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Episode-based Resource Use Measures

Episode-of-Care for Chronic Sinusitis

This measure was developed by the American Board of Medical Specialties Research and Education Foundation for the High Value Health Care Project: Characterizing Episodes and Costs of Care—funded by the Robert Wood Johnson Foundation under grant 63609.

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Sinusitis Measure Workgroup Members

Stan Borg, MD
Lee Eisenberg, MD
Anju Peters, MD
C. Douglas Phillips, MD
Terry Seaton, PharmD
James Sublett, MD
Peter Weber, MD

Episode-based Resource Use Measures Project Staff

Kevin Weiss, MD
Niall Brennan
Iris Chan
Katie Harrell
Raymond Kang
Todd Lee, PharmD, PhD
Christopher Lyttle
Larry Manheim, PhD
Sophie C. Shen
Kevin Stroupe, PhD
Robin Wagner
Adam Wilk
Mark Zezza, PhD

Episode-of-Care for Chronic Sinusitis

Measure Description

Chronic sinusitis consists of calendar year sinusitis-related resource use and costs for individuals identified as having a chronic sinusitis claim (473.xx) at some point during first nine months of the previous year and no sinusitis-related visits during the last three months of the previous year. Exclude individuals less than 1 year of age. Attribution occurs at the level of the individual provider based on plurality of E&M visits with attribution rule specified below.

Required Data Elements

Administrative claims data.

Calculation

For patients meeting inclusion criteria, determine chronic sinusitis-related resource use and costs during the episode. Prices from a standard price list will be applied to the services to estimate the cost of the episode.

Episode Definition

Sinusitis-related care over a calendar year for individuals with at least one outpatient diagnosis of chronic sinusitis anywhere on an E&M claim during the first nine months of the previous calendar year and no sinusitis E&M visits during the last three months of that prior year.

Rationale

Sinusitis is a condition that can be defined as either acute or chronic. Chronic sinusitis episodes will be defined as a calendar year, January 1 to December 31. All individuals with a chronic sinusitis diagnosis (primary or secondary diagnosis) on an E&M claim during the first nine months of the prior calendar year are included. If they have sinusitis visits during the last three months of that prior year, they are excluded. Individuals with acute care sinusitis claims but no chronic sinusitis claim during the year are not included, but may be captured in the acute/acute recurrent care sinusitis episode measure. As such, this measure is designed to observe variation in resource use during a year for patients presenting with chronic sinusitis during the previous calendar year.

Resource Use Measure

Sinusitis-related resource use/costs

- 1 Inpatient Facility
- 2 Evaluation and Management
- 3 Procedures
- 4 Imaging
- 5 Tests
- 6 DME
- 7 Pharmacy
- 8 OP Facility Costs
- 9 Exceptions/Unclassified
- 10 Other Services

Eligible Population

| | |
|----------------------------|--|
| Age | Patients at least 1 year of age or older. |
| Enrollment Criteria | Continuous medical and pharmacy benefit enrollment for two calendar years. |
| Inclusion Criteria | Identify patients that have one of the chronic sinusitis diagnostic codes in Table ChronicSinusitis-A for an E&M visit, defined by the CPT codes listed in Table ChronicSinusitis-A1 , during the event identification period, which consists of the first nine months of the previous year. These ICD-9 codes may be present in any diagnostic field. |
| Exclusion | <p>Patients are excluded for any of the following:</p> <ul style="list-style-type: none"> • Less than 1 year of age • Does not have continuous enrollment during prior or episode measurement period. • E&M claim for chronic or acute sinusitis during last three months of prior year (see Table ChronicSinusitis-C1). • Cystic fibrosis, primary immunodeficiency, ciliary dysfunction/immotile cilia syndrome during either prior or measurement year (see Table ChronicSinusitis-C2). |

- Facial dysmorphisms (e.g., cleft palate, Down's syndrome) or trauma during either the prior or measurement year (see **Table ChronicSinusitis-C2**).
- Claim with concomitant ICD-9 codes for acute or chronic sinusitis and also for fungal infection, during measurement period, (461.xx with 495 or 117; see **Table ChronicSinusitis-C3**).
- Active cancer treatment during measurement or prior period (see **Table Sinusitis-C4**).
- End stage renal disease (ESRD) during measurement or prior period (see **Table Sinusitis-C5**).
- Organ transplant during measurement or prior period (see **Table Sinusitis-C6**).
- HIV/AIDS during measurement or prior period (see **Table Sinusitis-C7**).
- Absence of Any E&M Visits (see **Table ChronicSinusitis-A1**) for Sinusitis During Episode Measurement Year (see **Table ChronicSinusitis-B1**).

Table ChronicSinusitis-A: Diagnostic Codes to Trigger Inclusion during First 9 months of Prior Year

| Description | ICD-9 Code |
|-------------------|------------|
| Chronic Sinusitis | 473.xx |

These ICD-9 codes, present in any diagnostic field, will be used to identify chronic sinusitis patients during the identification period and during the measurement period, regardless of corresponding CPT and UB revenue codes.

Table ChronicSinusitis-A1: Evaluation and Management Codes.

| Description | CPT Codes |
|---|--------------------------|
| Office or Other Outpatient Services | 99201–99215 |
| Hospital Observation Services | 99217–99220 |
| Consultations | 99241–99275 |
| Nursing Facility, Domiciliary and Home Services | 99301–99350 |
| Case Management Services and Care Plan Oversight Services | 99361–99380 |
| Preventive Medicine Services | 99381–99429 |
| Other E&M Services | 99450–99456, 99354–99357 |

Tables ChronicSinusitis-B: Codes Used to Identify Services/Costs to be Included during Episode Year**Table ChronicSinusitis-B1: Diagnostic Codes Used to Identify Services/Costs to be Included during Episode Year**

| Description | ICD-9 Code |
|---|------------|
| Chronic sinusitis (w/o concomitant code for fungal infection) | 473.xx |
| Acute sinusitis (w/o concomitant code for fungal infection) | 461.xx |

These ICD-9 codes, present in any diagnostic field, will be used to identify all sinusitis-related services during the measurement year, regardless of corresponding CPT or UB revenue codes.

Table ChronicSinusitis-B2: Procedure, diagnostic and lab tests to be included in resource use regardless of diagnosis code

| Description | CPT | HCPCS | ICD-9 Diagnosis |
|------------------------------|--------------|-------|-----------------|
| Irrigation, maxillary sinus | 31000 | | Any |
| Irrigation, sphenoid sinus | 31002 | | Any |
| Exploration, maxillary sinus | 31020, 31030 | | Any |
| Explore sinus, remove polyps | 31032 | | Any |
| | 31050-31087 | | Any |
| Exploration, sphenoid sinus | 31050 | | Any |

| | | | |
|--------------------------------|----------------------------|--|-----|
| Sphenoid sinus surgery | 31051 | | Any |
| Exploration of frontal sinus | 31070, 31075 | | Any |
| Removal of frontal sinus | 31080-31087 | | Any |
| Removal of ethmoid sinus | 31201, 31205 | | Any |
| Nasal endoscopy, dx | 31231 | | Any |
| Nasal/sinus endoscopy, dx | 31233, 31235 | | Any |
| Nasal/sinus endoscopy, surg. | 31237 | | Any |
| Nasal/sinus endoscopy, surg. | 31240 | | Any |
| Removal of ethmoid sinus | 31254, 31255 | | Any |
| Exploration of maxillary sinus | 31256 | | Any |
| Endoscopy, maxillary sinus | 31267 | | Any |
| Sinus endoscopy, surg. | 31276 | | Any |
| Nasal/sinus endoscopy, surg. | 31287, 31288, 31290, 31291 | | Any |
| Removal of nose polyps | 30110, 30115 | | Any |
| Nasopharyngoscopy | 92511 | | Any |

These procedure codes will be used to identify sinusitis-related services during the measurement period regardless of whether there is a diagnosis of sinusitis.

Table-B3: Medications for Sinusitis (all during measurement period)

| <i>grand_parent_category</i> | <i>parent_category</i> | <i>Category</i> | <i>drug_id</i> | <i>generic_drug_name</i> | <i>brand_drug_name</i> |
|------------------------------|------------------------|---------------------------|----------------|--------------------------|------------------------|
| anti-infectives | Antifungals | azole antifungals | d00071 | fluconazole | Diflucan |
| anti-infectives | Antifungals | azole antifungals | d00102 | itraconazole | Sporanox |
| anti-infectives | Antifungals | azole antifungals | d00103 | ketoconazole | Nizoral |
| anti-infectives | Antifungals | miscellaneous antifungals | d04012 | terbinafine | Lamisil |

Episode-based Resource Use Measures: Chronic Sinusitis

| | | | | | |
|-----------------|---------------------------|----------------------------------|--------|-------------------------------|--------|
| anti-infectives | miscellaneous antibiotics | tetracycline derivatives | d00037 | doxycycline | |
| anti-infectives | Cephalosporins | first generation cephalosporins | d00080 | cefadroxil | |
| anti-infectives | cephalosporins | first generation cephalosporins | d00096 | cephalexin | Keflex |
| anti-infectives | Cephalosporins | second generation cephalosporins | d00081 | cefaclor | Ceclor |
| anti-infectives | Cephalosporins | second generation cephalosporins | d00073 | cefprozil | Cefzil |
| anti-infectives | Cephalosporins | second generation cephalosporins | d00056 | cefuroxime | Ceftin |
| anti-infectives | Cephalosporins | second generation cephalosporins | d00105 | loracarbef | |
| anti-infectives | Cephalosporins | third generation cephalosporins | d04256 | cefdinir | |
| anti-infectives | Cephalosporins | third generation cephalosporins | d04767 | cefditoren | |
| anti-infectives | Cephalosporins | third generation cephalosporins | d00095 | cefpodoxime | Vantin |
| anti-infectives | Cephalosporins | third generation cephalosporins | d03874 | ceftibuten | Cedax |
| anti-infectives | lincomycin derivatives | NULL | d00043 | clindamycin | |
| anti-infectives | macrolide derivatives | Ketolides | d04933 | telithromycin | Ketek |
| anti-infectives | macrolide derivatives | macrolides | d00091 | azithromycin | |
| anti-infectives | macrolide derivatives | macrolides | d00097 | clarithromycin | Biaxin |
| anti-infectives | macrolide derivatives | macrolides | d03844 | dirithromycin | |
| anti-infectives | macrolide derivatives | macrolides | d00046 | erythromycin | Erytab |
| anti-infectives | miscellaneous antibiotics | NULL | d00108 | metronidazole | Flagyl |
| anti-infectives | miscellaneous antibiotics | NULL | d00124 | sulfamethoxazole-trimethoprim | |
| anti-infectives | Penicillins | aminopenicillins | d00088 | amoxicillin | Amoxil |
| anti-infectives | Penicillins | aminopenicillins | d00003 | ampicillin | Amcill |
| anti-infectives | Penicillins | beta-lactamase inhibitors | d00089 | amoxicillin-clavulanate | |
| anti-infectives | Penicillins | natural penicillins | d00116 | penicillin | |
| anti-infectives | Quinolones | NULL | d00011 | ciprofloxacin | Cipro |
| anti-infectives | Quinolones | NULL | d04859 | gemifloxacin | |
| anti-infectives | Quinolones | NULL | d04109 | levofloxacin | |

Episode-based Resource Use Measures: Chronic Sinusitis

| | | | | | |
|--------------------|---------------------------|--|--------|-----------------------|----------|
| anti-infectives | Quinolones | NULL | d04500 | moxifloxacin | Avelox |
| anti-infectives | Quinolones | NULL | d00114 | ofloxacin | Floxin |
| anti-infectives | Tetracyclines | NULL | d00041 | tetracycline | |
| Hormones | adrenal cortical steroids | glucocorticoids | d00206 | dexamethasone | |
| Hormones | adrenal cortical steroids | glucocorticoids | d00293 | methylPREDNISolone | Medrol |
| Hormones | adrenal cortical steroids | glucocorticoids | d00350 | predniSONE | |
| respiratory agents | Antihistamines | NULL | d00785 | brompheniramine | |
| respiratory agents | Antihistamines | NULL | d03827 | cetirizine | Zyrtec |
| respiratory agents | Antihistamines | NULL | d00191 | chlorpheniramine | |
| respiratory agents | Antihistamines | NULL | d00790 | cyproheptadine | |
| respiratory agents | Antihistamines | NULL | d04785 | desloratadine | |
| respiratory agents | Antihistamines | NULL | d00212 | diphenhydrAMINE | |
| respiratory agents | Antihistamines | NULL | d04040 | fexofenadine | Allegra |
| respiratory agents | Antihistamines | NULL | d00907 | hydrOXYzine | Atarax |
| respiratory agents | Antihistamines | NULL | d05851 | levocetirizine | Xyzal |
| respiratory agents | Antihistamines | NULL | d03050 | loratadine | Claritin |
| respiratory agents | Decongestants | NULL | d00704 | phenylephrine | |
| respiratory agents | Decongestants | NULL | d00769 | pseudoephedrine | |
| respiratory agents | Expectorants | NULL | d00797 | guaifenesin | |
| respiratory agents | leukotriene modifiers | NULL | d04289 | montelukast | |
| topical agents | nasal preparations | nasal antihistamines and decongestants | d04068 | azelastine nasal | Astelin |
| topical agents | nasal preparations | nasal lubricants and irrigations | d04242 | sodium chloride nasal | Ocean |
| topical agents | nasal preparations | nasal steroids | d04275 | beclomethasone nasal | |
| topical agents | nasal preparations | nasal steroids | d03640 | budesonide nasal | |
| topical agents | nasal preparations | nasal steroids | d05899 | ciclesonide nasal | |

| | | | | |
|----------------|--------------------|----------------|--------|---------------------|
| topical agents | nasal preparations | nasal steroids | d04279 | flunisolide nasal |
| topical agents | nasal preparations | nasal steroids | d04283 | fluticasone nasal |
| topical agents | nasal preparations | nasal steroids | d04223 | mometasone nasal |
| topical agents | nasal preparations | nasal steroids | d04233 | triamcinolone nasal |

Tables C: Exclusions

Table ChronicSinusitis-C1: Diagnostic Codes Used to Identify Exclusion Due to Services Received in Last 3 months of Prior Year.

| Description | ICD-9 Code |
|---|------------|
| Chronic sinusitis (w/o concomitant code for fungal infection) | 473.xx |
| Acute sinusitis (w/o concomitant code for fungal infection) | 461.xx |

Table ChronicSinusitis-C2: Diagnostic Codes (any field on claim) to Identify Exclusions During Prior or Episode Measurement Year

| Description | ICD-9-CM Diagnosis |
|---|------------------------|
| Cystic fibrosis | 277.0 |
| Primary immunodeficiency | 279.xx |
| Ciliary dysfunction/immotile cilia syndrome | 759.3 |
| Facial dysmorphisms: Cleft palate (749xx) Down’s syndrome (758.0) | 749.xx 758.0 |
| Trauma codes: fracture of nasal bone facial/neck injury | 802.0, 802.1 959.09 |

Table ChronicSinusitis-C3: Codes to Identify Exclusion Due to Fungal diagnosis on Same Claim as Sinusitis Diagnosis Code

| Description | ICD-9-CM Diagnosis |
|--------------|-------------------------------|
| Single Claim | 473.xx and (495.xx or 117.xx) |

Table ChronicSinusitis-C4: 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 ChronicSinusitis-C5: 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 ChronicSinusitis-C6: 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 ChronicSinusitis-C7: Codes to Identify HIV-AIDS

| Description | ICD-9-CM Diagnosis |
|-------------|--------------------|
| HIV | 042 |

Risk Adjustment Method

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

Episode Severity / Disease Staging

No episode severity/disease staging.

Level of Measurement/Analysis

Measurement will take place at the level of the individual provider. Attribution of resource use and costs for a patient will be assigned to the providers(s) that are responsible for the care of the acute sinusitis patient. If no physician has $\geq 30\%$ of E&M visits, then claim is not allocated to a physician. If any one physician has more than 70% of E&M visits, episode allocated only to that physician. If no physician has $\geq 70\%$ of E&M visits, episode allocated to all physicians with $\geq 30\%$ of E&M claims.

Technical Appendix

Episode-of-Care for Chronic Sinusitis

Appendix Overview

The following document provides step-by-step methods for implementing the Episode-of-Care for Chronic Sinusitis 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 an episode-of-care for chronic sinusitis. Chronic sinusitis consists of calendar year sinusitis-related resource use and costs for individuals identified as having a chronic sinusitis claim (473.xx) at some point during first nine months of the previous year. Individuals with a sinusitis claim during the last three months of the prior year are excluded as are individuals with no E&M visits for sinusitis-related resource use during the measurement year. Exclude individuals less than 1 year of age. Attribution occurs at the level of the individual provider based on plurality of E&M visits during the measurement year according to the attribution rules specified below. Episode related resource use for patients with chronic sinusitis is identified and standardized costs are applied. Total chronic sinusitis-related costs are calculated for each patient and summarized at the 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. An episode is defined by a trigger event observed over a 9-month identification period, defined as the first nine months of the year prior to measurement year. Any individual identified with chronic sinusitis in the first 9 months who also has a sinusitis claim, chronic or acute, in the last 3 months of the prior year, is excluded from analysis. In addition, the prior 12 month period is necessary to exclude individuals based on certain criteria. Finally, the measurement period is the 12 month calendar year, during which episode-related utilization is collected.

Definitions

| | |
|------------------------------------|--|
| Prior year | 12-month period prior to trigger event used to exclude people |
| Identification year | First nine-months of prior year used to define presence of chronic sinusitis. |
| Measurement period | Calendar year January 1 to December 31 over which sinusitis-related resource use is measured. |
| 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. |
| Sinusitis-related | Healthcare encounters defined as being related to Chronic Sinusitis care |
| Continuous enrollment | As identified in eligibility or enrollment information, full medical and pharmacy benefit enrollment during both the measurement period and the prior year. |
| Medication dispensing event | Medication dispensing with a positive, non-zero cost. |
| Inpatient Hospital Event | An acute care overnight hospital stay of ≥ 1 day with positive 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 that have one of the chronic sinusitis diagnostic codes in **Table ChronicSinusitis-A** for an ambulatory care visit, defined by the CPT codes listed in **Table ChronicSinusitis-AI**, during the event identification period, which consists of the first 9 months of the prior year. These ICD-9 codes may be present in any diagnostic field.

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

1. Age: Identify patients aged older than one year.
2. Eligibility
 - a. Identify benefits during both the measurement period and prior period.
 - b. To be included persons must have both of the following benefits in both periods
 - i. Medical benefit
 - ii. Pharmacy benefit
3. Continuous enrollment: To be eligible, persons must have continuous coverage during prior year and measurement years.

Step 3: Identify patients with exclusion criteria

1. Identify patients that meet one or more exclusion criteria during either the measurement period OR the prior year
2. Exclusion criteria
 - Less than 1 year of age
 - Does not have continuous enrollment during prior or episode measurement period.

- E&M claim for chronic or acute sinusitis during last three months of prior year (see **Table ChronicSinusitis-C1**).
- Cystic fibrosis, primary immunodeficiency, ciliary dysfunction/immotile cilia syndrome during either prior or measurement year (see **Table ChronicSinusitis-C2**).
- Facial dysmorphisms (e.g., cleft palate, Down's syndrome) or trauma during either the prior or measurement year (see **Table ChronicSinusitis-C2**).
- Claim with concomitant ICD-9 codes for acute or chronic sinusitis and also for fungal infection during measurement period. (461.xx with 495 or 117; see **Table ChronicSinusitis-C3**).
- Active cancer treatment during measurement or prior period (see **Table Sinusitis-C4**).
- End stage renal disease (ESRD) during measurement or prior period (see **Table Sinusitis-C5**).
- Organ transplant during measurement or prior period (see **Table Sinusitis-C6**).
- HIV/AIDS during measurement or prior period (see **Table Sinusitis-C7**).
- Absence of Any E&M Visits (see **Table ChronicSinusitis-A1**) for Sinusitis During Episode Measurement Year (see **Table ChronicSinusitis-B1**).

Step 4: Combine prior steps to identify measure population

1. Identify Chronic Sinusitis eligible population
2. Exclude those patients not meeting general inclusion criteria (e.g. age, 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 chronic sinusitis-related diagnosis codes or procedure codes. These events will be used to determine the chronic sinusitis-related resource use.

Outpatient events

Identify all outpatient claims / encounters with a chronic sinusitis-related diagnostic code appearing in *any* position (see **Table ChronicSinusitis-B1**).

Procedures and laboratory

Identify all CPT, HCPCs, and ICD-9 procedure claims / encounters with a chronic sinusitis-related code appearing in *any* position (see **Table ChronicSinusitis-B2**).

Inpatient hospitalization events

Identify all inpatient claims / encounters with a Chronic Sinusitis-related diagnostic code appearing in the primary diagnosis field only (see **Table Chronic Sinusitis-B1** above).

Prescription drugs

Identify chronic sinusitis-related medications by therapeutic class or generic/brand medication name during the measurement period (see **Table-B3**).

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 chronic sinusitis-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, modified to allow for separate categories for chiropractic and physical surgery procedure codes:
- *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, chiropractic-specific codes, physical therapy-specific codes, 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 below.

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.¹
- Step 6** Calculate the DRG-specific per-diem payment rate by adjusting the standard daily prices for inflation to a reference year using 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.

¹ 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.

Example² 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 of XXX.X (eligible event)
- A DRG of XXX
- 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 of XXX.X (eligible event)
- A DRG of XXX
- 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 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.³ 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

² Figures presented in this example are arbitrary and do not reflect any particular dataset or patient.

³ The C3 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.

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 of XXX.X (eligible event), and therefore ADSC category XXX
- 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

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 chronic sinusitis-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 chronic sinusitis-related events occurring during the measurement year at the adjusted-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 chronic sinusitis-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 ChronicSinusitis-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, 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 ChronicSinusitis-RAI. Risk Adjustment Model Specifications

| Model # | Independent Variables | | | | | | Distri- bution | 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 | | | | | X | | 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 chronic sinusitis episode.

Risk Adjustment Model

Expected Costs = 353+(Male*4)+(Age*286)+(End-Stage Liver Disease*(-281))+(Pancreatic Disease*109)+(Inflammatory Bowel Disease*76)+(Bone/Joint/Muscle Infections/Necrosis*217)+(Rheumatoid Arthritis and Inflammatory Connective Tissue Disease*107)+(Major Depressive, Bipolar, and Paranoid Disorders*112)+(Spinal Cord Disorders/Injuries*113)+(Polyneuropathy*76)+(Seizure Disorders and Convulsion*48)+(Respirator Dependence/Tracheostomy Status*348)+(Cardio-Respiratory Failure and Shock*132)+(Unstable Angina and Other Acute Ischemic Heart Disease*(-69))+(Cerebral Palsy and Other Paralytic Syndromes*237)+(Vascular Disease with Complications*101)+(Vascular Disease*48)+(Chronic Obstructive Pulmonary Disease*258)+(Aspiration and Specified Bacterial Pneumonias*192)+(Pneumococcal Pneumonia, Emphysema,Lung Abscess*161)+(Decubitus Ulcer of Skin*243)+(Vertebral Fractures without Spinal Cord Injury*133)+(Major Complications of Medical Care and Trauma*67).

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 ChronicSinusitis-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 ChronicSinusitis-RA2. Summary estimates of the average cost for each of the strata included in the test episode

| | Average Cost |
|-------------------|--------------|
| Chronic Sinusitis | \$602 |

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 \$1000. Calculate the adjustment factor by dividing the costs from the current population by the average costs in Table ChronicSinusitis-RA2. That would result in an adjustment factor=1.66. The adjustment factors is then applied to the estimated coefficients for the appropriate age specific model to provide an adjusted risk adjustment model.

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 chronic sinusitis 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 services occurring during the measurement period. These 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 claims during the measurement year (“single attribution”); OR
2. If no provider has more than 70% of the E&M claims, costs and resource use are assigned to each of the providers that have at least 30% of the E&M claims for a patient during the measurement year (“multiple attribution”); OR

3. If no provider has at least 30% of the E&M claims 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 ChronicSinusitis-AI**.

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

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

- Proportion of Care = Total count of provider’s E&M qualifying claims divided by total count of all qualifying E&M claims

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: episode 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 Chronic Sinusitis-Provider Summary below for example)

**Chronic Sinusitis
Provider Summary
Report for Physician XXXXXX**

| | MD XXXXX | Peer Group | Non-Peer Group | National Avg |
|----------------------------|-------------|------------|-------------------|--------------|
| Episodes | XX | XXXX | XXXXX | XXXXX |
| Observed Costs* | | | | |
| Average | \$ XXX | \$ XXX | \$ XXX | \$ XXX |
| Min | \$ XX | \$ XX | \$ XX | \$ XX |
| Median | \$ XXX | \$ XXX | \$ XXX | \$ XXX |
| Max | \$ XXX | \$ XXXX | \$ XXXX | \$ XXXX |
| Predicted Costs | | | | |
| Average | \$ 1,400 | \$ XXX | \$ XXX | \$ XXX |
| Min | \$ XXX | \$ XXX | \$ XX | \$ XXX |
| Median | \$ XXX | \$ XXX | \$ XXX | \$ XXX |
| Max | \$ XXX | \$ XXX | \$ XXX | \$ XXXX |
| Observed-to-Expected Ratio | | | | |
| Average | 0.XX | 0.XX | 0.XX | 0.XX |
| Min | X.XX | 0.XX | 0.XX | 0.XX |
| Median | X.XX | 0.XX | 0.XX | 0.XX |
| Max | X.XX | XX.XX | XX.XX | XX.XX |
| % ≥ 2.0 | X% | XX.X% | XX.X% | XX.X% |
| % ≥ 2.5 | X% | X.X% | X.X% | X.X% |

% ≥ 75th percentile peers X% (X%, XX.X%)

* 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 .

Reports by Categories of Service

For each of the claims / encounters identified for the episode’s chronic sinusitis-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.⁴

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 adjusted BETOS codes into the 6 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 adjusted 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.

⁴ https://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp

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 chronic sinusitis-related 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 chronic-sinusitis-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 chronic sinusitis-related and non-chronic sinusitis-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 chronic sinusitis-related and non chronic-sinusitis-related