in the following service categories are considered for assignment to the episode:

- Outpatient (OP) Facility and Clinician Services
- Emergency Department (ED)
- Inpatient (IP) – Medical
- IP – Surgical
- Inpatient Rehabilitation Facility (IRF)
- Long Term Care Hospital (LTCH)
- SNF³⁵
- Durable Medical Equipment, Prosthetics, Orthotics, and Supplies (DME)
- Home Health (HH)
- Part D drugs

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 can also be defined based on specific service information alone or service information combined with diagnosis information. Services may be assigned to the episode based on the following combinations:

- High level service code alone
- High level service code combined with first 3 digits of the 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

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** all trigger and reaffirming Part B Physician/Supplier claims occurring during the episode window.
- **Assign** all SNF stays based on the following criteria:
 - Identify SNF stays where both (i) the SNF stay's qualifying IP stay is assigned to episode and (ii) the SNF stay occurs during the episode window.
 - For those identified SNF stays, determine the number of days that overlap with the episode window; if the overlap is greater than 30 days, cap claim amount assigned to the episode at 30 days.
- **Assign** all IRF and LTCH stays based on the following criteria:
 - Identify IRF and LTCH stays for which (i) there is a preceding IP stay discharged within 7 days prior to the stay's start date, (ii) the preceding IP stay is assigned to the episode, and (iii) the IRF and LTCH stays occur during the episode window.

³⁵ Services performed in the IRF, LTCH, and SNF settings are assigned to an episode based on their association with the grouped IP stay.

- For those identified IRF and LTCH stays, determine the distribution of grouped claim cost across episodes and cap claim amount assigned to the episode at the 90th percentile of each observed cost distribution.³⁶
- **Assign** all inpatient E&M claims during IP stays assigned to episode.
- **Sum** the standardized Medicare allowed amounts for all claims assigned to each episode to obtain the total standardized episode observed cost.
- **Average** the total standardized episode observed cost over the number of days in the episode to get the episode average daily standardized observed cost.
- **Multiply** the episode average daily standardized observed cost by 365 to get the episode annualized standardized observed cost.

Service Assignment Example

- Clinician group A has been providing continuous care management for Patient K's asthma, and is attributed an episode with Patient K during the measurement period.
- Clinician group A performs a pulmonary stress test for Patient K during the episode window. Because the pulmonary stress test is considered a clinically related service, its costs will be assigned to Clinician group A's Asthma/COPD episode with Patient K.

4.6 Exclude Episodes

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

Episodes are excluded from the Asthma/COPD measure if they meet any of the following conditions:

- The patient has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the episode window;
- The patient was not enrolled in Medicare Parts A and B for the entirety of the 120-day lookback period plus episode window, or was enrolled in Part C for any part of the 120-day lookback period plus episode window;
- The patient is not found in the Medicare EDB;
- The patient has an episode window shorter than 1 year;
- The patient's death date occurred before the episode end date; or
- The patient resided outside the United States or its territories during the episode window.

4.7 Estimate Annualized Expected Costs For Risk Adjustment

Risk adjustment is used to estimate episode expected costs in recognition of the different levels of care patients 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

³⁶ Capping costs aims to limit the effects of extreme observed cost values on episode observed costs. Capping involves limiting the amount of claim costs that a provider can be assigned during an episode. For Asthma/COPD episodes with related LTCH and/or IRF costs, the value of the 90th percentile is assigned to all LTCH and IRF observed costs above the 90th percentile.

(CMS-HCC V22) 2016 Risk Adjustment Model,³⁷ as well as other standard risk adjustors (e.g., patient 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 the "RA_Details" tabs of the Asthma/COPD 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 patient's Medicare claims history in the 120-day period prior to the episode start date for certain billing codes that indicate the presence of a procedure, condition, or characteristic.
 - **Create** the following categories to identify HCC frequency as a marker of patient comorbidity: 0, 1, 2-3, 4-6, and 7+ HCCs.
- **Define** other risk adjustors that rely upon Medicare beneficiary enrollment and assessment data as follows:
 - Identify beneficiaries who are originally "Disabled without ESRD" or "Disabled with ESRD" using the original reason for joining Medicare field in the Medicare beneficiary EDB.
 - Identify beneficiaries with ESRD if their enrollment indicates ESRD coverage, ESRD dialysis, or kidney transplant in the Medicare beneficiary EDB in the 120-day lookback period.
 - Identify beneficiaries who have spent at least 90 days in a long-term care institution (LTCI) without having been discharged to the community for 14 days, using LTC MDS assessment data. Then, identify the beneficiaries whose Asthma/COPD episode start date overlaps with their stay in an LTCI.
- **Drop** risk adjustors that are defined for less than 15 episodes nationally for each sub-group and Part D enrollment status combination to avoid using very small samples.
- **Categorize** beneficiaries into age ranges using their date of birth information in the Medicare beneficiary EDB. 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).

The following steps are performed separately for each sub-group and Part D enrollment status combination:

- **Winsorize**³⁸ the episode annualized observed cost as follows:
 - **Assign** the value of the 98th percentile to all episode annualized observed costs above the 98th percentile.
- **Run** an ordinary least squares (OLS) regression model to estimate the relationship between all the risk adjustment variables and the dependent variable, the episode winsorized annualized observed cost calculated from the previous step, to obtain the episode annualized expected cost.

³⁷ 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.

³⁸ 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, and similarly for the higher end of the distribution involves setting extremely high predicted values above a predetermined limit to be equal to that predetermined limit.

- **Winsorize** the episode annualized expected cost as follows:
 - **Assign** the value of the 0.5th percentile to all episode annualized expected costs below the 0.5th percentile.
 - **Renormalize**³⁹ values by multiplying each episode's winsorized annualized expected cost by the average annualized expected cost, and dividing the resultant value by the average winsorized annualized expected cost.
- **Exclude** episodes with outliers as follows:
 - **Calculate** each episode's residual as the difference between the re-normalized, winsorized annualized expected cost computed above and the winsorized annualized observed cost.
 - **Exclude** episodes with residuals below the 1st percentile or above the 99th percentile of the residual distribution.
 - **Renormalize** the resultant annualized expected cost values by multiplying each episode's winsorized annualized expected costs by the average winsorized annualized observed cost (after excluding outliers), and dividing by the average winsorized annualized expected cost (after excluding outliers).

4.8 Calculate Measure Score

Measure scores are calculated for a clinician or clinician group practice as follows:

- **Calculate** the ratio of winsorized annualized standardized observed cost to annualized expected episode cost for each episode attributed to the clinician or clinician group.
- **Calculate** the measure as a weighted average of these ratios across all of a clinician's or a clinician group's attributed episodes, where the weighting is the number of assigned days for a clinician or a clinician group during the episode.
- **Multiply** the weighted average episode cost ratio by the national average winsorized annualized observed episode cost to generate a dollar figure for the cost measure score.

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:

$$Measure\ Score_j = \left[\frac{1}{n_j} \sum_{i \in \{I_j\}} \left(\frac{Y_{ij}}{\hat{Y}_{ij}} \times n_{ij} \right) \right] * \left(\frac{1}{N} \sum_{i \in \{I\}} Y_i \right)$$

³⁹ Renormalization is performed after adjustments are made to the episode's expected cost, such as winsorization 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.

Where:

Y_{ij}	is the winsorized annualized observed payment for episode i and attributed clinician (or clinician group practice) j
\hat{Y}_{ij}	is the annualized expected payment for episode i and attributed clinician (or clinician group practice) j
n_{ij}	is the number of assigned days for episode i and attributed clinician group practice j
n_j	is the total number of days assigned to attributed clinician (or clinician group practice) j across all episodes (summation of n_{ij})
N	is the total number of episodes attributed to clinicians (or clinician group practices) nationally
Y_i	is the winsorized annualized observed payment for episode i
$i \in \{I_j\}$	is all episodes attributed to clinician (or clinician group practice) j
$i \in \{I\}$	is all episodes attributed to clinicians (or clinician group practices) nationally

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

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

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.