

Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Measure

Measure Justification Form

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1.0 Introduction

This Measure Justification Form (MJF) provides results for the testing and evaluation of the Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation measure. The MJF is intended to provide detailed information about the testing conducted on this measure, and accompanies the Measure Methodology and Measure Codes List file, which together, comprise the specifications for this cost measure.¹

1.1 Project Title and Overview

The Centers for Medicare & Medicaid Services (CMS) has contracted with Acumen, LLC to develop care episode and patient condition groups for use in cost measures to meet the requirements of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA). The contract name is “MACRA Episode Groups and Cost Measures.” The contract number is HHSM-500-2013-13002I, Task Order HHSM-500-T0002.

1.2 Measure Name

Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Episode-Based Cost Measure

1.3 Type of Measure

Cost/Resource Use

¹ CMS, “Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Measure Methodology,” *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2019-revised-ebcm-measure-specs.zip>. CMS, “Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Measure Codes List,” *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2019-revised-ebcm-measure-specs.zip>.

2.0 Importance

2.1 Evidence to Support the Measure Focus

2.1.1 Measure Description

The Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation cost measure evaluates clinicians' risk-adjusted cost to Medicare for beneficiaries who receive inpatient treatment for an acute exacerbation of COPD. The cost measure score is a clinician's average risk-adjusted cost for the episode group across all episodes attributed to the clinician. This acute inpatient medical condition measure includes costs of services that are clinically related to the attributed clinician's role in managing care during each episode from the trigger event through 60 days after the trigger. Beneficiary populations eligible for the Inpatient COPD Exacerbation measure include Medicare beneficiaries enrolled in Medicare Parts A and B during the performance period.

2.1.2 Evidence for Measure Focus

Policymakers contend that an estimated 80 percent of overall health care costs are attributable to decisions made by clinicians.² However, these same clinicians are often unaware of how their care decisions influence the overall costs of care. One of the goals for using cost measures is to help inform clinicians on the costs attributable to their decision-making, as well as the total cost of their patient's care. A cost measure offers opportunity for improvement if clinicians can exercise influence on a significant share of costs during the episode, or if lower spending and better care quality can be achieved through changes in clinical practice.

According to the literature and previous feedback received through stakeholder input activities, this measure represents an area where there are opportunities for improvement. Opportunities for improvement for the treatment of acute exacerbation of COPD exist primarily in reducing readmissions that may result from poor education, such as improper inhaler teaching.

There is an opportunity for improvement in preventing readmissions due to improper inhaler teaching and use. Respiratory therapists or nurses usually administer nebulizer treatment for patients hospitalized for acute exacerbation of COPD, however, upon discharge, patients must know how to administer their medication via inhaler devices. As such, education and training in proper inhaler device technique is paramount. On average, more than two thirds of patients make at least one error when using an inhalation device. According to one study, adherence to the use of a dry powder inhaler (DPI) could be confirmed in only 23 percent of discharged COPD patients. The primary errors in inhaler device use "relate to problems with inspiratory flow, inhalation duration, coordination, dose preparation, exhalation maneuver prior to inhalation and breath-holding following dose inhalation."³ A notable relationship has been established between inhaler misuse and poor symptom control in COPD patients, increasing the likelihood of readmission.⁴

² Fred, Herbert L. "Cutting the Cost of Health Care: The Physician's Role." Texas Heart Institute Journal, vol. 43, no. 1, 2016, pp. 4 – 6.

³ Vogelmeier, C. F., G. J. Criner, et al. "Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease 2017 Report. Gold Executive Summary." [In Eng]. Am J Respir Crit Care Med 195, no. 5 (Mar 01 2017): 557-82.

⁴ Ibid.

2.2 Performance Gap

2.2.1 Rationale

Studies in 2008 found Medicare beneficiaries with COPD incur annual health care costs \$15,000 to \$20,000 greater than costs for beneficiaries without COPD, with the majority of this cost resulting from inpatient hospitalizations for COPD.⁵ In one study, hospitalizations due to COPD cost over \$19,000 on average whereas hospitalizations unrelated to COPD had an average cost below \$4,000.⁶ In addition, patients who are admitted for COPD exacerbations have been shown to have a higher rate of subsequent readmission and mortality.⁷ The Inpatient COPD Exacerbation episode-based cost measure was recommended for development by an expert clinician committee—the Pulmonary 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 area. Based on the initial recommendations from the Clinical Subcommittee, the subsequent measure-specific workgroup provided extensive, detailed input on this measure.

2.2.2 Performance Scores

Performance scores are provided for 3,763 clinician group practices (identified by Tax Identification Number [TIN]) and 10,053 practitioners (identified by combination of TIN and National Provider Identifier [NPI]). These counts represent attributed clinicians and clinician groups billing Part B Physician/Supplier claims under a Merit-based Incentive Payment System (MIPS) eligible clinician specialty, and do not reflect other MIPS eligibility criteria (e.g., Advanced Alternative Payment Model participation). This table uses a testing volume threshold of 20 episodes.

Table 1: Distribution of Performance Scores

Metric	TIN	TIN-NPI
Mean score	\$13,148	\$14,402
Standard deviation	\$1,496	\$1,713
Score IQR	\$1,619	\$2,179
Score percentile		
10 th	\$11,574	\$12,343
20 th	\$12,054	\$12,993
30 th	\$12,395	\$13,449
40 th	\$12,699	\$13,873
50 th	\$12,967	\$14,272
60 th	\$13,262	\$14,692
70 th	\$13,636	\$15,150
80 th	\$14,123	\$15,705
90 th	\$14,933	\$16,554

⁵ Menzin, J., L. Boulanger, et al. "The Economic Burden of Chronic Obstructive Pulmonary Disease (COPD) in a U.S. Medicare Population." [In Eng]. *Respir Med* 102, no. 9 (Sep 2008): 1248-56.

⁶ Ibid.

⁷ Almagro, Pedro, Joan B. Soriano, et al. "Short- and Medium-Term Prognosis in Patients Hospitalized for COPD Exacerbation: The CODEX Index." *Chest* 145, no. 5 (2014): 972-980.

3.0 Scientific Acceptability

3.1 Data Sample Description

3.1.1 Type of Data Used for Testing

Medicare administrative claims, Long-Term Minimum data set (MDS), enrollment database (EDB), and Common Medicare Environment (CME)

3.1.2 Specific Dataset Used for Testing

The Inpatient COPD Exacerbation measure uses Medicare Part A and Part B claims data maintained by CMS. Part A and B claims data are used to build episodes of care, calculate episode costs, and construct risk adjusters. Data from the EDB are used to determine beneficiary-level exclusions and supplemental risk adjusters, specifically Medicare Parts A, B, and C enrollment, primary payer, disability status, end-stage renal disease (ESRD), beneficiary birth dates, and beneficiary death dates. The risk adjustment model also accounts for expected differences in payment for services provided to beneficiaries in long-term care based on the data from the MDS. Specifically, the MDS is used to create the long-term care indicator variable in risk adjustment.

For measure testing, data from the American Census, American Community Survey (ACS), and CME are used in analyses evaluating social risk factors in risk adjustment.

3.1.3 Dates of the Data Used in Testing

The measurement period includes Inpatient COPD Exacerbation episodes ending from January 1, 2017 to December 31, 2017.

3.1.4 Levels of Analysis Tested

Individual clinician (identified by combination of TIN and NPI) and clinician group/practice (identified by TIN).

3.1.5 Entities Included in the Testing and Analysis

3,763 clinician group practices and 10,053 practitioners were included in the analyses. Clinicians and clinician groups were included in testing if they were attributed 20 or more Inpatient COPD Exacerbation episodes during the measurement period. Episodes from all 50 States and D.C. in the following setting were included: acute inpatient (IP) hospitals.

3.1.6 Patient Cohort Included in the Testing and Analysis

238,485 Medicare beneficiaries (from 306,721 episodes) were included in TIN level testing and analysis, and 147,718 beneficiaries (from 185,120 episodes) were included in TIN-NPI level measure testing.

The beneficiary population eligible for the Inpatient COPD Exacerbation measure calculation consists of Medicare beneficiaries enrolled in Medicare Parts A and B (but not Part C) who receive inpatient treatment for an acute exacerbation of COPD during the measurement period as identified by the episode trigger Medicare Severity Diagnosis-Related Group (MS-DRG) codes on IP claims. Beneficiaries and their episodes were included in the sample if they met a set of inclusion criteria (listed below) meant to ensure completeness of data and to focus the measure on a clinically homogeneous cohort of patients receiving inpatient treatment for an acute exacerbation of COPD.

The inclusion criteria are:

- The beneficiary has Medicare as their primary payer for the entire episode window, as well as the 120 days prior to the trigger day (the 120-day lookback period).
- The beneficiary was continuously enrolled in Medicare Parts A and B, and not enrolled in Part C, for the entirety of the episode window and the 120-day lookback period.
- The beneficiary has a sufficient 120-day lookback period.
- The beneficiary date of birth is not missing.
- The beneficiary death date did not occur before episode end.
- The episode trigger claim was in an IP setting.
- The IP facility is a short-term stay acute hospital as defined by subsection (d).⁸
- The trigger IP stay does not have the same admission date as another IP stay.
- The beneficiary did not have a COPD exacerbation following a lung resection.
- The beneficiary is not a lung transplant patient.
- The beneficiary did not leave the hospital against medical advice.
- The beneficiary has not received non-invasive positive pressure ventilation (NIPPV) for more than 96 hours.
- The beneficiary is not receiving treatment for lung cancer.
- The episode is not an outlier case.

To determine whether the Inpatient COPD Exacerbation measure's inclusion criteria distort patient characteristics on episodes, we produced and analyzed distributions of patient characteristics (age, race, sex, dual eligibility status, income, unemployment, hierarchical condition categories [HCCs]) for (i) episodes with inclusion criteria, (ii) episodes without inclusion criteria, (iii) beneficiaries with inclusion criteria, and (iv) beneficiaries without inclusion criteria.

This analysis shows that the Inpatient COPD Exacerbation measure's inclusion criteria have some effect on the percentage of beneficiaries of any particular demographic. The greatest difference between the percentage of beneficiaries being included or not included in the measure is less than 10.5 percentage points across each of the characteristics in the analysis at TIN level testing, and less than 11.6 percentage points or less at TIN-NPI level testing. To illustrate, the percentage of beneficiaries aged 65 to 69 without applying the inclusion criteria is 17.0 percent, compared to 17.3 percent at TIN level testing and 17.4 percent at TIN-NPI level testing. The difference in the percentage of beneficiaries for race with and without the inclusion criteria is generally within 2 percentage points for all categories for TIN and TIN-NPI level testing. The exceptions are for the race category: black at the TIN-NPI level which has a 2.4 percentage point decrease when inclusion criteria are applied, and the race category: white with a 2.2 percentage point difference at the TIN level and a 4.2 percentage point difference at the TIN-NPI level when considering the inclusion criteria. The breakdown of male and female beneficiaries without the inclusion criteria is 43.5 percent male and 56.5 percent female, compared with 41.1 percent male and 58.9 percent female at TIN level reporting and 40.7 percent male and 59.3 percent female at TIN-NPI level testing. These results indicate that there

⁸ 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 Chapter 2, Section 2779A1 of the [CMS State Operation Manual](#).

is minimal shift in patient characteristics as a result of using the inclusion criteria listed above at both TIN and TIN-NPI level testing.

3.1.7 Sample Differences

n/a

3.1.8 Social Risk Factors Included in Analysis

The social risk factors analyzed were variables from the ACS, EDB, and CME. All ACS variables are at the Census Block Group level. Social risk variables analyzed include the following:

- Income (ACS)
 - Low Income: median income < 33rd percentile nationally
 - Medium Income: median income in the interval spanning the 33rd percentile to the 66th percentile nationally
 - High Income: median income > 66th percentile
- Education (ACS)
 - Education < High School: when % with < high school education is the highest for a given Census Block Group
 - Education = High School: when % with only high school is the highest
 - Education > High School: when % with > high school is the highest
- Employment (ACS)
 - Unemployment Rate > 10%
 - Unemployment Rate <= 10%
- Race (EDB)
 - Asian, Black, Hispanic, North American Native, White, and Other
- Sex (EDB)
 - Female, male
- Dual status (CME)
 - Full dual, partial dual, non-dual

3.2 Reliability Testing

3.2.1 Level of Reliability Testing

The following levels of reliability were tested: critical data elements used in the measure and performance measure score (e.g., signal-to-noise analysis).

3.2.2 Method of Reliability Testing

Data Element Reliability

The Inpatient COPD Exacerbation measure is constructed using CMS claims data, as described in Section 3.1.2. CMS has implemented several auditing programs to assess overall claims code accuracy, ensure appropriate billing, and recoup any overpayments. CMS routinely conducts data analysis to identify potential problem areas and detect fraud, and audits important data fields used in this measure, including diagnosis and procedure codes and other elements that are consequential to payment. Specifically, CMS works with Zone Program Integrity Contractors, and formerly Program Safeguard Contractors, to ensure program integrity; the agency also uses Recovery Audit Contractors to identify and correct for underpayments and overpayments.

CMS also uses the Comprehensive Error Rate Testing (CERT) Program to ensure that Medicare payments are correct in accordance with coverage, coding, and billing rules. Between 2005 and 2017, CERT estimates that proper payment, which includes payments that met

Medicare coverage, coding, and billing rules, ranged from 87.3 to 96.4 percent of total payments each year.⁹ The Fiscal Year (FY) 2018 Medicare FFS program proper payment rate was 91.9 percent.¹⁰ CMS continues to perform successful corrective actions and give providers additional education to ensure accurate billing.

To ensure claims completeness and inclusion of any corrections, the measure was developed and tested using data with a three month claims run-out from the end of the measurement period.

Measure Reliability

Measure reliability is the degree to which repeated measurements of the same entity agree with each other. For measures of clinician performance, the measured entity is the TIN or TIN-NPI, and reliability is the extent to which repeated measurements of the TIN or TIN-NPI give similar results. To estimate measure reliability, we used a signal-to-noise analysis.

This approach seeks to determine the extent to which variation in the measure is due to true, underlying clinician performance rather than random variation (i.e., statistical noise) within clinicians due to the sample of cases observed. To achieve this, we calculate reliability scores as:

$$R_j = \frac{\sigma_b^2}{\sigma_b^2 + \sigma_{w_j}^2}$$

Where:

$\sigma_{w_j}^2$ is the within-group variance of the mean measure score of clinician j

σ_b^2 is the between-group variance of clinicians within the episode group

That is, reliability is calculated as the ratio of between-group variance to the sum of between-group variance and within-group variance. Reliability closer to a value of one indicates that the between-group variance is relatively large compared to the within-group variance, which suggests that the measure is effectively capturing the systematic differences between the clinician and their peer cohort.

3.2.3 Statistical Results from Reliability Testing

Measure Reliability

100 percent of TINs at the 20 and 30-episode volume thresholds have mean reliability greater than or equal to 0.4. At a 10-episode volume threshold, 71.7 percent of TINs and 24.8 percent of TIN-NPIs have a mean reliability greater than or equal to 0.4. At a 20-episode volume threshold, 100 percent of TINs and 68.0 percent of TIN-NPIs meet or exceed 0.4 reliability. At a 30-episode volume threshold, 100 percent of both TINs and TIN-NPIs meet or exceed 0.4 reliability. The mean reliability increases for both TINs and TIN-NPIs as the volume threshold increases.

⁹ Comprehensive Error Rate Testing (CERT) Program. "Appendices Medicare Fee-for-Service 2018 Improper Payments Report". Table A6. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Monitoring-Programs/Medicare-FFS-Compliance-Programs/CERT/Downloads/2018MedicareFFSSupplementalImproperPaymentData.pdf>

¹⁰ Ibid.

Table 2: Reliability Results at Various Volume Thresholds

Volume Threshold (# episodes)	TIN		TIN-NPI	
	Mean Reliability	% ≥ 0.4	Mean Reliability	% ≥ 0.4
10	0.57	71.7%	0.34	24.8%
20	0.69	100.0%	0.46	68.0%
30	0.75	100.0%	0.54	100.0%

3.2.4 Interpretation

Measure Reliability

Overall reliability of the Inpatient COPD Exacerbation measure exceeds 0.4 at a volume threshold of 20 episodes or more for both TINs and TIN-NPIs due to the large number of episodes attributed to clinicians. CMS generally considers 0.4 as the threshold indicating ‘moderate’ reliability, which is supported by previous work into reliability.¹¹

While higher volume thresholds yield even higher reliability results, it is at the cost of further reducing the number of clinicians and clinician groups able to receive a measure score.

3.3 Validity Testing

3.3.1 Level of Validity Testing

We conducted performance measure score validity testing, which included systematic assessment of face validity and empirical validity testing.

3.3.2 Method of Validity Testing

Face Validity

The Inpatient COPD Exacerbation measure was developed through a structured, iterative process for gathering detailed input from recognized clinician experts on the measure. These convened expert panels methodically assessed the extent to which the measure: (i) captured what it was intended to capture, and (ii) differentiated between provider performance. Experts in this clinical area evaluated specifications in an iterative process to ensure that each aspect of the measure (e.g., assigned services) was intentionally capturing only the costs of care within the reasonable influence of the attributed clinician for a defined patient population (i.e., the ability of the measure score to differentiate good from poor performance).

In developing and refining this measure, Acumen incorporated input from (i) the Pulmonary Disease Management Clinical Subcommittee, (ii) the Inpatient COPD Exacerbation workgroup, (iii) a Technical Expert Panel (TEP), (iv) a Person and Family Committee (PFC), and (v) stakeholder feedback from national field testing.

The Clinical Subcommittee comprised 25 members with clinical experience in pulmonary disease management, affiliated with 23 specialty societies. The Clinical Subcommittee provided input at an in-person meeting in April 2018 on which measure to develop, on the measure scope, and on the composition of a smaller, targeted workgroup to provide detailed input on each aspect of measure specifications. The Inpatient COPD Exacerbation workgroup was composed of 13 members, affiliated with 14 specialty societies, including the American Medical Association, the American Thoracic Society, and the Society of Hospital Medicine. The

¹¹ Mathematica, Inc., “Memorandum: Reporting Period and Reliability of AHRQ, CMS 30-Day and HAC Quality Measures – Revised,” http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/hospital-value-based-purchasing/Downloads/HVBP_Measure_Reliability-.pdf.

workgroup considered empirical analyses and their clinical expertise to provide input during an in-person meeting and several webinars between June to December 2018. Input was gathered in a structured manner including the use of a polling process requiring greater than 60 percent consensus.

The TEP provided high-level guidance and input on the overall direction of measure development and the framework for episode-based cost measures, while the PFC provided a patient and family perspective. PFC input included concepts of healthcare quality and value, guiding principles and measure-specific input to inform the workgroups such as pre- and post-trigger windows for selected episodes, and inclusion of services and costs for attributed clinicians. In addition, the national field testing feedback period in October and November 2018 offered all stakeholders an opportunity to review and provide input on draft measure specifications and measure feedback reports for attributed clinicians and clinician groups. During this period, 78,221 field test reports for TINs and TIN-NPIs were available for download and review for 11 episode-based cost measures developed throughout 2018.

One of the key roles of the measure-specific workgroup was to develop service assignment rules for the cost measure. These service assignment rules are intended to ensure clinicians are evaluated on services and costs that are clinically related to the attributed clinician's role in the inpatient treatment for an acute exacerbation of COPD, thus preventing inclusion of unrelated cost variation in this measure. Assigned services occurring in the durable medical equipment, emergency department, home health, inpatient medical, inpatient surgical, inpatient rehabilitation facility medical, and outpatient facility and clinician service setting were defined for the post-trigger window, and include COPD exacerbation, evaluation, testing, treatment, complications, and follow-up.

Empirical Validity Testing

We undertook two approaches to estimate the measure's validity. In the first approach, we evaluated the empirical validity of the Inpatient COPD Exacerbation measure by examining differences in risk-adjusted cost for known indicators of resource or service utilization based on a literature review, specifically complications related to the inpatient treatment for an acute exacerbation of COPD. For this analysis, we compared the ratio of observed to expected cost (henceforth called "O/E cost ratio") for Inpatient COPD Exacerbation episodes with and without complications related to the inpatient treatment for an acute exacerbation of COPD that occur in the post-trigger period. This analysis sought to confirm the expectation that the Inpatient COPD Exacerbation measure captures variation in service utilization.

In the second approach, we evaluated how different types of cost impact risk-adjusted measure scores. Certain services or costs included in the Inpatient COPD Exacerbation measure were classified into clinically coherent groups of services, called "clinical themes." The Inpatient COPD Exacerbation measure clinical themes are:

- **Physical Therapy / DME:** Physical and occupational therapy, respiratory therapy and pulmonary rehabilitation, medications to treat COPD and related DME/supplies such as walkers, wheelchairs, and oxygen systems.
- **Bronchoscopy:** Anesthesia and therapeutic procedures on respiratory systems, such as treatment of the tracheal cartilage fracture, insertion of stents, and thermal repairs of lung airways.
- **Post-Acute Care:** Outpatient, rehabilitation hospital, or skilled nursing facility, home health care or other therapeutic procedures for diabetes, sepsis, hypertension, kidney failure, and other diagnoses following the procedure.
- **COPD Exacerbation:** Inpatient and outpatient hospital care including emergency department visits and critical care provided for bronchitis, asthma, emphysema, or other

COPD disease, including imaging, diagnostic radiology and procedures, therapeutic procedures, and hospital care.

- **Pulmonary Complications, Other:** Inpatient and outpatient hospital care including emergency department visits or critical care related to respiratory infections or disorders following the procedure, including imaging, diagnostic and therapeutic procedures including tracheotomy, ventilator management and other pulmonary procedures.
- **Renal Failure and Metabolic Abnormalities:** Inpatient and outpatient hospital care including emergency department visits or critical care related to volume depletion, acute kidney failure, or other disorders of fluid, electrolyte and acid-based balance such as, hemodialysis, CT scans, diagnostic ultrasounds, diagnostic radiology and procedures, therapeutic procedures, procedures including tracheotomy and ventilator care.
- **Cardiac Complications:** Inpatient and outpatient hospital care including emergency department visits or critical care related to heart failure, hypotension, and arrhythmias, including CT scans, echocardiograms, diagnostic radiology and procedures, therapeutic procedures, ancillary services, cardiac defibrillator implant, coronary bypass, and percutaneous cardiovascular procedures within the appropriate time frame.
- **Diabetic Complications:** Inpatient and outpatient hospital care to address Type 1 or Type 2 diabetes mellitus, drug induced diabetes mellitus, or elevated blood glucose level, including CT scans, MRIs, diagnostic or therapeutic procedures, and ancillary services.
- **Sepsis:** Inpatient and outpatient hospital care including emergency department visits or critical care related to sepsis, including CT scans, diagnostic ultrasounds, diagnostic radiology and procedures, and therapeutic procedures.
- **Thromboembolism (DVT/PE):** Inpatient and outpatient hospital care including emergency department visits and critical care for defibrination syndrome, pulmonary embolisms, or other venous embolisms and thrombosis, including diagnostic or therapeutic procedures to diagnose, such as imaging, and hydration infusions.

As with the first analysis for validity, the aim of this analysis was to determine whether the measure is capturing variation in provider cost in the manner intended and expected. To measure this, we took the Pearson correlation between the cost of each clinical theme and the overall risk-adjusted cost for an episode.

We expected that the Post-Acute Care (PAC) theme would have the highest correlation with risk-adjusted episode cost, as it is associated with high cost even after accounting for beneficiary characteristics. We would also expect Sepsis to be moderately correlated with risk-adjusted cost as well due to the high costs associated with treating sepsis. By contrast, we expected that the Physical Therapy/DME theme would have more nuanced, offsetting effects

3.3.3 Statistical Results from Validity Testing

Table 3 presents an analysis of validity, showing the O/E cost ratio of episode with or without downstream acute (re)admissions and post-acute care. The mean O/E cost ratio for all episodes is 1.00. The mean O/E cost ratio for episodes with downstream acute readmission during the post-trigger period is 1.57, compared with 0.88 for episodes without downstream acute readmission during the post-trigger period. The mean O/E cost ratio for episodes with post-acute care during the post-trigger period is 1.29, compared with 0.82 for episodes without post-acute care during the post-trigger period.

Table 3: Distribution of Observed to Expected Ratios

Episode Type	Observed / Expected Ratio										
	Mean	Std. Dev.	Percentile								
			1st	5th	10th	25th	50th	75th	90th	95th	99th
All Final Episodes	1.00	0.53	0.44	0.54	0.59	0.68	0.79	1.14	1.71	2.13	2.96
Episodes with Downstream Acute (Re)Admission	1.57	0.54	0.76	0.92	1.02	1.20	1.44	1.79	2.29	2.66	3.36
Episodes without Downstream Acute (Re)Admission	0.88	0.44	0.43	0.52	0.57	0.66	0.75	0.91	1.35	1.87	2.78
Episodes with Post-Acute Care	1.29	0.62	0.51	0.62	0.69	0.84	1.10	1.61	2.19	2.58	3.26
Episodes without Post-Acute Care	0.82	0.36	0.42	0.51	0.56	0.64	0.72	0.83	1.24	1.54	2.33

The clinical themes analysis demonstrates that there is a strong correlation between the Post-Acute Care (correlation: 0.70) theme and risk-adjusted cost. The Sepsis (correlation: 0.47) and COPD Exacerbation (correlation: 0.45) themes are moderately correlated with risk-adjusted cost. By contrast, the Physical Therapy/DME (correlation: 0.07) and Bronchoscopy (correlation: -0.03) themes were found to have a weak correlation with risk-adjusted cost.

3.3.4 Interpretation

As expected, the average O/E cost ratio for episodes with post-trigger complications is higher than for episodes without downstream complications. This result demonstrates that the Inpatient COPD Exacerbation measure is able to accurately capture higher resource use.

The clinical themes analysis demonstrates that high risk-adjusted cost is strongly associated with Post-Acute Care, and also linked – though more weakly, to Sepsis. This indicates that the measure may penalize clinicians who have higher rates of complications or patients requiring additional care, while not disincentivizing the provision of appropriate post-operative care, such as Physical Therapy/DME. Importantly, we see that correlation with risk-adjusted cost is moderate not only for high-cost themes such as Sepsis (average cost for a median quintile physician: \$6,795), but also for lower cost themes such as COPD Exacerbation (average cost for a median quintile physician: \$1,606). This indicates that the correlation does not come from a mechanical increase in episode costs from high-cost themes.

3.4 Exclusions Analysis

3.4.1 Method of Testing Exclusions

Exclusions are used in the Inpatient COPD Exacerbation to ensure a homogenous patient population within the scope of the measure focus on the inpatient treatment of COPD exacerbation and that episodes provide meaningful information to attributed clinicians or as part of data processing, to ensure that sufficient data are available to accurately determine episode spending and calculate risk adjustment for each episode. For the exclusions analysis, we focused on exclusions added to ensure a homogenous patient population. These exclusions, along with their rationales, are listed below:

- *Episodes where beneficiary death date occurred before the episode end.*
 - These episodes are excluded for all measures due to the potential to inaccurately reflect a clinician's performance. Episodes where the beneficiary died may be unusually high-cost, due to perimortem treatment costs, or unusually low-cost,

due to the truncated episode window. Neither of these cases accurately reflects the efficiency of the clinician performing the treatment.

- *Episodes classified as outlier cases.*
 - To account for limitations of risk adjustment, episodes predicted to have expected costs that are substantially different from observed costs are excluded as outliers. Specifically, episodes with residuals from the risk adjustment model below the 1st percentile and above the 99th percentile are considered outliers and removed from measure calculation.

Given the rationales for these exclusions, we would expect these excluded episodes to have a different risk profile than the included episodes, such as a higher mean cost, or a different distribution of costs (e.g., a long tail of high-cost episodes). For the exclusions, we examined the number of episodes and beneficiaries affected, as well as the distributions of observed cost and ratio of observed to expected cost (calculated by applying existing risk factor coefficients to the excluded episodes) for excluded episodes. We then compared the cost characteristics of the excluded episodes to those of final episodes included in measure calculation to assess the distinctness between the two patient cohorts. A full list of the exclusions and details used for the Inpatient COPD Exacerbation measure is provided in the Measure Codes List.¹²

3.4.2 Statistical Results from Testing Exclusions

Table 4 below presents observed cost statistics and O/E cost ratios for the Inpatient COPD Exacerbation measure exclusions. Cost statistics are also provided for the set of final episodes included in the Inpatient COPD Exacerbation measure for comparison, with a testing volume threshold of 20 episodes at the TIN and TIN-NPI levels.

¹² CMS, "Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Measure Codes List," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2019-revised-ebcm-measure-specs.zip>.

Table 4: Cost Statistics for Measure Exclusions

Exclusion	Episodes		Observed Cost			O/E		
	#	%	Mean	Percentile		Mean	Percentile	
				10 th	90 th		10 th	90 th
All Episodes Meeting Triggering Logic	524,209	100.00%	\$15,498	\$6,796	\$29,791	1.06	0.55	1.91
Episodes where beneficiary death date occurred before the episode end	78,583	14.99%	\$17,682	\$7,934	\$32,374	1.01	0.46	1.91
Episodes where the trigger claim is for a procedure that was not performed in an IP setting	52,464	10.01%	\$26,427	\$6,842	\$54,507	1.71	0.61	3.30
Episodes where the beneficiary has an inpatient COPD exacerbation following lung resection	157	0.03%	\$16,813	\$7,422	\$38,595	1.12	0.52	2.07
Episodes where the beneficiary is a lung transplant patient	483	0.09%	\$26,138	\$7,778	\$51,404	1.48	0.52	3.05
Episodes where the beneficiary left the hospital against medical advice	5,414	1.03%	\$13,858	\$6,198	\$25,514	1.06	0.57	1.87
Episodes where the beneficiary has received more than 96 hours of NIPPV	5,745	1.10%	\$26,401	\$9,255	\$51,879	1.04	1.00	1.00
Episodes where the beneficiary is receiving active treatment for lung cancer	5,089	0.97%	\$14,266	\$7,530	\$24,596	1.01	0.54	1.73
Episodes classified as outlier cases	7,006	1.34%	\$36,686	\$6,627	\$74,569	2.41	0.33	5.09
<i>Final Episodes (TIN)</i>	306,721	58.51%	\$12,890	\$6,496	\$23,953	0.97	0.57	1.66
<i>Final Episodes (TIN-NPI)</i>	185,120	35.31%	\$13,167	\$6,655	\$24,509	0.98	0.58	1.68

3.4.3 Interpretation

The statistical results indicate that the excluded episodes may have substantially different results than the final set of episodes, and together with clinical considerations, indicate that the exclusions help ensure a comparable patient cohort that will yield meaningful information to attributed clinicians. Further discussion of the results for each exclusion is provided below.

Episodes ending in death: There is a large difference between mean observed episode cost for episodes ending in death and final episodes: \$17,682 compared to \$12,890. The observed cost for episodes ending in death is more than the expected cost, despite being likely to be shorter episodes (and therefore include fewer services) than beneficiaries with episodes that do not end in death. This may be the result of episodes ending in death including more complex and sick patients requiring costlier perimortem treatment. These episodes are excluded to avoid clinicians being disincentivized from treating high-risk patients.

Episodes where the trigger claim is for a procedure that was not performed in an IP setting: The mean observed cost of these episodes is approximately \$13,500 more than for the final set of episodes. These episodes are excluded as the measure intends to capture inpatient treatment of this condition.

Episodes where the beneficiary has an inpatient COPD exacerbation following lung resection. The mean observed cost of these episodes is \$3,923 more than final episodes at the TIN-level and \$3,646 at the TIN-NPI level. The difference in cost becomes more pronounced in the right tail of the episodes, with these episodes at the 90th percentile at \$38,595 compared to final episodes at the \$23,953 at the TIN-level and \$24,509 at the TIN-NPI level. These patients are excluded as they are more complex.

Episodes where the beneficiary is a lung transplant patient. The mean observed cost of these episodes is approximately double that of the final set of episodes. This reflects the complexity of treating patients who have received a lung transplant, and their different care from the rest of the patient cohort.

Episodes where the beneficiary is receiving active treatment for lung cancer. The mean observed cost of these episodes is approximately \$1,400 more than for the final set of episodes. While this is quite a small difference, these episodes are excluded as providing care for patients who are currently undergoing lung cancer treatment have different clinical considerations from the overall patient cohort.

Episodes where the beneficiary has received more than 96 hours of NIPPV. The mean observed cost of these episodes is approximately double that of the final set of episodes. This is also observed at the 90th percentile. Patients receiving NIPPV treatment are significantly more complex than the general patient population.

Outlier cases: The mean observed cost of these episodes is approximately three times greater than for the final set of episodes. The O/E cost ratio for outlier cases ranges from 0.33 at the 10th percentile to 5.09 at the 90th percentile, indicating that the risk adjustment model is currently unable to account for the patient characteristics associated with these high- and low-cost outlier episodes. Excluding outliers based on risk-adjusted cost eliminates the episodes that deviate most from expected spending levels based on patient characteristics.

3.5 Risk Adjustment or Stratification

3.5.1 Method of Controlling for Differences

Differences in case mix are controlled for using a statistical risk model with 116 risk factors and stratification by four risk categories.

The risk adjustment model for the Inpatient COPD Exacerbation measure broadly follows the CMS-HCC risk adjustment methodology, which is derived from Medicare Parts A and B claims and is used in the Medicare Advantage (MA) program. Although the MA risk adjustment model includes 24 age/sex variables, this risk adjustment model does not adjust for sex and so only includes 12 age categorical variables. Severity of illness is measured using HCCs, indicators of enrollment and long-term care status, and disease interactions. The risk adjustment model also includes variables for factors identified by the expert clinician workgroup as affecting resource use.

The model includes 79 HCC indicators derived from the beneficiary's Parts A and B claims during the period 120 days prior to the episode trigger and are specified in the CMS-HCC Version 22 (V22) 2016 model. Episodes for beneficiaries without a full 120-day lookback period are excluded from the measure. This 120-day period is used to measure beneficiary health status and ensures that each beneficiary's claims record contains sufficient fee-for-service data both for measuring spending levels and for risk adjustment purposes.

In addition, the risk adjustment model includes status indicator variables for whether the beneficiary qualifies for Medicare through Disability or ESRD. The model also includes an indicator of whether the beneficiary recently required long-term care, defined as 90 days in a

long-term care facility without being discharged to community for 14 days. Beneficiaries who need to reside in long-term care facilities typically require more intensive care than beneficiaries who live in the community. These enrollment and long-term care status variables are non-diagnostic indicators of severity of illness.

The model also accounts for disease interactions between HCCs and/or enrollment status variables included in the MA model. These interactions are included because certain combinations of comorbidities increase costs more than is predicted by the HCC indicators alone.

Furthermore, the risk adjustment model includes measure-specific factors intended to further isolate costs that attributed clinicians can reasonably influence, informed by expert clinician input and empirical analyses. The following variables indicate a risk for worse outcomes and higher cost episodes that need to be accounted for outside of the current HCC model and were added to avoid potential unintended consequences:

- whether the beneficiary received advance care planning;
- whether the beneficiary had anemia;
- whether the beneficiary had chronic respiratory failure, acute or chronic respiratory failure;
- whether the beneficiary had debility;
- whether the beneficiary had dementia;
- whether the beneficiary had a history of falls;
- whether the beneficiary had a history of home oxygen use;
- whether the beneficiary had a home hospital bed;
- whether the beneficiary had home oxygen;
- whether the beneficiary had mild cognitive impairment;
- whether the beneficiary received nursing facility physician visits;
- whether the beneficiary had a tracheostomy;
- whether the beneficiary had a previous non-COPD admission in 120 days before the trigger;
- whether the beneficiary had a previous non-COPD admission in 30 Days before the trigger;
- whether the beneficiary had prior intubation;
- whether the beneficiary had a recent admission to a long-term care hospital;
- whether the beneficiary recently received home health services, and;
- whether the beneficiary had a wheelchair.

As with the CMS-HCC model, the risk adjustment approach for this measure uses an ordinary least squares linear regression model. The predicted, or expected, cost is winsorized at 0.5th percentile to make sure episodes with unusually small predicted cost, which would lead to abnormally large O/E cost ratios, do not dominate certain clinicians' final score. The winsorized expected costs are renormalized to ensure the average expected episode cost is the same before and after winsorizing. Then, as noted in the exclusions analysis above, extremely low- or high-cost outlier episodes with residuals below the 1st percentile or above the 99th percentile are excluded to reduce the effect of episodes that deviate the most from their expected values in absolute terms. The expected cost after excluding these outliers is again renormalized to ensure that average expected costs are the same after outlier removal.

Finally, the risk adjustment model outlined above is performed separately for each of the four Inpatient COPD Exacerbation measure sub-groups, which represent more granular, mutually exclusive patient populations defined by clinical criteria:

- COPD Exacerbation with Mechanical Ventilation < 24 hours
- COPD Exacerbation with Mechanical Ventilation 24-96 hours
- COPD Exacerbation with NIPPV without Mechanical Ventilation
- COPD Exacerbation with No NIPPV or Mechanical Ventilation

Full details of the risk adjustment model are in the Measure Codes List File.¹³ The National Summary Data Report (NSDR) Addendum includes regression coefficients and standard errors for each of the covariates used in the risk adjustment model.¹⁴

3.5.2 Conceptual, Clinical, and Statistical Methods

We selected the CMS-HCC model based on previous studies evaluating its appropriateness for use in risk adjusting Medicare claims data. This model was developed specifically for use in the Medicare population, meaning that it accounts for conditions found in the Medicare population and is calibrated on Medicare fee-for-service beneficiaries. In addition, the CMS-HCC model is routinely updated for changes in coding practices (e.g., the transition from ICD-9 to ICD-10 codes) and is exhaustive on these code sets. Because the CMS-HCC model has already been extensively tested, we focus our testing on how the CMS-HCC model was adapted to the Inpatient COPD Exacerbation measure methodology.

The workgroup provided input on measure-specific risk adjusters after reviewing empirical analyses on subpopulations of interest to assess whether and if so, how, particular factors should be accounted for in the model. These could include patient characteristics, factors outside the influence of the attributed clinician, or any other factors that would help prevent unintended consequences. These additional risk adjusters are listed in the section above.

As previously noted, the risk adjustment model is run on episodes stratified into sub-groups which may qualify as "ordering" of risk factors. Sub-groups were also determined based the workgroup's input, with the goal of ensuring clinical comparability among episodes so that the cost measure fairly compares clinicians with similar patient case-mix. The sub-groups, which are based on the services a beneficiary receives during an inpatient COPD exacerbation, are listed in the above section. Sub-groups were created to more accurately compare severity of COPD by dividing the population into those not requiring aid in ventilation, those requiring only mechanical ventilation, those requiring a short period of intubation, and those requiring a longer period of intubation. Some COPD exacerbation patients require short intubation times, and these patients represent a different group from those requiring extended mechanical ventilation.

Information on data sources and methodology used to analyze social risk factors can be seen in Section 3.1.8.

3.5.3 Conceptual Model of Impact of Social Risks

Our conceptual model of the impact of social risk factors is informed by both published, peer-reviewed literature and data analysis.

¹³ CMS, "Inpatient Chronic Obstructive Pulmonary Disease (COPD) Exacerbation Measure Codes List," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2019-revised-ebcm-measure-specs.zip>.

¹⁴ CMS, "National Summary Data Report Addendum: 11 Episode-Based Cost Measures and Revised MSPB Clinician Measure," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/MACRA-Feedback.html>.

3.5.4 Statistical Results

The literature has extensively tested the use of the HCC model as applied to Medicare claims data. Although the variables in the HCC model were chosen to predict annual cost, CMS has also used this risk adjustment model in a number of other settings (e.g., ACOs, previous physician QRUR programs, and other measures such as NQF #2158: MSPB-Hospital cost measure). Recalling that the risk model relies on the existing CMS-HCC model, testing results for factors included in the CMS-HCC V22 2016 model can be found in the Pope et al (2011) report.¹⁵ For measure-specific factors not included in the CMS-HCC model, we sought expert clinician input through the workgroup, which provided recommendations on additional risk adjusters and sub-groups.

The results of the statistical analysis used to characterize our risk adjustment model can be found in the NSDR Addendum, which includes regression coefficients and standard errors for each of the covariates used in the risk adjustment model.

3.5.5 Analyses and Interpretation in Selection of Social Risk Factors

Acumen analyzed gender, dual status, income, education, and unemployment as social risk factors (more information on these variables can be found in Section 3.1.8). Beneficiary gender and dual status were obtained from the EDB and CME. Information on income, education, and unemployment was obtained from ACS data and linked to episodes by census block group where possible to provide a more granular level of analysis than ZIP code.

The percentage of female beneficiaries range from 57.5 percent to 59.5 percent across the four sub-groups in this measure. The majority of the beneficiaries (52.7% - 66.4%) have non-dual status. Income level is categorized into high, medium, and low from the continuous average income variable in ACS and each income category has one third of observations (32.3% - 34.3%). While 3.5 to 4.7 percent of beneficiaries are classified below a high school education level, more than 95 percent of all episodes (95.3% - 96.5%) are classified at a high school level or greater. Finally, 28.7 percent to 32.4 percent of beneficiaries have high unemployment designation (>10%).

Acumen examined the impact of including social risk factors into our risk adjustment model by running goodness of fit tests when different risk factors are added and compared to the base risk adjustment model, where the base risk adjustment model refers to the full standard set of risk adjustment variables from the CMS-HCC V22 2016 model, disability status, ESRD status, interaction variables, recent long-term care use, and measure-specific clinical risk adjusters. Acumen ran a step-wise regression to include gender, dual status, gender + dual status, and gender + dual + income + education + unemployment + race, on top of the adapted CMS-HCC model. The step-wise regressions help evaluate individual as well as joint significance of the social risk factors. We examined the impact of including social risk factors into our risk adjustment model with T-test of individual significance and F-test of joint significance.

First, we analyzed the model coefficients and p-values for each of the base and social risk factor models to understand whether any of the social risk factor covariates are predictive of episode cost. The T-test and F-test revealed many significant p-values, indicating that social risk factors are likely predictive factors for determining resource use among beneficiaries for the relevant characteristic. However, the analysis also shows that the directions of the effects of social risk factors are not consistent. In addition, the statistical significance is unclear: for example, for high income, the coefficient is statistically significant for two sub-groups (Non-invasive Positive Pressure Ventilation and No Non-invasive Positive Pressure Ventilation) but not statistically

¹⁵ Pope, Gregory C., John Kautter, Melvin J. Ingber, Sara Freeman, Rishi Sekar, and Cordon Newhart. "Evaluation of the CMS-HCC Risk-Adjustment Model: Final Report." RTI International: March 2011.

significant for the other two sub-groups (Mechanical Ventilation <24 hours, Mechanical Ventilation 24-96 Hours).

Secondly, we analyzed the impact of adding social risk variables on overall model performance by looking at the differences in the ratio of observed to expected episode cost with and without social factors in the risk adjustment model. When including social risk factors in our risk adjustment regression, the minor differences in the O/E cost ratios, even for providers at high or low extremes of risk, indicates that social risk factor effects on the model performance are likely captured through existing risk adjustment variables. When including the social risk factors in risk adjustment, the O/E cost ratios for 99.3 percent of TINs and 99.5 percent of TIN-NPIs changed by ± 0.03 or less.

Finally, we analyzed the correlation between measure scores calculated with and without the social risk factors. The measure scores calculated with and without these social factors were highly correlated at both the TIN and TIN-NPI level, with a Spearman correlation coefficient of 0.997 at the TIN level and 0.998 at the TIN-NPI level. These results indicate that the inclusion of social risk factors in the current risk adjustment model would have a limited effect on measure scores.

Due to the inconsistent direction and limited impact of social risk factor effects under the current risk adjustment model, we believe the Inpatient COPD Exacerbation measure risk adjustment model sufficiently accounts for the effects of social risk factor on clinician measure scores.

3.5.6 Method for Statistical Model or Stratification Development

To analyze the validity of current risk adjustment model, we examined three analyses: (1) R-squared and adjusted R-squared for the regression models, (2) predictive ratios and O/E cost ratios to examine the fit of the models at different levels of patient complexity, and (3) coefficient estimates, standard errors, and p-values for each sub-group.

- 1) *R-squared and adjusted R-squared* were calculated for the measure overall as well as for each sub-group. The results should be evaluated in the context of the service assignment rules, which indicate which costs are counted in the measures and which costs are not counted. This is an important distinction from all-cost measures, as a low R-squared does not necessarily indicate that a measure reflects variation unrelated to clinical care, while a high R-squared does not necessarily indicate the opposite; instead, the risk adjustment models must be evaluated in concert with the service assignment rules. These results are provided in Section 3.5.7.
- 2) *Predictive ratios and O/E cost ratios* were calculated for each “risk decile” for the episode group. A “risk decile” is based on the risk scores, which indicate how costly episodes are expected to be, as predicted through risk adjustment. After arranging episodes into deciles based on their risk score, we calculated the predictive ratios and average O/E cost ratios for each decile. The predictive ratio aims to examine the fit of the model at different levels of patient complexity to examine the model’s ability to predict both very low and high cost episodes, and is calculated using the formula of average (expected cost)/average (observed cost) for all episodes in each decile. Similarly, the O/E cost ratio demonstrates the model’s prediction accuracy, and is calculated using the formula of average (observed cost/expected cost) for all episodes in each decile. These are discussed in Sections 3.5.8 and 3.5.9.
- 3) *Coefficient estimates, standard errors, and p-values* were run for each sub-group to consider the extent to which the coefficients for the risk factor covariates are predictive of episode cost. Results for individual risk adjustment variables should be viewed in the context of the entire model and set of sub-groups, rather than being analyzed individually. For instance, coefficients indicate the incremental effect of a model variable, holding all

other variables fixed. As another example, interactions between model variables must be interpreted in concert with the effects of those variables in isolation.

The results of these analyses are presented in the NSDR Addendum to aid in the overall assessment of the predictive ability of the risk adjustment models.¹⁶

3.5.7 Statistical Risk Model Discrimination Statistics

The overall R-squared for the Inpatient COPD Exacerbation cost measure, calculated by dividing explained sum of squares by total sum of squares is 0.19. The adjusted R-squared is 0.19.

The NSDR Addendum also includes regression coefficients and standard errors for each of the covariates used in the risk adjustment model. More information on discrimination testing for the CMS-HCC model can be found at Pope et al. 2011.¹⁷

3.5.8 Statistical Risk Model Calibration Statistics

We interpret calibration as how accurately the risk model's predictions match the actual episode cost. We calculate the average O/E cost ratio for each risk decile to demonstrate the model's prediction accuracy. The average O/E cost ratio is generally close to one across risk deciles, indicating that the model is accurately predicting actual episode cost. Full results can be seen the NSDR Addendum.

3.5.9 Statistical Risk Model Calibration – Risk Decile

Analysis of predictive ratios by risk decile for the measure shows that the model has consistent predictive ratios across risk score deciles, with the average of all deciles having a predictive ratio of 1.00, ranging from 0.98 to 1.02.

3.5.10 Results of Risk Stratification Analysis

Results indicate that the four measure sub-groups have varying measure scores (see below table). Specifically, episodes with mechanical ventilation are more expensive than episodes without mechanical ventilation, regardless of if NIPPV is administered. At the TIN level the mean score for episodes no mechanical ventilation or NIPPV is \$12,175, compared to \$15,566 for episodes with NIPPV with mechanical ventilation, \$27,196 for episodes with 24 to 96 hours of mechanical ventilation, and \$24,311 for episodes with less than 24 hours of mechanical ventilation. A similar trend was observed at the TIN-NPI level, where the mean score was highest for episodes with 24 to 96 hours of mechanical ventilation. Episodes with mechanical ventilation and NIPPV have lower mean scores at the TIN and TIN-NPI levels than episodes with mechanical ventilation and no NIPPV. Stratifying episodes into these sub-groups helps ensure meaningful comparison of clinician resource use.

¹⁶ CMS, "National Summary Data Report Addendum: 11 Episode-Based Cost Measures and Revised MSPB Clinician Measure," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/MACRA-Feedback.html>.

¹⁷ Pope, Gregory C., John Kautter, Melvin J. Ingber, Sara Freeman, Rishi Sekar, and Cordon Newhart. "Evaluation of the CMS-HCC Risk-Adjustment Model: Final Report." RTI International: March 2011.

Table 5: Distribution of Score by Sub-Group

Level	Sub-group	Provider Count	Mean Score	Score Percentile						
				1st	10th	25th	50th	75th	90th	99th
TIN	All TINs	3,763	\$13,148	\$10,305	\$11,574	\$12,231	\$12,967	\$13,850	\$14,933	\$17,745
TIN	Mechanical Ventilation < 24 hrs	1,692	\$24,311	\$13,052	\$16,454	\$18,799	\$22,549	\$27,227	\$34,334	\$56,258
TIN	Mechanical Ventilation 24-96 hrs	2,594	\$27,196	\$14,246	\$17,835	\$20,775	\$25,095	\$30,543	\$38,854	\$65,067
TIN	NIPPV w/ Mechanical Ventilation	2,936	\$15,566	\$8,050	\$10,647	\$12,733	\$14,781	\$17,235	\$20,769	\$33,224
TIN	No NIPPV or Mechanical Ventilation	3,763	\$12,175	\$9,268	\$10,608	\$11,294	\$12,011	\$12,876	\$13,863	\$16,583
TIN-NPI	All TIN-NPIs	10,053	\$14,402	\$11,023	\$12,343	\$13,240	\$14,272	\$15,419	\$16,554	\$19,127
TIN-NPI	Mechanical Ventilation < 24 hrs	2,759	\$25,440	\$13,037	\$16,500	\$18,666	\$22,722	\$29,559	\$38,523	\$60,111
TIN-NPI	Mechanical Ventilation 24-96 hrs	5,753	\$28,056	\$14,244	\$17,857	\$20,538	\$25,325	\$32,251	\$40,988	\$72,378
TIN-NPI	NIPPV w/ Mechanical Ventilation	7,072	\$16,619	\$8,350	\$10,843	\$12,966	\$15,764	\$18,922	\$22,806	\$37,868
TIN-NPI	No NIPPV or Mechanical Ventilation	10,053	\$13,068	\$9,769	\$11,044	\$11,913	\$12,911	\$14,059	\$15,197	\$17,898

3.5.11 Interpretation

The R-squared values for the model, which measure the percentage of variation in results predicted by the model, are higher than the values presented in similar analyses of risk adjustment models.¹⁸ As noted in Section 3.5.6, these results should be interpreted alongside service assignment rules, which remove clinically unrelated services, so the resulting variation is reflective of variation related to factors within a clinician's reasonable influence.

As demonstrated in Sections 3.5.8 and 3.5.9, the average O/E cost ratios and the predictive ratios for all risk deciles are very close to one. Predictive ratios close to one indicate that expected spending is accurately predicting observed spending. Overall, the results show that the model is accurately predicting observed spending, regardless of overall risk level.

3.6 Identification of Meaningful Differences in Performance

3.6.1 Method

Our method of determining clinically meaningful differences in episode-based cost measure scores consists of stratifying the clinician measure scores by meaningful characteristics and investigating the clinician score distribution by percentile. Stratification is performed for each of

¹⁸ Pope, Gregory C., John Kautter, Melvin J. Ingber, Sara Freeman, Rishi Sekar, and Cordon Newhart. "Evaluation of the CMS-HCC Risk-Adjustment Model: Final Report." RTI International: March 2011

the following characteristics: urban/rural, census division, census region, risk score, and the number of episodes attributed to the clinician. We analyze the distribution of measure scores for clinicians defined by these characteristics, as well as for the overall episode group and for each sub-group.

The purpose of this analysis is to ensure that there is a sufficiently large difference in measure scores among clinicians to meaningfully determine a difference in performance. In addition, this analysis looks to confirm that the measure behaves as expected with respect to meaningful clinician characteristics.

3.6.2 Statistical Results

Key findings show that, generally, there is a large performance difference among clinicians in the Inpatient COPD Exacerbation measure:

- (i) the 99th percentile of the measure score is approximately 1.7 times the 1st percentile at both the TIN level and TIN-NPI levels;
- (ii) the Inpatient COPD Exacerbation measure score at the 90th percentile is approximately 25 percent greater than the score at the 10th percentile at the TIN level and 30 percent greater at the TIN-NPI level;

These results indicate that the Inpatient COPD Exacerbation measure is capturing meaningful differences in clinician performance and that there is large potential for Medicare spending savings.

The results also show that there is not systemic regional difference in clinician score. For instance, the mean scores for clinicians across nine census divisions (excluding 'Unknown') are within a less than \$1,430 range (i.e., \$12,478 - \$13,759 at the TIN level and \$13,524 – \$14,954 at the TIN-NPI level). Similarly, clinicians in urban areas seem to perform comparably to those in rural areas.

In terms of other clinician characteristics, analysis of clinicians by number of episodes indicates that clinicians with more episodes perform similarly to those who perform fewer procedures. We also analyzed clinicians by risk score decile, as variation by risk score decile could indicate that the risk adjustment model is over- or under-correcting for clinicians with systematically riskier patients. Measure scores also show little variation by risk score decile, with a range in mean TIN score of \$12,590 to \$14,041 and a range in mean TIN-NPI score of \$13,568 to \$14,695, indicating that the risk adjustment model is overall functioning as intended. Full results can be seen in the NSDR.¹⁹

3.6.3 Interpretation

There is clinically and practically significant variation in Inpatient COPD Exacerbation measure scores, indicating the measure's ability to capture differences in performance. Our findings regarding variation in measure scores are consistent with expert clinician input. The Inpatient COPD Exacerbation measure-specific workgroup suggested development of sub-groups to more accurately compare severity of COPD by dividing the population into those not requiring aid in ventilation, those requiring only mechanical ventilation, those requiring a short period of intubation, and those requiring a longer period of intubation. Risk adjustment variables likely have different impacts between the sub-groups as well. The results show a large difference in mean cost between COPD Exacerbation with no NIPPV or Mechanical Ventilation and COPD

¹⁹ CMS, "National Summary Data Report: 11 Episode-Based Cost Measures and Two Revised Cost Measures, Updated Following Field Testing (Oct-Nov 2018)," *MACRA Feedback Page*, <https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/value-based-programs/macra-mips-and-apms/macra-feedback.html>.

Exacerbation with 24 -96 hours of Mechanical Ventilation, further supporting the decision to subgroup the populations. Overall, as expected, results show that clinicians are not being systematically penalized or rewarded due to risk score decile given the current Inpatient COPD Exacerbation measure design (i.e., the differences in cost measure scores are not as a result of the risk profile of the patient cohort).

3.7 Missing Data Analysis and Minimizing Bias

3.7.1 Method

Since CMS uses Medicare claims data to calculate the Inpatient COPD Exacerbation measure, Acumen expects a high degree of data completeness. To further ensure that we have complete and accurate data for each beneficiary who opens an episode, Acumen excludes episodes where beneficiary date of birth information (an input to the risk adjustment model) cannot be found in the EDB, the beneficiary does not appear in the EDB, or the beneficiary death date occurs before the episode trigger date.

The Inpatient COPD Exacerbation measure also excludes episodes where the beneficiary is enrolled in Medicare Part C or has a primary payer other than Medicare in the 120-day lookback period and episode window. In such situations, Medicare Parts A and B claims data may not capture the complete clinical profile for the beneficiary needed to capture the clinical risk of the beneficiary in risk adjustment. Furthermore, Parts A and B claims data may not capture all Medicare resource use if some portion of the beneficiary's care is covered under Medicare Part C.

3.7.2 Missing Data Analysis

The table below presents the frequency of missing data across the four categories of missing data which caused episodes to be excluded from the Inpatient COPD Exacerbation measure. Frequency is presented in terms of the number of episodes excluded due to missing data, as well as the number of TINs and TIN-NPIs who had at least one episode excluded due to missing data. The missing data categories are:

- Beneficiary date of birth is missing
- Beneficiary death date occurred before the admission date
- Beneficiary has a primary payer other than Medicare during the episode window or in the 120-day lookback period
- Beneficiary was not enrolled in Medicare Parts A and B, or was enrolled in Part C, during the 120-day lookback period and episode window

Table 6: Missing Data Categories for the Inpatient COPD Exacerbation Measure

Exclusion	# Episodes	# TINs	# TIN-NPIs
Missing birth date	0	0	0
Death before admission	3,671	2,666	5,339
Other primary payer	62,352	11,651	67,393
Not continuously enrolled	48,889	8,020	39,874

3.7.3 Interpretation

As the Inpatient COPD Exacerbation measure is calculated with Medicare claims data, Acumen expects a high degree of data completeness, which is supported by the limited frequency of missing data as noted above. Acumen takes measures to address cases of missing or inaccurate information in claims data.

4.0 Feasibility

4.1 Data Elements Generated as Byproduct of Care Processes

The data elements used in this measure are generated, collected and/or used by healthcare personnel during the provision of care (e.g., blood pressure, laboratory values, diagnosis, depression score). The data collected during care provision are then translated into the appropriate coding system (e.g. ICD-10 diagnoses, MS-DRGs) for use in Medicare claims.

4.2 Electronic Sources

All data elements are in defined fields in electronic claims.

4.3 Data Collection Strategy

4.3.1 Data Collection Strategy Difficulties

Lessons and associated modifications may be categorized into three types: data collection procedures, handling of missing data, and sampling data associated with beneficiaries who died during an episode of care.

4.3.1.1 Data Collection

Acumen receives claims data directly from the Common Working File (CWF) maintained at the CMS Baltimore Data Center. Medicare claims are submitted by healthcare providers to a Medicare Administrative Contractor (MAC), and are subsequently added to the CWF. However, these claims may be denied or disputed by the MAC, leading to changes to historical CWF data. In rare circumstances, finalizing claims may take many months, or even years. As a result, it is not practical to wait until all claims for a given month are finalized before calculating this measure. As such, there is a trade-off between efficiency (accessing the data in a timely manner) and accuracy (waiting until most claims are finalized) when determining the length of the time (i.e., the “claims run-out” period) after which to pull claims data. To determine the appropriate claims run-out period, Acumen has performed testing on the delay between claim service dates and claims data finalization. Based on this analysis, Acumen uses a run-out period of three months after the end of the calendar year to collect data for development and testing purposes. If this measure is used in a CMS program, calculation and reporting would be done in line with that program’s reporting practices.

4.3.1.2 Missing Data

This measure requires complete beneficiary information, and a small number of episodes with missing data are excluded to ensure completeness of data and accurate comparability across episodes. For example, episodes where the beneficiary was not enrolled in Medicare Parts A and B for the 120 days prior to the episode start date are not included in this measure. This enables the risk adjustment model to accurately adjust for the beneficiary’s comorbidities using data from the previous 120 days of Medicare claims. Additionally, the risk adjustment model includes a categorical variable for beneficiary age bracket, so episodes for which the beneficiary’s date of birth cannot be located are not included in this measure.

4.3.1.3 Sampling

During measure testing, Acumen noted that episodes in which the beneficiary died prior to the episode end date exhibited different cost distributions compared to other episodes. To avoid this effect’s potential impact on clinician scores, this measure does not include episodes for which the beneficiary’s date of death occurs prior to the end of the episode window.

5.0 Usability and Use

5.1 Use

5.1.1 Current and Planned Use

The measure was developed for potential use in the Merit-based Incentive Program (MIPS), under a contract with CMS.

5.1.2 Feedback on the Measure and Development Process

5.1.2.1 Technical Assistance Provided During Development or Implementation

Development: Field Testing

Acumen and CMS conducted a national field test of 11 episode-based cost measures developed in 2018, including the Inpatient COPD Exacerbation measure, for a 35-day comment period (October 3 to November 5, 2018). We provided field test reports to a sample of clinician groups and clinicians.²⁰ Each report included information for all measures for which the clinician or clinician group was attributed 10 or more episodes. The testing sample was selected to balance coverage and reliability, since a key goal of field testing was to test the measures with as many stakeholders as possible. This sampling technique was used for field testing only and does not determine case minimums used for any potential program implementation.

- Total testing sample across all 11 episode-based cost measures: 14,237 TINs; 63,984 TIN-NPIs
- Testing sample for Inpatient COPD Exacerbation: 6,184 TINs; 28,561 TIN-NPIs

All stakeholders, including those who did not receive a field test report, could review a mock field test report that was posted on the CMS website. Other public documentation posted during field testing included: measure specifications for each measure (comprising a Draft Cost Measure Methodology document and a Draft Measure Codes List file), a Measure Development Process document, a Frequently Asked Questions document, and a Fact Sheet.²¹ During field testing, Acumen conducted education and outreach activities including a national webinar, office hours with specialty societies, and Help Desk support.

5.1.2.2 Technical Assistance with Results

Field Testing

During the feedback period, 2,388 field test reports for episode-based cost measures were downloaded by 403 clinician groups (TINs) and 1,985 clinicians (TIN-NPIs). Stakeholder comments from field testing were summarized for the workgroup to consider in recommending refinements to the measures based on the testing data and feedback.

The following sections offer more details on the contents of each report and describe the education and outreach efforts associated with the field testing feedback period.

Data Provided During Field Testing

Each field test report contained the following sheets:

- High-level summary results across all episode-based cost measures being field tested

²⁰ The field test reports were available for download from the CMS Enterprise Portal: <https://portal.cms.gov/wps/portal/unauthportal/home/>.

²¹ The Measure Development Process, Frequently Asked Questions, and Fact Sheet documents are posted on the MACRA Feedback Page: <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/MACRA-Feedback.html>.

- Results for each measure including cost measure score and breakdown of episode cost compared to the national average and TIN/TIN-NPIs with a similar patient case mix (or risk profile)
- Drill-down detail for each measure, including more detailed information on potential cost drivers in the TIN/TIN-NPI's episodes. For example:
 - Analysis of utilization and cost for the measure by specific service categories (e.g., outpatient evaluation and management services, procedures, and therapy, hospital inpatient services, emergency room services, post-acute services)
 - Breakdown of costs for Physician/Supplier Part B and inpatient claims (e.g., top 5 most billed services and by risk bracket)
- Episode-level table with detailed information for all episodes attributed to the TIN/TIN-NPI across all measures in the report
 - Data across six major categories: (i) episode costs, (ii) beneficiary information, (iii) attributed clinician(s), (iv) evaluation and management visits performed during episode, (v) Physician Fee Schedule costs to Medicare billed during episode, and (vi) other providers rendering care.

A mock field test report can be viewed on the CMS MACRA Feedback webpage.²²

Education and Outreach

Acumen directly conducted outreach via email to tens of thousands of stakeholders using the stakeholder contact list developed through previous education and outreach and clinician engagement efforts, as well as CMS, Quality Payment Program, and other available listservs. More detail on this outreach can be found in the Field Test Summary Report on the CMS MACRA Feedback webpage.

Acumen and CMS hosted two office hours sessions in October 2018, to provide an overview of field testing to specialty societies, discuss what information their members would be particularly interested in, and answer any questions. Acumen also hosted two office hours sessions with members of Clinical Subcommittees and workgroups to provide an update on development and field testing. Across all four office hours sessions, there were over 100 attendees.

Acumen worked with the Physician Value helpdesk and QPP Service Center to answer stakeholder questions during field testing and continued to answer questions after the feedback period ended.

Acumen and CMS hosted a national field testing webinar on October 9, 2018 to provide an overview of the measures being field tested and the information available for public comment. The webinar consisted of an hour-long presentation, outlining (i) the cost measure development activities, (ii) field testing activities, (iii) how to access and understand the confidential field test reports, and (iv) the contents of the reports. The presentation was followed by a 30-minute Q&A session. Around 85 comments and questions were received via webinar chat and on the phone.

A post-field testing webinar was held on March 27, 2019 to provide an update on the measures following field testing. The webinar consisted of a 60 minute presentation providing an overview of the basics of measure construction, highlighting refinements made after field testing, and

²² CMS, "Episode-based Cost Measures Mock Field Test Report," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2018-Mock-report-for-Episode-Based-Cost-Measures.xlsx>.

summarizing the testing done on the measures. This presentation was followed by a Q&A session.²³

5.1.2.3 Feedback on Measure Performance and Implementation

Field Testing

In total, Acumen received 67 survey responses and 25 comment letters, including many from specialty societies representing large numbers of potentially attributed clinicians.

Survey responses and comment letters were collected via an online survey, which contained general and detailed questions on the reports themselves, questions on the supplemental documentation, and questions on the measure specifications.

Pre-Rulemaking

CMS received 37 comments on the 11 episode-based cost measures included in the Measures Under Consideration List released in December 2018. This included four comments for the Inpatient COPD Exacerbation cost measure. After the MAP Clinician Workgroup meeting in December 2018, there was another public comment period on their preliminary recommendations, which received 23 comments across the 11 measures, with one comment specific to the Inpatient COPD Exacerbation cost measure.²⁴ These public comment periods were facilitated by NQF. Stakeholders were able to submit their comments via the NQF website.

5.1.2.4 Feedback from Providers being Measured

Field Testing

The Field Testing Feedback Summary Report presents all feedback gathered during the field testing period. The following list synthesizes some of the key points that were raised through the field testing feedback period:

- *Stakeholder engagement and involvement remains an important aspect of the measure development process.* Stakeholders expressed appreciation for the opportunity to provide feedback during field testing and for CMS' continued efforts to involve them in the measure development process. Commenters also valued the decision to operationalize previously collected feedback, as demonstrated through the addition of measure-specific workgroups to the development process.
- *Field test reports present useful information for understanding clinician performance, though reduced complexity could encourage more clinician participation.* Stakeholders praised the presentation and content of the field test reports. However, the complexity of the information presented in the reports was a challenge for some stakeholders.
- *Improved supplemental field testing materials are helpful but can be further refined.* Some stakeholders found the supplemental field testing materials to be informative and thorough, providing useful information on field testing and the specifications of the cost measures. However, many noted that although the materials are comprehensive, they remain lengthy and complex, and they believe the amount of information provided is too overwhelming to be useful.
- *Ample time for review of field testing reports and materials is vital to collecting meaningful stakeholder feedback.* Some stakeholders suggested the field testing period be extended or kept open, given the large amount and complexity of the information that was presented.

²³ CMS, Webinar Recordings, Slides and Transcripts, *QPP Webinar Library*
<https://qpp.cms.gov/about/webinars>.

²⁴ Measure Applications Partnership, *National Quality Forum*.
https://www.qualityforum.org/Setting_Priorities/Partnership/Measure_Applications_Partnership.aspx.

- *Transparent Clinical Subcommittee and measure-specific workgroup selection and voting encourages buy-in from stakeholders.* Some stakeholders expressed concern with the selection and voting processes for the Clinical Subcommittees and workgroups, highlighting that a transparent approach to member selection would ensure an appropriate mix of specialties and clinician types.
- *Field test report access continues to present challenges for stakeholders.* Some stakeholders noted that they faced difficulties creating accounts and downloading their field test reports from the CMS Enterprise Portal and these challenges may have negatively impacted the number of clinicians that were able to participate in field testing. Stakeholders urged CMS to communicate directly with clinicians receiving field test reports and to find an alternative for delivering and accessing the reports.

The report additionally contains measure-specific feedback, which was used as the basis for the post-field testing refinements that were made to the measures, summarized below:

- Refinements to trigger codes, attribution, sub-groups, episode windows, assigned services, risk adjustment variables, exclusions, and alignment of cost with quality
- Adding/removing certain trigger codes and assigned services, further sub-grouping, and revising the attribution methodology
- Stakeholders also noted that the level of clinician engagement in the development of these episode-based cost measures is a significant improvement over the development process for earlier cost measures.

5.1.2.5 Feedback from Other Users

Pre-Rulemaking

The MAP recognized the importance of cost measures to the MIPS program and conditionally supported the Inpatient COPD Exacerbation cost measure pending NQF endorsement. Specifically, the MAP encouraged the NQF endorsement Cost and Efficiency Standing Committee to consider the appropriateness of the risk adjustment model to ensure clinical and social risk factors are reviewed and included when appropriate. MAP cautioned about the potential stinting of care and noted that appropriate risk adjustment could help safe guard against this practice. The MAP also encouraged the Standing Committee to examine the exclusions in this measure to ensure appropriate attribution.

5.1.2.6 Consideration of Feedback

Field Testing

Careful consideration was given to all feedback gathered during field testing, and several updates were made to the measure based on the recommendations of field testing commenters and an expert clinician workgroup comprised of subject matter and measure-development experts.

After completing field testing, Acumen compiled the feedback provided through the survey and comment letters into a measure-specific report, which was then provided to the expert clinician workgroup, along with empirical analyses to inform their discussion and evaluation of any refinements needed to ensure that the measure is capturing what it was intended to capture.

The changes to the Inpatient COPD Exacerbation measure made after consideration of field testing analyses and stakeholder feedback are:

- **Triggers:** Edited the following triggers:
- Removed MS-DRG 207 Respiratory System Diagnosis With Ventilator Support 96+ Hours with ICD-DGN – Principal and ICD-10 DGN checks for COPD Exacerbation diagnoses.

- **Sub-Grouping:** Replaced field testing sub-groups with following sub-groups:
 - COPD Exacerbation with No NIPPV or Mechanical Ventilation
 - COPD Exacerbation with NIPPV < 96 hours without Mechanical Ventilation
 - COPD Exacerbation with Mechanical Ventilation < 24 hours
 - COPD Exacerbation with Mechanical Ventilation 24-96 hours
- **Exclusions:** Added the following measure-specific exclusions:
 - Mechanical Ventilation > 96 hours
 - NIPPV > 96 hours
 - Patients Receiving Active Treatment for Lung Cancer
- **Service Assignment:**
 - Added the following services:
 - Inhaled medications
 - Removed the following services:
 - Hip fracture and other sequelae of falls if they occur after discharge from hospitalization
 - Initial ambulance transport to the hospital
 - Pneumothorax
- **Risk Adjustment:**
 - Added measure-specific risk adjustors for:
 - Previous non-COPD admission in 31-120 days before the trigger
 - Previous non-COPD admission in the 30 days before the trigger
 - Frailty :dementia, wheelchair use, home hospital bed, anemia, advance care planning, history of falls, mild cognitive impairment, history of nursing physician facility visits, history of home health, history of long-term care hospital

5.2 Usability

5.2.1 Improvement

n/a. The measures have not yet been implemented, and as such have not had influence over performance.

5.2.2 Unexpected Findings

n/a. There were no unexpected findings during the development and testing of this measure

5.2.3 Unexpected Benefits

n/a. There were no unexpected benefits during the development and testing of this measure.

6.0 Related and Competing Measures

6.1 Relation to Other Cost Measures

There are currently no related NQF-endorsed or non-NQF-endorsed cost measures that address this same measure focus or target population. There are no competing NQF-endorsed or non-endorsed cost measures that address both this same measure focus *and* at this same target population.

6.2 Harmonization

n/a

6.3 Competing Measures

n/a

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The Inpatient COPD Exacerbation workgroup is composed of members from the larger Pulmonary Disease Management Clinical Subcommittee. The composition list of the Clinical Subcommittee is included in the [Episode-Based Cost Measures Development Process document](#).²⁵

²⁵ CMS, "Episode-Based Cost Measure Field Testing Measure Development Process," *MACRA Feedback Page*, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/2018-measure-development-process.pdf>.