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Research and Education Foundation

Episode-based Resource Use Measures

Episode-of-Care for 21-day Period around Colonoscopy

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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Episode-of-Care for 21-day Period around Colonoscopy

Measure Description

Resource use and costs associated with colonoscopy. Patients undergoing a colonoscopy are identified and the resource use and costs associated with colonoscopy in the 7 days before the procedure and the 14 days following the procedure are measured. For the group of patients with a colectomy that includes a primary diagnosis for colon cancer within the 14-day follow-up period, the episode will be from 7 days preceding the colonoscopy to 2 days preceding the colectomy. Those with a colectomy with a primary diagnosis of colon cancer within 2 days of the colonoscopy will be excluded from the measure.

Required Data Elements

Administrative claims data

Calculation

For patients meeting inclusion criteria, determine colonoscopy-related resource use and costs in the 7-day period preceding the colonoscopy and the 14 days following their colonoscopy. Those with a colectomy with a primary diagnosis for colon cancer within the 14-day follow-up period will be followed until two days prior to the date of the colectomy. A standard price list will be applied to the resource use to estimate the costs of the episode of care related to colonoscopy. Resources will be defined for nine categories: 1) inpatient facility; 2) outpatient facility; 3) evaluation and management; 4) procedures; 5) imaging; 6) tests; 7) DME; 8) other drugs and services; 9) medications; and 10) other. Population will be stratified based on age (40-75 yrs and ≥ 76 yrs). 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 the index event. For each of the other resource use categories, standardized prices will be assigned to each type of utilization that is defined as colonoscopy related.

Episode Definition

Colonoscopy-related costs

Rationale

The Institute of Medicine and AQA (formerly known as the Ambulatory Care Quality Alliance) have identified colon cancer 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, its impact on those patients, and the perception of opportunity to significantly improve the quality and efficiency of related care. Colon cancer screening

has also been identified as a priority area in other national initiatives including Health Resources and Services Administration's (HRSA) Health Disparities Collaboratives and the Quality Improvement Program at Centers for Medicare and Medicaid Services (CMS).¹

In 2001, Medicare expanded coverage of colorectal cancer screening to include colonoscopy. This has led to an increase in the number of colonoscopies that are performed annually in the United States. For those aged 50 years and older, the eligible proportion that had received a colonoscopy in 2001 was slightly less than 20% in women and slightly more than 20% in men.² By 2003, the proportion of the eligible population with a colonoscopy had increased to just below 30% for women and around 32% for men. Concerns have been raised with respect to disparities in colorectal cancer screening rates and limited access may further exacerbate these disparities if colonoscopy becomes the predominant screening modality. Furthermore, while rates of adverse events following colonoscopy are low, there were specific patient populations that were at higher risk for adverse events.³ The fact that disparities may exist due to access to colonoscopy and rates of high cost adverse events may also vary by patient and possibly provider characteristics, highlights the potential for differences in resource use and costs around the colonoscopy.

This measure focuses on the variation in resource use in the 21 day period surrounding a colonoscopy. The measure will include resources that are used in the seven days preceding the colonoscopy and resources that are used in the 14 days following the colonoscopy. There may be variability in the resource use due to the type of colonoscopy that is performed and other services subsequent to the initial colonoscopy. Particularly, there may be differential use of conscious sedation under the care of an endoscopist versus monitored anesthesia care with an anesthesiologist involved in the care when performing colonoscopy which may potentially influence the overall healthcare resource use. In addition, there may be differences in complication rates following colonoscopy that lead to differences in resource use related to the procedure. Therefore, the measure captures complication-related resource use in the days immediately following the procedure.

The measure is stratified by patient age because of the recommendations of the US Preventive Services Task Force cap the colorectal screening age at 75 years. Therefore, the population will be divided by age into those younger than 76 years of age and those 76 years and older. The resource use for this episode will be attributed to the provider that performed the colonoscopy. In addition, regional level estimates for the colonoscopy-related resource use will be compared.

¹ Priority Areas for National Action: Transforming Health Care Quality. Institute of Medicine. Karen Adams and Janet Corrigan Editors. March 10, 2003.

² Meissner HI, Breen N, Klabunde CN, Vernon SW. Patterns of colorectal cancer screening uptake among men and women in the United States. *Cancer Epidemiol Biomarkers Prev* 2006;15(2):389-394.

³ Warren JL, Klabunde CN, Mariotto AB, Meekins A, Topor M, Brown ML, Ransohoff DF. Adverse events after outpatient colonoscopy in the Medicare population. *Ann Intern Med* 2009;150(12):849-857.

Measures

- Colonoscopy related resource use / costs
 - Inpatient Facility
 - Outpatient Facility (ambulatory surg ctr, physician office, hospital outpt)
 - Evaluation and Management
 - Procedures
 - Imaging
 - Tests
 - DME
 - Other drugs and services
 - Exceptions / Unclassified
 - Other
 - Pharmacy

Eligible Population

Age	Age \geq 40 yrs
Enrollment Criteria	Continuous medical and pharmacy benefit enrollment for at least one year preceding the measurement 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 will be included in the measure if they have a procedure code for colonoscopy during the measurement period (see Table COL-A). The first occurring colonoscopy in the measurement period is used as the triggering event for inclusion in the cohort.
Exclusion	<p>Persons with any of the following diagnoses in the measurement year or the year prior to measurement are excluded (see Tables COL-H1-4 for codes):</p> <ul style="list-style-type: none">active cancer; end stage renal disease (ESRD); dialysis; renal failure; organ transplant; HIV/AIDS <p>Persons with any of the following diagnoses in the year preceding the colonoscopy or during the colonoscopy episode are excluded (see Table COL-H5 for codes):</p> <ul style="list-style-type: none">ulcerative colitis; Crohn's disease; inflammatory bowel disease <p>Persons with colectomy with primary diagnosis of colon cancer within 2 days of colonoscopy (see Tables COL-H6 and COL-H7).</p>

Table COL-A: Codes to identify colonoscopy

Description	CPT	HCPCs	ICD-9 Procedure
Colonoscopy, rigid or flexible, transabdominal via colostomy, single or multiple	45355		
Colonoscopy, flexible, proximal to splenic flexure; diagnostic, with or without collection of specimen(s) by brushing or washing, with or without colon decompression (separate procedure)	45378		
with biopsy, single or multiple	45380		
with ablation of tumor(s), polyp(s), or other lesion(s) not amenable to removal by hot biopsy forceps, bipolar cautery or snare techniques	45383		
with removal of tumor(s), polyp(s), or other lesion(s) by hot biopsy or forceps or bipolar cautery	45384		
with removal of tumor(s), polyp(s), or other lesion(s) by snare techniques	45385		
Colorectal cancer screening; colonoscopy on individual at high risk		G0105	
Colorectal cancer screening; colonoscopy on individual not meeting criteria for high risk		G0121	
Colonoscopy			45.23
Endoscopic polypectomy of large intestine			45.42

These CPT, HCPCs or ICD-9 procedure codes, present in any field, will be used to identify colonoscopy patients during the measurement period, regardless of corresponding ICD-9 codes.

Table COL-B: Diagnosis codes to identify colonoscopy related services

Description	ICD-9
Vomiting ^a	787.0, 787.01, 787.03, 787.04
Dehydration	276.51
Abdominal pain	789.x
Fever	780.60, 780.61, 780.62
Perforation of intestine ^a	569.83
Gastrointestinal hemorrhage ^a	578

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Blood in stool	578.1
Hemorrhage of gastrointestinal tract, unspecified	578.9
Cardiopulmonary complications ^a	
Myocardial infarction	410.x, except 410.x2
Angina	413.x
Acute coronary syndrome	411.1, 411.8x
Cardiac dysrhythmias, arrhythmias	427.xx
Congestive heart failure (CHF)	428.xx, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93
Cardiac or respiratory arrest	427.5, 518.81, 518.84, 799.1, 997.1
Syncope	780.2
Hypotension	458.9
Shock	518.5, 785.50, 785.51, 785.59, 998.0
Stroke ^a	431.x-438.x
Coagulation complications ^b	
Pulmonary embolism	415.1x
DVT	453.4x
Accidental Falls ^c	
Fall on or from stairs or steps	E880
Fall on or from ladders or scaffolding	E881
Other fall from one level to another	E884
Anesthesia-related adverse effects	
Unspecified adverse effect of anesthesia	995.22
Shock due to anesthesia, NEC	995.4
Malignant hyperthermia	995.86
Other specified adverse effects, NEC	995.89

These ICD-9 codes, present in any field, will be used to identify related services during the measurement period.

^a Vomiting, vomiting following gastrointestinal surgery, perforation, gastrointestinal hemorrhage, cardiopulmonary complications and stroke claims only included from day t_{-1} to day t_{+14} , where t is the date of the colonoscopy (event date)

^b Coagulation complications only included from day t_0 to day t_{+14} , where t is the date of the colonoscopy (event date)

^c Falls only included from day t_{-1} to day t_{+1} , where t is the date of the colonoscopy (event date)

Table COL-C: Imaging codes during colonoscopy episode

Description	CPT/HCPCS
Gastrointestinal Tract Imaging	
Diagnostic Imaging - Gastrointestinal Tract - Radiologic Examination - Colon, Barium Enema, With Or Without Kub	74270
Diagnostic Imaging - Gastrointestinal Tract - Radiologic Examination - Colon, Air Contrast With High Density Barium, With Or Without Glucagon	74280
Computed tomographic (CT) colonography (ie, virtual colonoscopy); screening	0066T
Computed tomographic (CT) colonography (ie, virtual colonoscopy); diagnostic	0067T
Abdominal Imaging	
Diagnostic Imaging - Abdomen - Radiologic Examination - Single Anteroposterior View	74000
Diagnostic Imaging - Abdomen - Radiologic Examination - Anteroposterior And Additional Oblique And Cone Views	74010
Diagnostic Imaging - Abdomen - Radiologic Examination - Complete, Including Decubitus And/Or Erect Views	74020
Diagnostic Imaging - Abdomen - Radiologic Examination - Complete Acute Abdomen Series, Including Supine, Erect, Decubitus, Chest	74022
Diagnostic Imaging - Abdomen - Computed Tomography - Without Contrast Material	74150
Diagnostic Imaging - Abdomen - Computed Tomography - With Contrast Material	74160
Diagnostic Imaging - Abdomen - Computed Tomography - Without Contrast Material, Followed By Contrast Material	74170
Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - Without Contrast Material	74181
Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - With Contrast Material	74182
Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - Without Contrast Material, Followed By Contrast Material	74183

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

Table COL-D: Procedure codes during colonoscopy episode

(see **Table COL-A** for repeat colonoscopies performed during measurement period)

Table COL-E: Laboratory and pathology codes during colonoscopy episode

Description	CPT/HCPCS
Consultations (Clinical pathology)	
Clinical Pathology Consultation, Limited, Without Review Of Patient's History And Medical Records	80500
Clinical Pathology Consultation, Comprehensive, For A Complex Diagnostic Problem, With Review Of Records	80502
Surgical Pathology	
Level I - Surgical Pathology, Gross Examination Only	88300
Level III - Surgical Pathology, Gross And Microscopic (Abscess, Colon, Colostomy, Hematoma, Soft Tissue Debridement)	88304
Level IV - Surgical Pathology, Gross And Microscopic (Colon Biopsy, Lymph Node Biopsy, Colorectal Polyp)	88305
Level V - Surgical Pathology, Gross And Microscopic (Colon, Segmental Resection, Other Than For Tumor, Liver Biopsy Or Partial Resection)	88307
Level VI - Surgical Pathology, Gross And Micoscopic (Colon, Resection For Tumor, Total Colon Resection)	88309
Special Stains, Histochemical With Frozen Section	88314
Consultation And Report On Referred Slides Prepared Elsewhere	88321
Consultation And Report On Referred Material Requiring Preparation Of Slides	88323
Consultation, Comprehensive, With Review Of Records And Specimens	88325
Immunohistochemistry (including tissue immunoperoxidase), each antibody	88342

These codes identify colonoscopy-related services during the measurement period, regardless of corresponding ICD-9 codes.

Table COL-F: Anesthesia codes related to colonoscopy

Description	CPT	HCPCS	ICD-9 Procedure
Anesthesia for lower intestinal endoscopic procedures, endoscope introduced distal to duodenum	00810		
Unlisted anesthesia procedure	01999		
Conscious Sedation			
Code deleted for 2006. To report, see 99143...99145 Sedation with or without analgesia (conscious sedation); intravenous, intramuscular or inhalation	99141		
Code deleted for 2006. To report, see 99143...99145	99142		

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Sedation with or without analgesia (conscious sedation); oral, rectal and/or intranasal			
Moderate sedation services (other than those services described by codes 00100-01999) provided by the same physician performing the diagnostic or therapeutic service that the sedation supports, requiring the presence of an independent trained observer to assist in the monitoring of the patient's level of consciousness and physiological status; younger than 5 years of age, first 30 minutes intra-service time	99143		
Moderate sedation services (other than those services described by codes 00100-01999) provided by the same physician performing the diagnostic or therapeutic service that the sedation supports, requiring the presence of an independent trained observer to assist in the monitoring of the patient's level of consciousness and physiological status; age 5 years or older, first 30 minutes intra-service time	99144		
Moderate sedation services (other than those services described by codes 00100-01999) provided by the same physician performing the diagnostic or therapeutic service that the sedation supports, requiring the presence of an independent trained observer to assist in the monitoring of the patient's level of consciousness and physiological status; each additional 15 minutes intra-service time (List separately in addition to code for primary service)	99145		
Moderate sedation services (other than those services described by codes 00100-01999), provided by a physician other than the health care professional performing the diagnostic or therapeutic service that the sedation supports; younger than 5 years of age, first 30 minutes intra-service time	99148		
Moderate sedation services (other than those services described by codes 00100-01999), provided by a physician other than the health care professional performing the diagnostic or therapeutic service that the	99149		

sedation supports; age 5 years or older, first 30 minutes intra-service time			
Moderate sedation services (other than those services described by codes 00100-01999), provided by a physician other than the health care professional performing the diagnostic or therapeutic service that the sedation supports; each additional 15 minutes intra-service time (List separately in addition to code for primary service)	99150		

Table COL-G: Prescription medications identified as related to colonoscopy (all during the measurement period)

Class	Medications	Redbook THERCLS or HCPCs
Benzodiazepines	alprazolam, bromazepam, chlordiazepoxide, clonazepam, clorazepate, diazepam, lorazepam, medazepam, nordazepam, oxazepam, prazepam	64
Antibiotics	All	4, 6, 7, 9, 10, 11, 12, 16, 17
Pain medications		57, 58, 59, 60, 61, 62
Colonoscopy Prep Medications	Product Names: Tridate, Colyte Flavored, Oral Colonic Lavage, Trilyte w/Flavor Packs, Fleet Prep Kit (1-6), PEF 35550 & Electrolytes, Evac-Q-Kwik, Nulytely, Co-Lav, Go-Evac, Colyte, PEG-Lyte, Golytely, Lax Prepare, Moviprep	153 (not all meds in this class)
Anesthesia-related	Droperidol/fentanyl, meperidine, midazolam, fentanyl, diprivan, ketamine	J1810, J2175, J2180, J2250, J3010
Antiemetics, NEC		160

J-Code Medications

HCPC	Long Description
J1810	INJECTION, DROPERIDOL AND FENTANYL CITRATE, UP TO 2 ML AMPULE
J2175	INJECTION, MEPERIDINE HYDROCHLORIDE, PER 100 MG
J2180	INJECTION, MEPERIDINE AND PROMETHAZINE HCL, UP TO 50 MG
J2250	INJECTION, MIDAZOLAM HYDROCHLORIDE, PER 1 MG

J3010	INJECTION, FENTANYL CITRATE, 0.1 MG
J0780	INJECTION, PROCHLORPERAZINE, UP TO 10 MG
J1260	INJECTION, DOLASETRON MESYLATE, 10 MG
J1626	INJECTION, GRANISETRON HYDROCHLORIDE, 100 MCG
J2405	INJECTION, ONDANSETRON HYDROCHLORIDE, PER 1 MG
J2469	INJECTION, PALONOSETRON HCL, 25 MCG
J2550	INJECTION, PROMETHAZINE HCL, UP TO 50 MG
J2765	INJECTION, METOCLOPRAMIDE HCL, UP TO 10 MG
J3230	INJECTION, CHLORPROMAZINE HCL, UP TO 50 MG
J3250	INJECTION, TRIMETHOBENZAMIDE HCL, UP TO 200 MG
J3280	INJECTION, THIETHYLPERAZINE MALEATE, UP TO 10 MG
J3310	INJECTION, PERPHENAZINE, UP TO 5 MG
J8498	ANTIEMETIC DRUG, RECTAL/SUPPOSITORY, NOT OTHERWISE SPECIFIED
J7030	INFUSION, NORMAL SALINE SOLUTION , 1000 CC
J7040	INFUSION, NORMAL SALINE SOLUTION, STERILE (500 ML=1 UNIT)
J7042	5% DEXTROSE/NORMAL SALINE (500 ML = 1 UNIT)
J7050	INFUSION, NORMAL SALINE SOLUTION , 250 CC
J7051	STERILE SALINE OR WATER, UP TO 5 CC
J7060	5% DEXTROSE/WATER (500 ML = 1 UNIT)
J7070	INFUSION, D5W, 1000 CC
J7100	INFUSION, DEXTRAN 40, 500 ML
J7110	INFUSION, DEXTRAN 75, 500 ML
J7120	RINGERS LACTATE INFUSION, UP TO 1000 CC
J7130	HYPERTONIC SALINE SOLUTION, 50 OR 100 MEQ, 20 CC VIAL

Tables COL-H: Exclusion codes

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

Table COL-HI: Codes to Identify Active Cancer Treatment

Description	ICD-9-CM Diagnosis
Cancer	140-208, 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 COL-H2: 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 COL-H3: 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 COL-H4: Codes to Identify HIV

Description	ICD-9-CM Diagnosis
HIV	042

Table COL-H5: Codes to Identify Inflammatory Bowel Disease

Description	ICD-9-CM Diagnosis
Regional enteritis of small intestines	555.0
Regional enteritis of large intestines	555.1
Regional enteritis of small intestines with large intestine	555.2
Regional enteritis of unspecified site	555.9
Ulcerative enterocolitis	556.0
Ulcerative ileocolitis	556.1
Ulcerative proctitis	556.2
Ulcerative Proctosigmoiditis	556.3
Pseudopolyposis of colon	556.4
Left-sided ulcerative colitis	556.5
Universal ulcerative colitis	556.6
Other ulcerative colitis	556.8
Ulcerative colitis, unspecified	556.9

Table COL-H6: Codes to identify colectomy

Description	CPT
Open Colectomy	
Colectomy - Open - Partial; With Anastomosis	44140
Colectomy - Open - Partial; With Skin Level Cecostomy Or Colostomy	44141
Colectomy - Open - Partial; With End Colostomy And Closure Of Distal Segment	44143
Colectomy - Open - Partial; With Resection, With Colostomy Or Ileostomy And Mucous Fistula	44144
Colectomy - Open - Partial; With Coloproctostomy	44145
Colectomy - Open - Partial; With Coloproctostomy And Colostomy	44146
Colectomy - Open - Partial; Abdominal And Transanal Approach	44147
Colectomy - Open - Total; Without Proctectomy, With Ileostomy Or Ileoproctostomy	44150
Colectomy - Open - Total; Without Proctectomy, With Continent Ileostomy	44151
Colectomy - Open - Total ; Abdominal With Proctectomy, With Ileostomy	44155
Colectomy - Open - Total; Abdominal With Continent Ileostomy	44156
Colectomy - Open - Total; Abdominal With Ileoanal Anastomosis, Includes Loop Ileostomy	44157
Colectomy - Open - Total; With Creation Of Ileal Reservoir, Includes Loop Ileostomy	44158
Colectomy - Open - Partial; With Removal Of Terminal Ileum With Ileocecostomy	44160
Laparoscopic colectomy	
Colectomy - Laparoscopic - Partial; With Anasomosis	44204
Colectomy - Laparoscopic - Partial; With Removal Of Terminal Ileum, With Ileocolostomy	44205
Colectomy - Laparoscopic - Partial; With End Colostomy And And Closure Of Distal Segment (Hartmann Type Procedure)	44206
Colectomy - Laparoscopic - Partial; With Anastomosis With Coloproctostomy	44207
Colectomy - Laparoscopic - Partial; With Anastomosis With Coloproctostomy And Colostomy	44208
Colectomy - Laparoscopic - Total; Abdominal Without Proctectomy, With Ileostomy Or Ileoproctostomy	44210
Colectomy - Laparoscopic - Total; Abdominal With Proctectomy, With Ileoanal Anastomosis, Creation Of Ileal Reservoir, Loop Ileostomy	44211
Colectomy - Laparoscopic - Total; Abdominal With Proctectomy, Ileostomy	44212

These CPT, codes, present in any field, will be used to identify colectomy patients during the measurement period, along with a corresponding ICD-9 code for colon cancer (See **Table COL-H7**).

Table COL-H7: Diagnosis codes to identify colon cancer

Description	ICD-9
Malignant neoplasm of colon	153.x
Carcinoma in situ of colon	230.3

These diagnosis codes must be present as *primary* diagnosis on colectomy claim for patients to be flagged for the exclusion within 2 days of colonoscopy.

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

Patients included in the colonoscopy episode measure will be stratified by age (40-75 yrs and ≥ 76 yrs). The United States Preventive Services Task Force guidelines cap the recommendations for colonoscopy at age 75 which is the age that will be used to define the two strata for this measure.

Outlier Methodology

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

Level of Measurement/Analysis

The level of measurement is at the provider performing the colonoscopy. In addition, measurements will be summarized at the region level.

Technical Appendix

Episode-of-Care for 21-day Period around Colonoscopy

Appendix Overview

The following document provides step-by-step methods for implementing the Episode-of-Care for 21-day Period around Colonoscopy 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 and costs associated with colonoscopy. Patients undergoing a colonoscopy are identified and the resource use and costs associated with colonoscopy in the 7 days before the procedure and the 14 days following the procedure are measured. For the group of patients with a colectomy that includes a primary diagnosis for colon cancer within the 14-day follow-up period, the episode will be from 7 days preceding the colonoscopy to 2 days preceding the colectomy. Those with a colectomy with a primary diagnosis of colon cancer within 2 days of the colonoscopy will be excluded from the measure. Episode-related resource use for patients with in the episode is identified and standardized costs are applied. Total colonoscopy-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. Patients included in the colonoscopy episode measure will be stratified by age (40-75 yrs and ≥ 76 yrs). The United States Preventive Services Task Force guidelines cap the recommendations for colonoscopy at age 75 which is the age that will be used to define the two strata for this measure.

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 measurement period where eligible events are identified and a 12-month period preceding the measurement period (identification year) so that each individual has 12 months of data prior to identification of their eligible event.

Definitions

Measurement year	12-month period used to identify patients with eligible events for inclusion in the measure
Identification year	12-month period immediately preceding the eligible event over which patient comorbidities are 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 at the time of the eligible event
Colonoscopy-related¹	Healthcare encounters defined as being related to colonoscopy event
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.

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

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.

Inpatient Hospital Event An acute care overnight hospital stay of ≥ 1 day with positive associated charges

Section 1 – 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 measurement period
2. Patients will be included in the measure if they have a procedure code for colonoscopy during the measurement period (see **Table COL-A**). The first occurring colonoscopy in the measurement period is used as the triggering event for inclusion in the cohort.

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

1. Eligibility
 - a. Identify benefits during both the measurement year and the identification 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

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).

- c. To be eligible, persons must have at least 320 total days of coverage during each year

Step 3: Identify patients with exclusion criteria

- I. Identify patients that meet one or more exclusion criteria during either the identification year OR the measurement year
 - a. Standard Exclusion Criteria (**Tables COL-HI-4**):
 - i. Active cancer (excluding melanoma, skin, prostate, and CLL)
 - ii. End stage renal disease (ESRD)
 - iii. HIV/AIDS
 - iv. Organ transplant
 - b. Persons with any of the following GI-related diagnoses in the year preceding the colonoscopy or during the colonoscopy episode are excluded (see **Table COL-H5** for codes)
 - i. Ulcerative colitis
 - ii. Crohn's disease
 - iii. Inflammatory bowel disease
 - c. Persons with colectomy with primary diagnosis of colon cancer within 2 days of colonoscopy (see **Tables COL-H6 and COL-H7**)

Step 4: Combine prior steps to identify measure population

1. Identify colonoscopy 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 colonoscopy-related diagnosis codes or procedure codes. These events will be used to determine the colonoscopy-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 COL-B**) or hospitalizations with an eligible colonoscopy code (see **Table COL-A**).

Outpatient events

Identify all outpatient claims / encounters with a colonoscopy-related diagnostic code appearing in **any** position (see **Table COL-B**).

Procedures and laboratory

Identify all claims / encounters with colonoscopy-related CPT, HCPCs, or ICD-9 procedure codes (see **Tables COL-A, COL-B, COL-C through COL-F**).

Prescription drugs

Identify colonoscopy-related medications and J-codes during the measurement period (see **Table COL-G**).

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 colonoscopy-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 COL-I below.

Table COL-I: 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
- 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 $\$900.17 \times 8 = \$7,201.36$.

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.

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 for eligible events for the episode should be included in this calculation.

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 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.

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.

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

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

Patients included in the colonoscopy episode measure will be stratified by age. Group patients into the following mutually exclusive categories: 40-75 years of age and ≥ 76 years of age.

Section 5 – Calculation of total individual episode costs

The resource use identified as colonoscopy-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 colonoscopy-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 colonoscopy-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 COL-RA1, 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 COL-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						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 colonoscopy episode.

Risk Adjustment Model

Risk Adjusted Colonoscopy Episode Costs =

$\$1,131 + (\text{Male} * \$36) + (\text{Age } 55-58 * (\$22)) + (\text{Age } 59-64 * (\$6)) + (\text{Diabetes without Complication} * \$0) + (\text{Congestive Heart Failure} * \$88) + (\text{Age } 51-54 * (\$26)) + (\text{Chronic Obstructive Pulmonary Disease} * \$124) + (\text{Septicemia/Shock} * \$139) + (\text{Diabetes with Renal or Peripheral Circulatory Manifestation} * \$53) + (\text{Diabetes with Neurologic or Other Specified Manifestation} * \$68) + (\text{Diabetes with Acute Complications} * \$125) + (\text{Diabetes with Ophthalmologic or Unspecified Manifestation} * \$68) + (\text{End-Stage Liver Disease} * \$197) + (\text{Chronic Hepatitis} * \$54) + (\text{Intestinal Obstruction/Perforation} * \$160) + (\text{Pancreatic Disease} * \$152) + (\text{Rheumatoid Arthritis and Inflammatory Connective Tissue Disease} * \$34) + (\text{Severe Hematological Disorders} * \$64) + (\text{Disorders of Immunity} * \$51) + (\text{Drug/Alcohol Dependence} * \$103) + (\text{Major Depressive, Bipolar, and Paranoid Disorders} * \$48) + (\text{Muscular Dystrophy} * \$212) + (\text{Polyneuropathy} * \$91) + (\text{Respirator Dependence/Tracheostomy Status} * \$383) + (\text{Cardio-Respiratory Failure and Shock} * \$70) + (\text{Acute Myocardial Infarction} * \$153) + (\text{Unstable Angina and Other Acute Ischemic Heart Disease} * \$92) + (\text{Angina Pectoris/Old Myocardial Infarction} * \$84) + (\text{Specified Heart Arrhythmias} * \$93) + (\text{Cerebral Hemorrhage} * \$203) + (\text{Ischemic or Unspecified Stroke} * \$106) + (\text{Vascular Disease with Complications} * \$87) + (\text{Vascular Disease} * \$119) + (\text{Nephritis} * \$97) + (\text{Chronic Ulcer of Skin, Except Decubitus} * \$53) + (\text{Hip Fracture/Dislocation} * \$87) + (\text{Major Complications of Medical Care and Trauma} * \$88)$

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 COL-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 COL-RA2. Summary estimates of the average cost for colonoscopy in the test episode

Average Cost
\$1,150

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 \$1,219. Calculate the adjustment factor by dividing the costs from the current population by the average cost in Table COL-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 Colonoscopy Episode Costs = 1.06 * Risk Adjusted Colonoscopy 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 colonoscopy episodes are attributed to the provider identified as performing the colonoscopy.

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 COL-Provider Summary below for example)

**Colonoscopy Episode
Provider Summary
Report for Physician
#XXXXXXX**

Provider type = Gastroenterologist

	MD	Peer Group	Non-Peer Group	National Avg
Episodes	33	328,728	61,847	390,608
Observed Costs*				
Average	\$ 1,267	\$ 1,163	\$ 1,081	\$ 1,150
Min	\$ 426	\$ 426	\$ 426	\$ 426
Median	\$ 877	\$ 1,035	\$ 924	\$ 1,020
Max	\$ 2,360	\$ 3,365	\$ 3,365	\$ 3,365
Predicted Costs				
Average	\$ 1,157	\$ 1,150	\$ 1,149	\$ 1,150
Min	\$ 1,109	\$ 1,105	\$ 1,105	\$ 1,105
Median	\$ 1,145	\$ 1,141	\$ 1,141	\$ 1,141
Max	\$ 1,268	\$ 2,296	\$ 1,918	\$ 2,296
Observed-to-Expected Ratio				
Average	1.10	1.01	0.94	1.00
Min	0.37	0.36	0.36	0.24
Median	0.78	0.90	0.81	0.89
Max	2.13	3.05	3.05	3.05
% ≥ 2.0	3.0%	6.9%	6.1%	6.8%
% ≥ 2.5	0%	3.2%	2.9%	3.2%

% ≥ 75th percentile peers 45.5% (28.1%, 63.6%)

* 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 colonoscopy-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 colonoscopy-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

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

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- For each type-of-service category for non-inpatient, non-pharmacy claims, summaries of the 20 CPT and HCPCs codes among non-colonoscopy-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 colonoscopy-related and non-colonoscopy-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 colonoscopy-related and non-colonoscopy-related