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Episode-based Resource Use Measures

Episode-of-Care for Patients with Unstable Chronic Obstructive Pulmonary Disease (COPD) over a 1-year Period

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Episode-of-Care for Patients with Unstable Chronic Obstructive Pulmonary Disease (COPD) over a 1-year Period

Measure Description

Resource use and costs associated with management of patients with unstable chronic obstructive pulmonary disease (COPD) over a one year period. Patients with COPD are identified in the year preceding the measurement year and those with one or more qualifying severe events are identified during the measurement year. The possible qualifying severe events are: 1) home oxygen use of two or more months consecutively; 2) severe hospitalization (severe hospitalization meets one of the following criteria: length of stay 14 days or more; ventilation; discharge to acute rehabilitation or skilled nursing facility); and 3) lung volume reduction surgery (LVRS). The onset of the episode begins at the first instance of one of the qualifying events, with the exception of LVRS where the episode begins 60 days prior to the procedure. The unstable COPD-related resource use and costs are measured on a person-month basis for each of those included in the measure. Patients are stratified by the presence of a claim for hospice care during the measurement period. Costs of care are attributed in one of three ways: 1) to a single physician if that provider has more than 70% of the unstable COPD-related E&M codes; 2) to all providers that had 30% or more and 70% or less of E&M codes if no provider has more than 70% of visits; 3) no attribution if no provider has at least 30% of E&M codes during the measurement year.

Required Data Elements

Administrative claims data

Calculation

For patients meeting inclusion criteria, determine monthly unstable COPD-related resource use and costs over a one-year period in the measurement year. Costs are reported on a person-month basis because of there will likely be a relatively high death rate in patients included in this measure. Measurement begins from the earliest date of a qualifying event during the measurement year. A standard price list will be applied to the unstable COPD-related resource use to estimate the costs of the episode of care related to unstable COPD. Resources will be defined for ten categories: 1) inpatient facility; 2) evaluation and management; 3) procedures; 4) imaging; 5) tests; 6) DME; 7) other drugs and services; 8) medications; 9) other and 10) outpatient facility. Costs will be risk adjusted for age and comorbidities. For inpatient facility costs, the standard cost is based on a per diem cost for a DRG and will be multiplied by the length of stay. For each of the other resource use categories, standardized prices will be available for each of the unique codes available under the other four categories.

Episode Definition

Unstable COPD-related care over a one year period.

Rationale

The Institute of Medicine and AQA (formerly known as the Ambulatory Care Quality Alliance) have identified COPD as one of 20 conditions that should be considered priority areas in need of quality improvement based on its relevance to a significant volume of patients (12.1 million adults 25 and older were diagnosed with COPD in 2001¹), its impact on those patients, and the perception of opportunity to significantly improve the quality and efficiency of related care. COPD had also been previously identified as a priority area in other national initiatives including the Agency for Healthcare Research and Quality's Medical Expenditure Panel Survey.² In addition, the costs of treatment for COPD patients can be very high in some cases – in 2002, the direct medical costs of COPD were approximately \$18 billion in the U.S. Furthermore, these costs can vary dramatically from one provider to the next as well as across regions because of variations in practice patterns.

COPD is a chronic condition, and therefore the measurement period will be a one-year period. Because patients with more unstable disease will consume a disproportionate share of resources, they are included in a separate measure. Through administrative data we are unable to measure disease stability using clinical markers and therefore we use events (e.g., two or more consecutive months of home oxygen therapy) to identify patients that are included in the more unstable category. This measure includes all patients meeting the criteria of a person with unstable COPD.

Patients with COPD often receive treatment for the condition from multiple physicians (e.g., a primary care doctor and a pulmonologist) during a given year. They, together, are typically responsible for the majority of the patient's treatment. Thus, while attribution is appropriate at the individual physician level, a standard single-physician attribution model may not be merited. Costs of care are attributed in one of three ways: 1) to a single physician if that provider has more than 70% of the unstable COPD-related E&M codes; 2) to all providers that had 30% or more and 70% or less of E&M codes if no provider has more than 70% of codes; 3) no attribution if no provider has at least 30% of E&M codes during the measurement year.

Measures

- COPD-related resource use / costs
 - Inpatient Facility
 - Evaluation and Management

¹ COPD International, quoted from National Heart, Blood, and Lung Institute. <http://www.copd-international.com/>. March 26, 2009.

² Priority Areas for National Action: Transforming Health Care Quality. Institute of Medicine. Karen Adams and Janet Corrigan Editors. March 10, 2003.

- Procedure and Laboratory
- Pharmacy
- Other

Eligible Population

Age Those 40 years and older during the identification year are eligible for inclusion

Enrollment Criteria Continuous medical and pharmacy benefit enrollment during the identification year and during the measurement year, with no more than one gap in enrollment of more than 45 days during each year of continuous enrollment.

Inclusion Criteria Patients included in the measure must meet one of the following criteria during the identification year:

- 1) One outpatient E&M claim with a diagnosis of COPD (see **Table COPD US-A**)

and

One prescription for a bronchodilator (see **Table COPD US -B**)

OR

- 2) One inpatient claim with a diagnosis of COPD (see **Table COPD US -A**)

and

One prescription for a bronchodilator (see **Table COPD US-B**)

OR

- 3) Two claims (either outpatient E&M claims or inpatient claim) with COPD diagnosis

Patients included in the measure must have one of the following during the measurement year:

- 1) Two or more months of home oxygen use (**Table COPD-C5**) (measurement begins from date of first oxygen use)

OR

2) One severe COPD-related hospitalization (see **Table COPD-CI** for COPD-related hospitalizations)

and

- i) Length of stay 14 days or longer
- ii) Ventilation during the hospitalization (see **Table COPD US-C6**)
- iii) Discharge to acute rehabilitation or skilled nursing facility

OR

3) Lung volume reduction surgery (see **Table COPD US -C7**) [measurement begins 60 days prior to date of LVRS]

Exclusion

Persons meeting the following criteria during either the identification or measurement year will be excluded (see **Tables COPD US-DI-6** for codes):

- Active cancer (excluding melanoma, skin, prostate, and CLL)
- End stage renal disease (ESRD)
- HIV/AIDS
- Organ transplant
- Ventricular assist device
- Cystic fibrosis

Table COPD US-A: Codes to identify COPD qualifying events

Description	ICD-9 Code	DRG
COPD	491.x, 492.x, 496	88

Codes present in **any** diagnostic field during measurement period on outpatient claims group to the episode. Codes present as **primary** diagnosis for hospitalization group to the episode.

Table COPD US-B: Bronchodilators for qualifying COPD event

Class	Medication
Short-acting beta-agonists	Albuterol
Long-acting beta-agonists	Salmeterol; formoterol
Anticholinergics	Ipratropium; Tiotropium
Methylxanthines	Theophylline; Aminophylline

These pharmacy claims will be used to identify COPD patients during the measurement period, regardless of corresponding CPT and UB revenue codes.

Tables COPD US-C: Codes to Identify COPD-related care and categories of service

Table COPD US-C1 COPD-related visits and services

Description	ICD-9 Code
Bronchitis	490
Chronic bronchitis	491.x
Emphysema	492.x
Asthma	493.x
Bronchiectasis	494
Chronic airway obstruction, NEC	496
Acute nasopharyngitis	460
Acute sinusitis	461.x
Acute pharyngitis	462
Acute laryngitis and tracheitis	464.x
Acute upper respiratory infections of multiple or unspecified sites	465.x
Acute bronchitis and bronchiolitis	466.x
Chronic pharyngitis and nasopharyngitis	472.x
Chronic sinusitis	473.x
Other diseases of upper respiratory tract	478.x
Viral pneumonia	480.x
Pneumococcal pneumonia	481
Other bacterial pneumonia	482.x
Pneumonia due to other specified organism	483.x
Pneumonia in infectious disease classified elsewhere	484.x
Bronchopneumonia, organism unspecified	485
Pneumonia, organism unspecified	486
Influenza	487.x
Empyema	510.x
Pleurisy	511.x
Pneumothorax	512.x
Abscess of lung and mediastinum	513.x
Pulmonary congestion and hypostasis	514
Other diseases of lung	518.x
Other diseases of respiratory system	519.x
Cough	786.2
Hemoptysis	786.3
Dyspnea	786.09
Wheezing	786.07
Shortness of breath	786.05
Acute respiratory failure	518.81
Other pulmonary insufficiency not elsewhere classified	518.82

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Acute and chronic respiratory failure	518.84
Respiratory arrest	799.1

For inpatient events, these ICD-9 codes, present in the **primary** diagnostic field, will be used to identify COPD-related services during the measurement period, regardless of corresponding CPT codes.

For outpatient events, these ICD-9 codes, present in **any** diagnostic field, will be used to identify COPD-related services during the measurement period, regardless of corresponding CPT codes.

Table COPD US-C2 Evaluation and Management Codes

Description	CPT Codes
EPSDT: Health Exam	90751–90753
Allergy Counseling	95105
Office or Other Outpatient Services	99201–99215
Hospital Observation Services	99217–99220
Hospital Inpatient Services	99221–99239
Consultations	99241–99255, 99261–99263, 99271–99275
Critical Care and Intensive Care Services	99289–99298
Nursing Facility, Domiciliary and Home Services	99301–99350
Case Management Services and Care Plan Oversight Services	99361–99380
Preventive Medicine Services	99383–99390, 99393–99405, 99410–99429
Other E&M Services	99450–99456, 99354–99357

These codes will be used to help identify those COPD-related services that should be categorized as “E&M” during our analyses. They do not identify the only services that will be included.

Table COPD US-C3 Procedure and Laboratory

Description	CPT	HCPCS	ICD-9 Procedure
Pulmonary rehabilitation			93.1, 93.2
Spirometry	94010, 94014, 94015, 94016, 94060, 94070, 94150, 94200, 94240, 94250, 94260, 94350, 94360, 94370, 94375, 94400,		

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	94450, 94620, 94621		
Echocardiography	93303, 93304, 93307, 93308, 93312, 93313, 93314, 93315, 93316, 93317, 93320, 93321, 93325, 93350		
Non-invasive ventilator	94656, 94657, 94660, 94662	A7027, A7028, A7029, A7030, A7031, A7032, A7033, A7034, A7035, A7036, A7037, A7038, A7039	93.90, 93.91
Chest X-ray	71010 – 71035		
Chest CT	71250, 71260, 71270		
VQ scan	78588		
ABGs	82800, 82803, 82805, 82810		
Oximetry	94760, 94761, 94762		
Sleep studies	95805 – 95962		
EKGs	93000, 93005, 93010, 93012, 93014, 93015, 93016, 93017, 93018, 93040, 93041, 93042, 93224, 93225, 93226, 93227, 93230, 93231, 93232, 93233, 93235, 93237		
Right and left heart catheterization	93501, 93503, 93505, 93508, 93510, 93511, 93514, 93524, 93526, 93527, 93528, 93529, 93530, 93531, 93532, 93533, 93536, 93539, 93540, 93541, 93541, 93542, 93543, 93544, 93545, 93555, 93556, 93561, 93562, 93571, 93572		
Bronchoscopy	31615 – 31656		
Nasal laryngoscopy	31505 – 31579		
Serum chemistry	80047, 80048, 80050, 80053, 80069		
Sputum analysis	89350		
EGD	43200 – 43272		
Nebulized Medication Administration			93.94
Oxygen and Supplies		S8120, S8121, A4616, E0424, E0425, E0430, E0431, E0434,	

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		E0435, E0439, E0440, E0441, E0442, E0443, E0444, E0445	
Spacers		S8100, S8101	
Vaccinations (Influenza, Pneumococcal)	90657 – 90660, 90669, 90732		99.52, 99.55
Peak flow meters		A4614, S8096	
Nebulizer		A7015, A7016, A7017, A7018	

These procedure codes will be used to identify COPD-related services during the measurement period, regardless of corresponding ICD-9 codes.

Table COPD US-C4 Medications (during the measurement period)

Class	Medication
Short-acting beta-agonists	Albuterol
Long-acting beta-agonists	Salmeterol; formoterol
Anticholinergics	Ipratropium; Tiotropium
Methylxanthines	Theophylline; Aminophylline
Inhaled corticosteroids	Budesonide, fluticasone, flunisolide, triamcinolone, beclamethasone, mometasone
Nicotine replacement therapy	(patches, gum, inhaler)
Smoking cessation therapy	Bupropion, varenicline
Antibiotics*	
Anitvirals	
	sildenafil

* Only including antibiotics with <= 14 day supply with the exception of inhaled tobramycin

Table COPUS-C5 Home oxygen

Description	CPT	HCPCs
Oxygen and Supplies		S8120, S8121, A4616, E0424, E0425, E0430, E0431, E0434, E0435, E0439, E0440, E0441, E0442, E0443, E0444, E0445

These DME codes will be used to identify COPD-related care during the measurement period, regardless of corresponding ICD-9 codes.

Table COPD US-C6 Ventilation during inpatient stay

Description	CPT	HCPCs	ICD-9 Diagnosis	ICD-9 Procedure
Non-invasive ventilator	94656, 94657, 94660, 94662	A7027, A7028, A7029, A7030, A7031, A7032, A7033, A7034, A7035, A7036, A7037, A7038, A7039		93.90, 93.91

These procedure codes will be used to identify COPD-related services during the measurement period, regardless of corresponding ICD-9 diagnosis codes.

Table COPD US-C7 Lung volume reduction surgery

Description	CPT	HCPCs	ICD-9 Diagnosis	ICD-9 Procedure
Lung volume reduction surgery	32124, 32141, 32480, 32491, 32500, 32655, 32656, 32657, 32999	G0302, G0303, G0304, G0305		32.25

These procedure codes will be used to identify COPD-related services during the measurement period, regardless of corresponding ICD-9 diagnosis codes.

Tables COPD-D: Codes to Identify Exclusions

The following codes will be used to identify exclusions during the identification period or the measurement period.

Table COPD-DI-Cancer: Codes to Identify Active Cancer Treatment

Description	ICD-9-CM Diagnosis
Cancer	140-171; 174-184; 187-203; 204.0; 204.2; 204.8; 205- 208; 230-239

WITH

Description	CPT	ICD-9-CM Procedure	UB Revenue
Treatment	38230, 38240-38242, 77261- 77799, 79000-79999, 96400- 96549	41.0, 41.91, 92.2	028x, 033x, 0342, 0344, 0973

Table COPD-D2-ESRD: Codes to Identify ESRD

Description	CPT	HCPCS	ICD-9-CM Diagnosis	ICD-9-CM Procedure	UB Revenue	UB Type of Bill	POS
ESRD (including renal dialysis)	36145, 36800-36821, 36831-36833, 90919-90921, 90923-90925, 90935, 90937, 90939, 90940, 90945, 90947, 90989, 90993, 90997, 90999, 99512	G0257, G0311-G0319, G0321-G0323, G0325-G0327, G0392, G0393, S9339	585.5, 585.6, V42.0, V45.1, V56	38.95, 39.27, 39.42, 39.43, 39.53, 39.93, 39.94, 39.95, 54.98	080x, 082x-085x, 088x	72x	65

Table COPD-D3-Transplant: Codes to Identify Organ Transplant

Description	CPT	HCPCS	ICD-9-CM Procedure	UB Revenue
Organ transplant	32850-32856, 33930-33945, 44132-44137, 44715-44721, 47133-47147, 48160, 48550-48556, 50300-50380	S2152, S2053-S2055, S2060, S2061, S2065	33.5, 33.6, 37.5, 41.94, 46.97, 50.5, 52.8, 55.6	0362, 0367, 0810-0813, 0819

Table COPD-D4-HIV: Codes to Identify HIV

Description	ICD-9-CM Diagnosis
HIV	042

Table COPD-D5-VAD: Codes to identify ventricular assist device

Description	CPT	ICD-9 Procedure
VAD	33975, 33976	37.66

Table COPD-D6-CF: Codes to Identify Cystic Fibrosis

Description	ICD-9-CM Diagnosis
CF	277.0x

Risk Adjustment Method

Comorbid conditions identified as HCCs in 12 months preceding event date using inpatient and outpatient ICD-9 codes.

Episode Severity / Disease Staging

The results will be reported separately based on the criteria by which the individual qualifies for the unstable measure. That is, the results will be presented for the following strata: 1) home oxygen; 2) severe hospitalization; and 3) lung volume reduction surgery.

Outlier Methodology

All individuals are included in the analysis with costs winsorized at the 2nd and 98th percentile.

Level of Measurement/Analysis

Measurement will take place at the level of the individual physician. Attribution of resource use and costs for a patient will be assigned to a physician or physicians on a hierarchical basis. Total number of E&M codes for the measurement year for unstable COPD-related services will be determined. Inpatient stays count as a single E&M code for the entire stay. Attribution will be assigned using the following hierarchy:

- 1) Costs and resource use assigned to a single provider if that physician has more than 70% of the E&M codes during the measurement year (single attribution); OR
- 2) If no provider has more than 70% of the E&M codes, costs and resource use are assigned to each of the providers that have more than 30% of E&M codes for a patient during the measurement year (multiple attribution); OR
- 3) If no provider has at least 30% of the E&M codes during the measurement year, the care for that patient is not attributed to any provider (no attribution).

Technical Appendix

Episode-of-Care for Patients with Unstable Chronic Obstructive Pulmonary Disease (COPD) over a 1-year Period

Appendix Overview

The following document provides step-by-step methods for implementing the Episode-of-Care for Patients with Unstable Chronic Obstructive Pulmonary Disease (COPD) over a 1-year Period measure using an administrative, claims, or healthcare encounter database.

There are 9 sections for calculating person-level episode costs:

1. Eligible population identification
2. Identification of related resources
3. Assignment of standardized prices
4. Create episode specific strata
5. Calculation of individual episode costs
6. Calculation of risk-adjusted costs
7. Determination of attributable provider
8. Creation of provider summaries
9. Reporting

Measure Description

Resource use associated with management of patients with unstable COPD over a one-year period. Patients with COPD are identified in the year preceding the measurement year and those with one or more qualifying severe events are identified during the measurement year. The possible qualifying severe events are: 1) home oxygen use of two or more months consecutively; 2) severe hospitalization (severe hospitalization meets one of the following criteria: length of stay 14 days or more; ventilation; discharge to acute rehabilitation or skilled nursing facility); and 3) lung volume reduction surgery (LVRS). The onset of the episode begins at the first instance of one of the qualifying events, with the exception of LVRS where the episode begins 60 days prior to the procedure. Episode-related resource use for patients with unstable COPD is identified and standardized costs are applied. Total unstable COPD-related costs are calculated for each patient and summarized at the attributable provider level. Observed costs are compared to risk-adjusted expected costs at the provider level.

Required Data Elements

Eligibility and/or enrollment information (both medical and pharmacy)

Administrative claims:

- Inpatient
- Outpatient
- Pharmacy

Required Data Duration and Timeframe

A minimum of 24 months of continuous data is necessary to calculate the measure. The 24-month period is divided into a 12-month identification period and a 12-month measurement period.

Definitions

Identification year	12-month period used to identify patients eligible for inclusion in the measure
Measurement year	12-month period over which unstable COPD-related resource use is measured; immediately follows identification year
Measure population	The collection of patients who meet all measure inclusion criteria and do not meet any measure exclusion criteria. Their resource use will be calculated and included in provider summary reports.
Age	Patient age during the identification or measurement year will be defined as the patient's age at the first day of the identification period.
COPD-related¹	Healthcare encounters defined as being related to unstable COPD care
Continuous enrollment	As identified in eligibility or enrollment information, full medical and pharmacy benefit enrollment during both the identification year and the measurement year, with at least 320 total days of coverage during each year ²
Medication dispensing event	Medication dispensing with a positive, non-zero cost.
Inpatient	An acute care overnight hospital stay of ≥ 1 day with positive

¹ May refer to services both appropriately and inappropriately rendered in the treatment or management of a patient with unstable COPD

² This method was derived using HEDIS methods for determining coverage eligibility. HEDIS rules require that each eligible person have no more than 1 gap in coverage of up to 45 days in each year.

Hospital Event associated charges

Section I – Eligible Population Identification

The process of identifying patients to be included in the measure is divided into three separate steps, each with multiple sub-steps. The following steps are used for identifying the included population:

Step 1: Identify patients that meet the episode definition inclusion criteria

Step 2: Identify patients that meet eligibility and continuous enrollment criteria

Step 3: Identify patients with exclusion criteria

Step 4: Combine prior steps to identify measure population

Step 1: Identify patients that meet episode inclusion criteria

1. Identify patients 40 years and older during the identification year
2. Identify patients that meet any one of the following sets of inclusion criteria during the identification year:

Inclusion Criteria Set 1:

One outpatient E&M claim with a diagnosis of COPD (see **Table COPD US-A**)

and

One prescription for a bronchodilator (see **Table COPD US-B**)

Inclusion Criteria Set 2:

One inpatient admission with a diagnosis of COPD (see **Table COPD US-A**)

and

One prescription for a bronchodilator (see **Table COPD US-B**)

Inclusion Criteria Set 3:

≥2 claims (either outpatient E&M claims or inpatient claim) with COPD diagnosis

3. Identified the subset of patients meeting the above eligibility criteria that have one of the following during the measurement year:
 - 1) Two or more months of home oxygen use (**Table COPD US-C5**) (measurement begins from date of first oxygen use)

OR

- 2) One severe COPD-related hospitalization (see **Table COPD US-C1** for COPD-related hospitalizations)

and

- i) Length of stay 14 days or longer
- ii) Ventilation during the hospitalization (see **Table COPD US-C6**)
- iii) Discharge to acute rehabilitation or skilled nursing facility

OR

- 3) Lung volume reduction surgery (see **Table COPD US-C7**) [measurement begins 60 days prior to date of LVRS]

Step 2: Identify patients that meet eligibility and continuous enrollment criteria

1. Eligibility

- a. Identify benefits during both the identification year and the measurement year
- b. To be included persons must have both of the following benefits in both years
 - i. Medical benefit
 - ii. Pharmacy benefit

2. Continuous enrollment

- a. Determine enrollment during both the identification and measurement years
- b. Identify (or estimate³) total days of coverage in each year
- c. To be eligible, persons must have at least 320 total days of coverage during each year

Step 3: Identify patients with exclusion criteria

1. Identify patients that meet one or more exclusion criteria during either the identification year OR the measurement year
2. Exclusion criteria (**Tables COPD US-D1-6**):
 - Active cancer (excluding melanoma, skin, prostate, and CLL)
 - End stage renal disease (ESRD)
 - HIV/AIDS
 - Organ transplant
 - Ventricular assist device

³ If precise information regarding persons' total days of coverage is not available, it is recommended that measure implementers estimate this information to the best of their ability using available data elements (e.g., monthly enrollment indicators).

- Cystic fibrosis

Step 4: Combine prior steps to identify measure population

1. Identify unstable COPD eligible population
2. Exclude those patients not meeting general inclusion criteria (e.g., continuous eligibility)
3. Exclude those patients meeting one or more measure exclusion criteria
4. The resulting collection of patients is the measure population

Section 2 – Eligible Event Identification

For each individual in the measure population, identify the following paid claims for services rendered during the measurement year. Claims / encounters will be identified based on the presence of unstable COPD-related diagnosis codes or procedure codes. These events will be used to determine the unstable COPD-related resource use.

Inpatient hospitalization events

Identify all inpatient hospitalization events with one of the following diagnosis codes appearing in the **primary** diagnosis field (see **Table COPD US-C1**).

Outpatient events

Identify all outpatient claims / encounters with an unstable COPD-related diagnostic code appearing in **any** position (see **Table COPD US-C1**).

Procedures, laboratory, and other

Identify all claims / encounters with unstable COPD-related CPT, HCPCs, or ICD-9 procedure codes (see **Tables COPD US-C1, COPD US-C3, COPD US-C5**). The procedure codes are used to identify unstable COPD-related services during the measurement period, regardless of corresponding ICD-9 diagnosis codes. Similarly, all claims with a qualifying ICD-9 code are included regardless of the procedure codes associated with that claim.

Prescription drugs

Identify unstable COPD-related medications during the measurement period (see **Table COPD US-C4**).

Section 3 – Assignment of standardized prices

Standardized prices are calculated for all of the components of care used to treat or manage the patient's condition to ensure that comparisons can be made solely on the

basis of differential practice patterns and resource use. Three separate methodologies are used to derive these standardized prices: for inpatient facility charges, for ambulatory pharmacy charges (i.e., prescriptions dispensed outside the inpatient hospital setting), and for all other charges. These standardized prices are then applied to the claims identified as unstable COPD-related.

Standard Cost Calculation

- Step 1** Identify all claims paid for services rendered during the measurement year and with positive non-zero paid amounts for all patients, regardless as to whether they have been included in the measure population. Categorize these claims as follows (in accordance with the BETOS classification process followed in Step 3 above):
- *Inpatient Facility* (services provided by a facility during an acute inpatient hospital stay, standard price includes room and board and ancillary services)
 - *Ambulatory Pharmacy* (ambulatory prescriptions included in a member's pharmacy benefit)
 - *All other* (E&M, procedures, imaging, tests, DME, other, and exceptions/unclassified)
- Step 2** For each category identified, compute standardized prices. Refer to each service category's instructions (i.e., *Calculating Standard Units of Service and Total Standard Cost*) below.
- Step 3** Combine standardized prices with eligible events (e.g., through a file merge as specified in each service category's instructions).
- Step 4** For each individual claim, multiple standardized price by the number of service units identified on the claim to determine the full cost of the service, hospitalization, or prescription.

Calculating Standard Units of Service and Total Standard Cost: *Inpatient Facility*

For inpatient facility costs, standardized prices are developed at the diagnosis-related group (DRG) level and – for those hospitalizations where DRG-level information is unavailable – at the ADSC level. Each is adjusted for length-of-stay (LOS) so as to more closely mirror the payment systems typically applied among commercial health plans. Both approaches use RRU HEDIS standardized daily price tables developed by NCQA. All inpatient facility costs are considered “acute” for this analysis.

- Step 1** Identify all inpatient stays that occurred during the measurement year. Include stays that may have started before the measurement year or ended after the close of the measurement year. Define a single, unique record describing the member’s inpatient stay.
- Step 2.** Identify the primary discharge DRG. Also identify the DRG version (e.g., CMS-DRG vs. MS-DRG). Care must be taken in using the standardized price tables (specified below) to insure the data and the tables use the same DRG version.
- Step 3** Compute the stay’s total LOS in days, using paid or expected-to-be-paid days only. Include all paid days in the LOS calculation, whether or not they fall outside the measurement year. Also identify the stay’s LOS group based on the stay’s LOS and the information contained in Table COPD US-E below.

Table COPD-E: Length of Stay Group

LOS (Days)	LOS GRP
1	A
2	B
3-4	C
5-6	D
7-8	E
9-15	F
16 or more	G

- Step 4** Compute the LOS per diem multiplier. If the inpatient stay falls completely within the measurement year, use the total number of paid days as the per diem multiplier. If the inpatient stay does not fall completely inside the measurement year, count only the days within the measurement year (including the last day of the year) to compute the per diem multiplier.
- Step 5** Download the HEDIS RRU standardized daily price tables from the NCQA website (www.ncqa.org) for the corresponding measurement years. Note that there is a one year lag in the file and data years (i.e. files designated 2007 are based on 2006 data). Some years may have two sets of tables if there is a significant change in DRG versions.⁴

⁴ The project staff worked in collaboration with NCQA in development of this methodology for purposes of testing the initial set of measures. Users of the measures may need to implement their own methodology that does not rely on a price list from NCQA.

Step 6 Calculate the DRG-specific per-diem payment rate by adjusting the standard daily prices for inflation to a reference year using the medical care component of the Consumer Price Index (CPI).

Step 7 Combine DRG-specific per-diem payment rates with the dataset containing eligible inpatient hospital events for the measure. For each event, multiply the per-diem payment rate by the event's LOS per diem multiplier to determine the event's total standard cost.

Total standard costs will not be computed using this approach for stays that have not been assigned a DRG, and for DRGs that are not assigned a standard price by HEDIS. These stays will be assigned a standard price using the ADSC method described below.

Example⁵ Assume the calculated DRG-specific per-diem payment rate for DRG XXX for FY 2007 is \$900.17. An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis with an eligible ICD-9 code
- A DRG of XXX (DRG associated with an eligible inpatient stay for the episode)
- Date of admission of February 2, 2007 and date of discharge of February 9, 2007 (fiscal year 2007)
- A LOS of 8 days, and therefore a LOS per diem multiplier of 8 days

This event has a calculated total standard cost of $\$900.17 \times 8 = \$7,201.36$.

Example Again assume the calculated DRG-specific per-diem payment rate for DRG XXX for FY 2007 is \$900.17. An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis with an eligible ICD-9 code
- A DRG of XXX (DRG associated with an eligible inpatient stay for the episode)
- Date of admission of December 28, 2006 and date of discharge of January 2, 2007 (fiscal year 2007)
- A LOS of 6 days, and a LOS per diem multiplier of 2 days (January 1-2).

This event has a calculated total standard cost of $\$900.17 \times 2 = \$1,800.34$.

Step 8 If DRG information is not available for a given inpatient hospitalization a method must be used that assigns prices to those hospitalizations. The methodology used in

⁵ Figures presented in this example are arbitrary and do not reflect any particular dataset or patient. Additionally, the DRG XXX is intended to be used as an illustrative example for calculating inpatient costs. Only DRGs related to the episode should be included in this calculation.

testing the initial development of the measures was to assign an Aggregate Diagnostic Service Category (ADSC) for the stay using the principal discharge diagnosis. To assign ADSC, download the ADSC Table (Table SPT-INP-ADSC) from the NCQA Web site (www.ncqa.org) and match the principal ICD-9-CM Diagnosis code from the discharge claim to an ADSC. If the claim does not contain a DRG and the primary ICD-9-CM Diagnosis code is invalid or missing, map the inpatient stay to the ADSC Table's MISA category.⁶ An alternative would be to create average prices from the dataset the measures are being implemented for each of the ADSC categories and discharge ICD-9-CM codes and assign those prices to missing hospitalizations.

Step 9 Determine if the member underwent major surgery during the inpatient stay. If this information is not available within the dataset, this may be determined using the list of codes included in a table from the NCQA Web site (Maj-Surg Table). Flag eligible members if one procedure code in the Maj-Surg-Table is present from any provider during the time period defined by the admission and discharge dates.

Step 10 Match each ADSC, LOS per diem multiplier, and major surgery flag assignment for the stay to a value in the Table SPT-INP-ADSC to obtain the assigned standard price. For each event, multiply the per-diem payment rate by the event's LOS per diem multiplier to determine the event's total standard cost. As with the DRG method, the ADSC standard prices must be adjusted for inflation to a reference year using the CPI. Between this ADSC methodology and the previously described DRG-based methodology, each inpatient hospital stay should now have an associated standardized price.

Example An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis for an eligible event assigned to ADSC category Respiratory-C (RESC)
- No available valid DRG information
- Date of admission of February 2, 2007 and date of discharge of February 9, 2007
- A LOS of 8 days, and therefore LOS group E
- A major surgery event during the stay

Using Sample Table SPT-INP-ADSC, we determine this event has a standard per-diem payment rate of \$1,474.00. Therefore, this event has a calculated total standard cost of $\$1,474 \times 8 = \$11,792$.

Calculating Standard Units of Service and Total Standard Cost: *Ambulatory Pharmacy*

⁶ The project staff worked in collaboration with NCQA in development of this methodology for purposes of testing the initial set of measures. Users of the measures may need to implement their own methodology that does not rely on a price list from NCQA.

For ambulatory pharmacy-related costs, standardized prices are developed at the NDC level, adjusted for days supply.

- Step 1** Identify all pharmacy services that occurred during the measurement year. The following pharmacy services should also be included:
- Prescriptions that may have been dispensed before the measurement year and had days supply that extended into the measurement year (e.g., a prescription with a dispensed date of December 15, 2007 and 30 days supply would extend 13 days into the measurement year beginning January 1, 2008)
 - Prescriptions that may have been dispensed during the measurement year and had days supply that extended into the following year (e.g., a prescription with a dispensed date of December 20, 2008)

Define a single, unique record describing the pharmacy service.

- Step 2** Identify the NDC code and the days supply for each prescription, whether or not some days fall outside the measurement year.

If the days supply is not available for a given pharmacy claim, set the claim's standard cost to be equal to its listed payment amount.

- Step 3** Compute the days supply per diem multiplier. If the prescription's days supply fall completely within the measurement year, use the claim's listed days supply as the per diem multiplier. If the prescription's days supply do not fall completely inside the measurement year, count only the days within the measurement year (including the last day of the year) to compute the per diem multiplier.

- Step 4** For each NDC, calculate the total NDC-specific payments and the total days supply across all pharmacy claims within that NDC during the measurement year. Using these totals, calculate NDC-specific per-day-supply payment rates by dividing total NDC-specific payments by total days supply for each NDC.

- Step 5** Combine NDC-specific per-day-supply payment rates with the dataset containing eligible pharmacy events for the measure. For each event, multiply the per-day-supply payment rate by the event's days supply per diem multiplier to determine the event's total standard cost.

Calculating Standard Units of Service and Total Standard Cost: All Other

For all non-inpatient hospital, non-pharmacy costs, standardized prices are developed at the procedure code and modifier level.

- Step 1** Identify all non-inpatient hospital, non-pharmacy services that occurred during the measurement year.

- Step 2** Identify the primary procedure code (CPT, HCPCs, ICD-9, etc.) and the first

modifier code for each service.

- Step 3** For each procedure-modifier combination, calculate the total procedure/modifier-specific payments across all non-inpatient-hospital, non-pharmacy claims with that procedure-modifier combination as well as the frequency of the procedure-modifier combination during the measurement year. Calculate procedure/modifier-specific payment rates by dividing total procedure/modifier-specific payments by the frequency for each procedure-modifier combination.
- Step 4** Combine procedure/modifier-specific payment rates with the dataset containing eligible non-inpatient-hospital, non-pharmacy events for the measure so that each procedure-modifier combination is paired with its corresponding payment rate. This payment rate is the event's total standard cost.

Section 4 – Create episode specific strata

Not applicable.

Section 5 – Calculation of total individual episode costs

The resource use identified as unstable COPD-related– and to which standardized prices have been applied (i.e., the collection of eligible events) – is used to calculate individual level episode costs. The following steps are used in the calculation of total individual level costs.

Step 1: For each individual included in the episode, sum all of the total standard costs linked to unstable COPD-related events occurring during the measurement year at the BETOS level. This will provide an estimate of the costs of each category of service over the measurement year.

Step 2: For each individual in the episode, sum ALL total standard costs linked to unstable COPD-related events to calculate TOTAL episode costs.

Section 6 – Calculation of risk adjusted costs

The model developed for comorbidity adjustment uses Hierarchical Condition Categories (HCC) to identify comorbidities. This reflects the risk adjustment methodology used by CMS and recently evaluated by NCQA for their Relative Resource Use (RRU) measures. However, there is an important distinction between the use of HCCs by CMS and the model evaluated by NCQA and the risk adjustment model used to estimate expected costs. The CMS and NCQA model use HCCs to adjust TOTAL costs of care, whereas this model focuses on episode-specific costs of care. Because models developed to adjust total costs of care may not reflect the expected costs for episode-specific resource use, new models were developed from a sample of commercially insured patients for risk adjustment. The following process was completed to develop the models:

1. Utilized quasi-Modified Delphi approach with the condition-specific workgroup to categorize HCCs into three groups:

- Include in risk adjustment model;
- Exclude in risk adjustment model; and
- Test impact in risk adjustment model.

2. Identified HCCs in denominator population during the 12 months preceding the measurement year.

3. Tested 12 different model specifications shown in Table COPD-RAI, where the HCCs included in the model varied, and the distribution and link functions in the generalized linear models also varied. Models were developed in a stepwise manner as indicated. The first four models used a gamma distribution and a log link function. The first model included all HCCs identified by the condition-specific workgroup as “Include HCCs” with a prevalence in the population of $\geq 1\%$. The second model was a reduction of the first model that only included HCCs where $p < 0.1$. The third model extended the second model by including HCCs with prevalence $\geq 1\%$ identified as “Test HCCs” by the condition-specific workgroup. The fourth model was a reduction of the third model and included only those HCCs where $p < 0.1$. The next set of four models (Models 5-8) repeated the process of the first four models but used a normal distribution and identity link function. Model 9 used all of the HCCs, with the exception of the HCC for the episode being evaluated (e.g., diabetes for the diabetes episode; however HCCs for complications of diabetes were included), and a gamma distribution with log link function. Model 10 was a reduction of Model 9 where only the HCCs with $p < 0.1$ were included. The final two models (Models 11-12) used the same process as Models 9 and 10 with a normal distribution and identity link function.

Table COPD-RAI. Risk Adjustment Model Specifications

Model #	Independent Variables						Distribution	Link function
	WG Specified ($> 1\%$)	WG specified ($> 1\%$) $p < 0.1$	Test conditions ($> 1\%$)	Test conditions ($> 1\%$) $p < 0.1$	All HCCs	All HCCs $p < 0.1$		
1	X						Gamma	Log
2		X					Gamma	Log
3		X	X				Gamma	Log
4		X		X			Gamma	Log
5	X						Normal	Identity
6		X					Normal	Identity
7		X	X				Normal	Identity

8	X	X	Normal	Identity
9			Gamma	Log
10			X Gamma	Log
11		X	Normal	Identity
12			X Normal	Identity

4. Models were developed in a split sample approach with 75% of the population randomly selected for model development and the remaining 25% used in model evaluation. Model performance was also evaluated in the full cohort.

5. The performance of each model was evaluated through comparisons of the observed and predicted distributions, comparisons of residuals, comparisons of absolute differences between observed and predicted, comparisons of observed-to-predicted ratios, and comparisons of mean squared errors across models. Summary information on model performance was presented to the condition-specific workgroup for selection of a risk adjustment model for the condition. Final model selection was based on the best performing model across metrics. Where model performance was similar, models using the normal distribution were preferentially chosen over the gamma distribution models for ease of implementation. More parsimonious models were also preferentially chosen.

The following is the model selected for estimating adjusted costs in the unstable COPD episode.

Risk Adjustment Model

Risk Adjusted Unstable COPD Episode Costs =

COPD Unstable Episode Expected Costs

$$\begin{aligned} &= \$40,850 + (\text{Male} \times -\$1993) + (\text{Age} \times -\$299) \\ &+ (\text{Septecemia, shock} \times \$12,899) + (\text{CHF} \times \$2865) \\ &+ (\text{Ischemic or unspecified stroke} \times \$10,067) \\ &+ (\text{Vascular disease with complications} \times \$10,045) \\ &+ (\text{Vascular disease} \times \$6802) \\ &+ (\text{Aspiration and specified bacterial pneumonias} \times \$13,439) \\ &+ (\text{Pneumococcal pneumonia, emphysema, lung abscess} \times \$6045) \\ &+ (\text{Renal failure} \times \$4555) \\ &+ (\text{Major complications of medical care and trauma} \times \$6074) \\ &+ (\text{Diabetes with neurologic or other specified manifestation} \times -\$7601) \\ &+ (\text{Diabetes with ophthalmologic or unspecified manifestation} \times -\$7758) \\ &+ (\text{Diabetes without complications} \times -\$1760) \\ &+ (\text{Intestinal obstruction, perforation} \times \$5596) \\ &+ (\text{Bone, joint, muscle infections, necrosis} \times \$16,361) \\ &+ (\text{Drug, alcohol dependence} \times \$10,284) + (\text{HIV} \times \$5758) \\ &+ (\text{Unstable angina and other acute ischemic heart disease} \times \$9572) \\ &+ (\text{Angina pectoris, old myocardial infarction} \times \$5000) \\ &+ (\text{Specified heart arrhythmias} \times \$3021) \\ &+ (\text{Chronic ulcer of skin, except decubitus} \times \$3021) \end{aligned}$$

Measure implementers have two choices when calculating risk adjusted costs. The first is to follow the process specified above to create risk adjustment models that are specific to their population and their dataset. The second option is to follow the below steps and use the above estimates for calculating risk adjusted costs. While the latter is a straightforward calculation, caution is warranted as the risk adjusted equations were derived from a population that may be different from the population to which the measure is being applied.

To estimate risk adjusted costs using the above risk adjustment equations in the measurement population, use the following steps:

Step 1: Identify the presence of HCCs on any claim in the 12 months preceding the measurement year, utilizing both inpatient (primary diagnosis field only) and outpatient encounters (all diagnosis fields).

Step 2: Create a person level file that contains an indicator (yes/no) variable for each of the HCCs. These variables indicate whether or not the patient had evidence of each HCC during the previous 12 months.

Step 3: Calculate an adjustment factor of the average episode costs in the measure population and divide it by the average cost of the test episode (Table COPD-RA2). Apply the inflation factor to the risk adjustment coefficients to account for cost differences between datasets used in development of the risk adjustment models and those used in calculating episode costs.

Table COPD US-RA2. Summary estimates of the average cost for unstable COPD in the test episode

Average Cost
\$40,015

Example: To calculate the inflation factor, determine the average episode cost for the population to which the measure is being applied. As an example, the average cost might be \$42,500. Calculate the adjustment factor by dividing the costs from the current population by the average cost in Table COPD US -RA2. That would result in an adjustment factor of 1.06. The adjustment factor is then applied to the estimated coefficients to provide an adjusted risk adjustment model.

Risk and Mean Adjusted Model

Risk and Mean Adjusted Unstable COPD Episode Costs = 1.06 * Risk Adjusted Unstable COPD Episode Costs

Step 4: Use the equation for the appropriate age group to generate risk adjusted expected costs for each individual in the dataset.

Section 7 – Determination of attributable provider

Resource use and costs for diabetes episodes are attributed to one or more physicians on a hierarchical basis. The total counts of E&M codes by unique provider ID are used for provider attribution. For each episode identify all such E&M codes occurring during the measurement year. The E&M codes are used to assign attribution using the following hierarchy:

1. Costs and resource use assigned to a single provider if that physician has at least 70% of the E&M codes during the measurement year (“single attribution”); OR
2. If no provider has more than 70% of the E&M codes, costs and resource use are assigned to each of the providers that have at least 30% of the E&M codes for a patient during the measurement year (“multiple attribution”); OR
3. If no provider has at least 30% of the E&M codes during the measurement year, the costs and resource use for that patient are not attributed to any provider (“no attribution”).

To identify the attributable provider, the following steps will be used:

Step 1: Identify qualifying E&M codes for the episode from **Table COPD US-C2**.

Step 2: For each individual included in the episode, sum the total qualifying E&M codes by each provider for that individual.

Step 3: Calculate the proportion of E&M codes for each provider that had a claim for each of the patients:

- $\text{Proportion of Care} = \frac{\text{Total count of provider's E\&M qualifying codes}}{\text{total count of all qualifying E\&M codes}}$

Step 4: Assign attribution based on the hierarchical attribution model described above.

Section 8 – Creation of provider summaries

The provider summaries are a report of the resource use for an individual provider compared to their peer group, their non-peer group and all episodes in the dataset. Creation of the provider summaries uses the summary episode costs combined with the attributable provider data and the risk adjusted episode costs.

Step 1: Create a dataset that includes the following information: patient ID, total episode cost, attributable provider ID, attributable provider specialty type and episode expected costs from the risk adjustment model.

Step 2: Calculate the observed-to-expected ratio for each of the episodes by dividing observed costs for the episode by expected (predicted) costs for the episode.

Step 3: Summarize the observed, expected and observed-to-expected ratio for each attributable provider.

Step 4: Summarize the observed, expected and observed-to-expected ratio for each provider type.

Step 6: Summarize the observed, expected and observed-to-expected ratio for the all of the episodes.

Step 7: For each attributable provider, determine the proportion of observed-to-expected ratios above the 75% percentile of the peer group and calculate the 95% confidence interval

Step 8: Create provider summary reports for each attributable provider in the dataset (See Unstable COPD Episode-Provider Summary below for example)

**Unstable COPD Episode
Provider Summary
Report for Physician
#XXXXXXX**

Provider type = Internal Medicine

	MD	Peer Group	Non-Peer Group	National Avg
Episodes	118	33,079	67,876	233,029
Observed Costs*				
Average	\$ 3,721	\$ 3,893	\$ 3,756	\$ 4,015
Min	\$ 356	\$ 356	\$ 356	\$ 356
Median	\$ 2,476	\$ 2,990	\$ 2,852	\$ 3,087
Max	\$ 19,884	\$ 19,884	\$ 19,884	\$ 19,884
Predicted Costs				
Average	\$ 3,896	\$ 4,006	\$ 3,957	\$ 4,019
Min	\$ 2,789	\$ 2,156	\$ 2,156	\$ 2,129
Median	\$ 3,613	\$ 3,696	\$ 3,668	\$ 3,696
Max	\$ 10,807	\$ 13,870	\$ 16,098	\$ 16,618
Observed-to-Expected Ratio				
Average	0.97	0.97	0.95	1.00
Min	0.09	0.03	0.04	0.03
Median	0.66	0.76	0.74	0.78
Max	5.30	9.11	8.18	9.11
% ≥ 2.0	9.3%	7.7%	7.7%	8.4%
% ≥ 2.5	6.8%	5.2%	5.2%	5.6%

% ≥ 75th percentile peers 22.9% (15.7%, 31.5%)

* Observed costs adjusted for outliers (winsorized)

Section 9 – Reporting

The following section describes reports of unadjusted episode costs that were used to understand patterns of resource use associated with the episodes. Most of these reports are based on the classifications of related resource use by type-of-service category using the Berenson-Eggers Type of Services (BETOS) classification system. This system can be applied following the steps described below.

Reports by Categories of Service

For each of the claims / encounters identified for the episode's unstable COPD-related resource use calculations, BETOS codes will be applied to categorize services. BETOS codes and crosswalks to procedure codes are available through the Centers for Medicare & Medicaid Services website.⁷

Step 1: Obtain BETOS files for the relevant year from the CMS website.

Step 2: Combine BETOS codes with eligible events (e.g., through a file merge).

Step 3: Categorize data from outpatient pharmacy files as pharmacy-related costs – these claims will not have a BETOS code to combine with the eligible events data. Similarly, categorize data from inpatient hospital files as inpatient facility-related costs.

Step 4: Categorize BETOS codes into the 7 specified “major categories”:

1. Evaluation and Management (E&M)
2. Procedures
3. Imaging
4. Tests
5. Durable Medical Equipment (DME)
6. Other
7. Exceptions/Unclassified

These categories (along with categories for inpatient facility costs and pharmacy costs) will be used for reporting overall episode costs.

Step 5: Categorize any/all remaining services without corresponding BETOS codes as belonging to the Exceptions/Unclassified category.

Step 6: Create summary reports of the distribution of costs for each type of service category for all episodes.

The reports we completed to analyze this episode, relying on BETOS categories, included:

- Summaries of per-episode resource use by type of service, including mean, median, standard deviation and variance, other statistical variables: overall and for each episode stratum
- For each type-of-service category for non-inpatient, non-pharmacy claims, summaries of the 20 CPT and HCPCS codes among unstable COPD-related

⁷ https://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp

- services most commonly appearing in episodes and the 20 CPT and HCPCs codes that account for the largest proportions of the category's costs
- For each type-of-service category for non-inpatient, non-pharmacy claims, summaries of the 20 CPT and HCPCs codes among non-unstable COPD-related services most commonly appearing during the measurement window and the 20 CPT and HCPCs codes that account for the largest proportions of the category's costs
 - For inpatient hospitalization events, the 20 DRG codes and primary ICD-9 diagnosis codes most commonly appearing and accounting for the largest proportions of inpatient facility costs: both unstable COPD-related and non-unstable COPD-related
 - For pharmacy claims, the 20 generic drug names and therapeutic classes most commonly appearing and accounting for the largest proportions of pharmacy costs: both unstable COPD-related and non-unstable COPD-related