NATIONAL QUALITY FORUM

Resource Use Measure Evaluation 1.0
January 2011

This form contains the measure information submitted by stewards. Blank fields indicate no information was provided. Attachments also may have been submitted and are provided to reviewers. The subcriteria and most of the footnotes from the evaluation criteria are provided in Word comments within the form and will appear if your cursor is over the highlighted area. Hyperlinks to the evaluation criteria and ratings are provided in each section.

Resource Use Definition:

- Resource use measures are broadly applicable and comparable measures of input counts—(in terms of units or dollars)-- applied to a population or population sample
- Resource use measures count the frequency of specific resources; these resource units may be monetized, as appropriate.
- The approach to monetizing resource use varies and often depends on the perspective of the measurer and those being measured. Monetizing resource use allows for the aggregation across resources.

NQF Staff: NQF staff will complete a preliminary review of the measure to ensure conditions are met and the form has been completed according to the developer's intent. Staff comments have been highlighted in green.

TAP/Workgroup (if utilized)**:** Complete all yellow highlighted areas of the form. Evaluate the extent to which each subcriterion is met. Based on your evaluation, summarize the strengths and weaknesses in each section.

Note: *If there is no TAP or workgroup, the SC also evaluates the subcriteria (yellow highlighted areas).*

Steering Committee: Complete all pink highlighted areas of the form. Review the workgroup/TAP assessment of the subcriteria, noting any areas of disagreement; then evaluate the extent to which each major criterion is met; and finally, indicate your recommendation for the endorsement. Provide the rationale for your ratings.

Evaluation ratings of the extent to which the subcriteria are met (TAP or Steering Committee)
High (H) – based on the information submitted, there is high confidence (or certainty) that the criterion is met
Moderate (M) – based on the information submitted, there is moderate confidence (or certainty) that the criterion is met
Low (L) - based on the information submitted, there is low confidence (or certainty) that the criterion is met
Insufficient (I) – there is insufficient information submitted to evaluate whether the criterion is met, e.g., blank, incomplete, or information is not relevant, responsive, or specific to the particular question (unacceptable)
Not Applicable (NA) - Not applicable (only an option for a few subcriteria as indicated)

Evaluation ratings of whether the measure met the overall criterion (Steering Committee)
Yes (Y)- The overall criteria has been met
No (N)-The overall criterion has NOT been met
High (H) – There is high confidence (or certainty) that the criterion is met
Moderate (M) – There is moderate confidence (or certainty) that the criterion is met
Low (L) - There is low confidence (or certainty) that the criterion is met

Recommendations for endorsement (Steering Committee)
Yes (Y) – The measure should be recommended for endorsement
No (N)-The measure should NOT be recommended for endorsement
Abstain (A)- Abstain from voting to recommend the measure

TAP/Workgroup Reviewer Name:	
Steering Committee Reviewer Name:	
Staff Reviewer Name(s):	
NQF Review #: 1583	**NQF Project:** Endorsing Resource Use Standards- Phase II

BRIEF MEASURE INFORMATION
Measure Title: Episode of care for 21-day period around a colonoscopy
Measure Steward (IP Owner): American Board of Medical Specialties Research and Education Foundation, 222 N. LaSalle St., Suite 1500, Chicago, Illinois, 60601
Brief description of measure: 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.
Resource use service categories: Inpatient services: Inpatient facility services Inpatient services: Evaluation and management Inpatient services: Procedures and surgeries Inpatient services: Imaging and diagnostic Inpatient services: Lab services Inpatient services: Admissions/discharges Ambulatory services: Outpatient facility services Ambulatory services: Emergency Department Ambulatory services: Pharmacy Ambulatory services: Evaluation and management Ambulatory services: Procedures and surgeries Ambulatory services: Imaging and diagnostic Ambulatory services: Lab services
Brief description of measure clinical logic: 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.
If included in a composite or paired with another measure, please identify composite or paired measure:
Subject/ Topic Areas: Cancer
Type of resource use measure: Cost/Resource Use
Data Type: Administrative claims Other

CONDITIONS FOR CONSIDERATION BY NQF	
Four conditions must be met before proposed measures may be considered and evaluated for suitability as voluntary consensus standards:	**NQF Staff**
A. Measure Steward Agreement. *The measure is in the public domain or an intellectual property (measure steward agreement) is signed. Public domain only applies to governmental organizations. All non-government organizations must sign a measure steward agreement even if measures are made publicly and freely available.* **A.1.Do you attest that the measure steward holds intellectual property rights to the measure? (If no, do**	**A** **Y☐** **N☐**

not submit) Yes **A.2. Please check if either of the following apply:** **A.3. Measure Steward Agreement.** Agreement signed and submitted **A.4. Measure Steward Agreement attached:** Signed_NQFMeasureSteward Agreement_020309-634387010562075261.pdf	
B. Maintenance. *The measure owner/steward verifies there is an identified responsible entity and process to maintain and update the measure on a schedule that is commensurate with the rate of clinical innovation, but at least every 3 years. (If no, do not submit)* Yes, information provided in contact section	**B** **Y☐** **N☐**
C. Purpose/ Use *(All the purposes and/or uses for which the measure is specified and tested:* Quality Improvement (Internal to the specific organization)	**C** **Y☐** **N☐**
D. Testing. *The measure is fully specified and tested for reliability and validity (See guidance on measure testing).* Yes, reliability and validity testing completed	**D** **Y☐** **N☐**
E. Harmonization and Competing Measures. *Have NQF-endorsed measures been reviewed to identify if there are related or competing measures? (List the NQF # and title in the section on related and competing measures)* Yes *E.1.***Do you attest that measure harmonization issues with related measure (either the same measure focus or the same target population) have been considered and addresses as appropriate? (List the NQF # and title in the section on related and competing measures)** No related measures *E.2.Do you attest that competing measures (both the same measure focus and the same target population) have been considered and addressed where appropriate?* No competing measures	**E** **Y☐** **N☐**
F. Submission Complete. *The requested measure submission information is complete and responsive to the questions so that all the information needed to evaluate all criteria is provided.*	**F** **Y☐** **N☐**
Have all conditions for consideration been met? **Staff Notes to Steward** (*if submission returned*)**:**	**Y ☐** **N ☐**
Staff Notes to Reviewers (*issues or questions regarding any criteria*)**:**	
File Attachments Related to Measure/Criteria:	

Attachment:
Attachment: S5_Data Dictionary-634350288283956071.pdf
Attachment:
Attachment:
Attachment:
Attachment:
Attachment:
Attachment:
Attachment: 10.1_Risk adjustment method-634350294325063237.pdf
S12_sample score report colonoscopy.pdf
Attachment: SA_Reliability_Validity Testing Colonoscopy.pdf

IMPORTANCE TO MEASURE AND REPORT	
Extent to which the specific measure focus is important to making significant gains in health care quality (safety, timeliness, effectiveness, efficiency, equity, patient-centeredness) and improving health outcomes for a specific high impact aspect of healthcare where there is variation in performance. **Importance to Measure and Report is a threshold criterion that must be met in order to recommend a measure for endorsement. All subcriteria must be met to pass this criterion.**	**Eval Rating**
High Impact **IM1. Demonstrated high impact aspect of healthcare:** A leading cause of morbidity/mortality **IM1.1. Summary of evidence of high impact:** The Institute of Medicine and AQA have identified breast 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 (1). Colorectal cancer is the third most commonly diagnosed cancer and the third leading cause of cancer death in both men and women in the US (2). In 2010 there were an estimated 102,000 new cases of colon cancer diagnosed in the United States (3). The American Cancer Society estimates that in 2011 there will be 101,700 new cases of colon cancer, and it is expected to cause 49,380 deaths in the U.S. (4). Colon cancer was responsible for the third leading number of new cancer cases in both men and women in 2010. In addition, it was estimated that more than 50,000 individuals died from colon cancer in the United States in 2010. Colon cancer kills men and women with nearly equal frequency. Incidence and death rates for colorectal cancer increase with age. Overall, 91% of new cases and 94% of deaths occur in individuals 50 and older (2). Recent analyses have shown the average total colon cancer attributable healthcare costs for a Medicare patient were just under $30,000 annually (5). Thus, colon cancer is responsible for a large number of cases and a significant economic burden. In a recent study, Mariotto et al. used cancer incidence, survival, and medical cost of care data in the United States to estimate and project the national costs of cancer care through the year 2020. Colorectal was the cancer site with the second highest cost in 2010 at $14.14 billion and is projected to cost $17.41 billion (in 2010 dollars) by the year 2020 (6). Colon Cancer Screening: There are multiple methods of screening available for the detection of colon cancer including fecal occult blood tests, fecal immunochemical tests, flexible sigmiodoscopy and colonoscopy. The type of screening test used by the American population has varied over the past decade, with colonoscopy is becoming the dominant screening method in the United	**1a** **H☐** **M☐** **L☐** **I☐**

States. Rates of lower endoscopy in the past 10 years increased from 44.8% in 2002 to 55.7% in 2006 (7). In contrast, the use of fecal occult blood tests decreased from 21.6% to 16.2% in that same period. In the Medicare population, while fecal testing was the dominant screening method in 2005 for enrollees aged 65 years and older, the rate of FOBT use is decreasing and the rate of colonoscopy use is increasing (8).
However, despite the evidence supporting the effectiveness of colorectal screening and the availability of various screening tests, half of the US population aged 50 and older has not been tested (9).

IM1.2. Citations for evidence of high impact cited in IM1.1.:

1. Alliance AQ. Candidate list of conditions for cost of care measurement. Available at: http://www.aqaalliance.org/files/CandidateListofConditionsforCostofCare MeasurementApproved.pdf. Accessed April 17, 2011.
2. Colorectal Cancer Facts & Figures 2008-2010. American Cancer Society. www5.cancer.org/downloads/STT/f861708_finalforweb.pdf.
3. American Cancer Society. Cancer Facts & Figures 2010. Atlanta: American Cancer Society; 2010.
4. American Cancer Society, Key Statistics, Colorectal Cancer. www.cancer.org/cancer/colorectalcancer/detaiedguide/html
5. Lou Z, Bradley CJ, Dahman BA, Gardiner JC. Health Care Financ Rev 2009; 31(1): 35-50.
6. Mariotto AB, Yabroff KR, Shao Y et al. Projections of the cost of cancer care in the United States: 2010-2020. J Natl Cancer Inst. 201;103:117-28.
7. Use of colorectal cancer tests—United States, 2002, 2004, and 2006, MMWR Morb Mortal Wkly Rep 57 (2008), pp. 253–258.
8. A.P. Schenck, S.C. Peacock and C.N. Klabunde et al., Trends in colorectal cancer test use in the Medicare population, 1998–2005, Am J Prev Med 37 (2009), pp. 1–7.
9. Shapiro JA, Seeff LC, Thompson TD, Nadel MR, Klabunde CN, Vernon SW. Colorectal cancer test use from the 2005 national health interview survey. Cancer Epidemiol Biomarkers Prev 2008;17(7):1623-30.

IM2. Opportunity for Improvement

IM2.1. Briefly explain the benefits envisioned by use of this measure:

The intent is that the measure will be paired with quality measures to examine the overall efficiency of care being provided for patients undergoing a colonoscopy. This will help to identify providers that may be undertaking best care practices through identification of those that provide 'efficient' care by examining both the resource use as well as the quality of care. It will be necessary to put both of these measures together in order to fully realize the potential of resource use measures. However, in the interim this can be used to compare the relative resource use by different providers to examine patterns in colonoscopy-related healthcare costs. This may provide actionable information if for example one providers costs are always higher because they provider is using more expensive medications or if the providers patients have more frequent hospitalizations than the patients of comparable providers.

IM2.2. Summary of data demonstrating variation across providers or entities:

--Jansman et al, note the economic implications of colorectal cancer treatment are substantial. The costs of treatment are mainly attributable to the early and terminal stage of the disease (i.e. surgery, hospitalization, chemo- and immunotherapy and supportive care). The introduction of new chemo- and immunotherapeutics has caused a marked and continuing increase of treatment expenditures. Therefore, comparative costs and cost effectiveness are important for assessing the value of new treatment regimens (1)

--Ferro et al conducted a nationwide study of oncology practices demonstrating large variation in the use of modern chemotherapy regimens for colorectal cancer, resulting in dramatic differences in costs. Based on completing a full course of chemotherapy, the authors found the total cost of chemotherapy may differ by as much as $36,999 per patient depending on the regimen (2)

--A review by Meropol and Schulman examined costs of common regimens in the treatment of CRC for 6 months of treatment and noted the wide variation of costs among regimens (3).

--A study by Wong describes marked variations in proximal colon cancer 5-year survival by sex and race/ethnicity. These variations were not explained by age, date of diagnosis, stage of disease, or type of cancer therapy received. Potential explanations include disparities in delivery of health care resources between demographic groups with similar

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disease characteristics, variations in cancer screening programs, or differences in genetics and cancer biology between each group. (4)

Colon Cancer Screening:

There are multiple methods of screening available for the detection of colon cancer including fecal occult blood tests, fecal immunochemical tests, flexible sigmiodoscopy and colonoscopy. The type of screening test used by the American population has varied over the past decade, with colonoscopy is becoming the dominant screening method in the United States.

Rates of lower endoscopy in the past 10 years increased from 44.8% in 2002 to 55.7% in 2006 (5). In contrast, the use of fecal occult blood tests decreased from 21.6% to 16.2% in that same period. In the Medicare population, while fecal testing was the dominant screening method in 2005 for enrollees aged 65 years and older, the rate of fecal occult blood testing use is decreasing and the rate of colonoscopy use is increasing (6).

Colonoscopy is the preferred colorectal cancer screening strategy of both the American College of Gastroenterology (ACG) and the American Society of Colon and Rectal Surgeons (ASCRS), receiving a Grade 1B recommendation in the ACG's most recent guidelines (issued in 2008)(7). Colon cancer screening is similarly recommended by the US Preventive Services Task Force and has also been identified as a priority area in other national initiatives, including the Health Resources and Services Administration's(HRSA) Health Disparities Collaboratives and the Centers for Medicare and Medicaid Services' (CMS) Quality Improvement Program(8). Although the role of colonoscopy in detecting and preventing colon cancer is clear,concerns have been raised in recent years about the overall rising costs of the procedure. These concerns are in part based on the increasing total volume of colonoscopy procedures performed as well as the increasing costs of each individual procedure. In 2003, for example, 30% of eligible women and 32% of eligible men 50 years and older had undergone the procedure(9,10. The rising costs of each procedure may largely be attributable to increasing costs of ancillary resources that are used. For example, because patient discomfort during the procedure can be considerable, some sort of sedation or anesthesia is typically administered. However, the type of sedation given, whether or not more complete anesthesia should be used, and whether or not sedation is even necessary at all in every circumstance is of some debate. As a result, considerable individual provider discretion is the norm (11). Furthermore, the procedure has some inherently associated potential complications (eg, bleeding and bowel perforation), and the potential for these complications to occur may also vary depending on the level of sedation. Whereas procedures performed with sedation have higher risks of respiratory depression, falls, and other sedation-related complications, those performed without sedation have higher failure rates in part because of patient discomfort (12–14).

IM2.3. Citations for data on variation:

1. Jansman FG, Postma MJ, Brouwers JR. Cost considerations in the treatment of colorectal cancer. Pharmacoeconomics. 2007;25(7):537-562.

2. Myer BS, Wolff DA, Poniewierski MS, et al. Variation in the cost of medications for the treatment of colorectal cancer. Am J Manag Care. 2008;14:717-725.

3. Meropol NJ, Schulman KA. Cost of cancer care: issues and implications. J Clin Oncol. 2007;25:180-186.

4. Wong RJ. Marked Variations in Proximal Colon Cancer Survival by Race/Ethnicity Within the United States. Journal of Clinical Gastroenterology 2010;44:625-630.

5. Use of colorectal cancer tests—United States, 2002, 2004, and 2006, MMWR Morb Mortal Wkly Rep 57 (2008), pp. 253–258.

6. A.P. Schenck, S.C. Peacock and C.N. Klabunde et al., Trends in colorectal cancer test use in the Medicare population, 1998–2005. Am J Prev Med 2009;37:1–7.

7. Rex D, Johnson D, Anderson J, et al. American College of Gastroenterology guidelines for colorectal cancer screening 2009. Am J Gastroenterol 2009;104:139–50.

8. Adams K, Corrigan J, editors. Priority areas for national action: transforming health care quality. Institute of Medicine. Washington, DC: National Academies Press; 2003. p. 117–25.

9. Meissner HI, Breen N, Klabunde CN, et al. Patterns of colorectal cancer screening uptake among men and women in the United States. Cancer Epidemiol Biomarkers Prev 2006;15:389–94.

10. Harewood GC, Lieberman DA. Colonoscopy practice patterns since introduction of Medicare coverage for average-risk screening. Clin Gastroenterol Hepatol. 2004;2:72–7.

11. Leung FW, Aharonian HS, Guth PH, et al. Unsedated colonoscopy: time to revisit this option? J Fam Pract 2008;57:E1–4.

12. Witt TN, Enns R. The difficult colonoscopy. Can J Gastroenterol 2007;21:487–90.

13. Arrowsmith JB, Gerstman BB, Fleischer DE, et al. Results from the American Society for Gastrointestinal Endoscopy/US Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. Gastrointest Endosc 1991;37:421–7.

14. Sharma VK, Nguyen C, Crowell MD, et al. A national study of cardiopulmonary unplanned events after GI endoscopy. Gastrointest Endosc 2007;66:27–34.

IM2.4. Summary of data on disparities by population group:

Racial and ethnic minorities, particularly those in impoverished urban communities, have higher colorectal cancer morbidity and mortality rates (1-3). Mortality rates for African Americans are 45% higher than those in whites (4). African Americans are 1.67 times more likely to die within five years after surgical treatment (5). Part of the difference in mortality rates can be attributed to a later stage of disease at presentation due to a lack of screening. This prompted the American College of Gastroenterology to revise its screening recommendations for African Americans to begin screening colonoscopies at age 45 rather than at age 50 (5).

Compared to whites, all other racial/ethnic groups are less likely to be diagnosed with colorectal cancer at the localized stage, when treatment is more successful. More than two-thirds of patients are not diagnosed until the disease has advanced (6). Screening rates for CRC are relatively low in general, but in particular among racial/ethnic minorities (6). Despite the fact that Medicare now covers (since July of 2001) the cost of colonoscopy, fewer than half of the elderly are screened (7), and this is a particular problem among Hispanic elderly (7).

In a study of low-income Latino and white patients in an urban community health center, Green and colleagues (2008) found that for both groups, complicated scheduling processes, financial difficulties and transportation issues, fear of the procedure, pain, or complications, and a cancer diagnosis, embarrassment, and dissuasion from others were barriers to screening. In addition, Latinos in the study experienced language barriers (6). Among females, Hispanic and black women are three times as likely as white women to present with complicated colorectal cancer (8). Culturally appropriate educational materials (9), population-tailored interventions (7), and disparities messages framed in a positive manner (10) have been shown to increase willingness to be screened for colon cancer among racial/ethnic groups.

Stratified analyses showed that blacks as a group generally had poorer survival outcomes for proximal colon cancers (11). Other studies have shown a lower follow-up rate for diagnostic evaluation after screen-detected abnormalities among African Americans compared with whites (12).

Another area of concern is the lack of adherence to chemotherapy guidelines for postoperative care for stage III colon cancer. In the U.S. nearly half of patients with stage III colon cancer do not receive chemotherapy (13). It is not clear whether chemotherapy is not being offered, if patients are not being referred, or whether therapy is being offered but is declined (14). There are also racial/ethnic and socioeconomic disparities in the receipt of chemotherapy (15). Investigators have found that lower SES was significantly associated with decreased survival, even after controlling for race/ethnicity, patient tumor characteristics and definitive treatment (15).

Chemotherapy rates also are disproportionately low for African Americans compared to whites (52.1% vs. 64.1%) even in a Medicare insured population (15). While there are multiple factors that impact the receipt of chemotherapy, referral to a medical oncologist for evaluation is a key factor and area of disparities especially among elderly patients (16). Socioeconomic factors mediate the quality of colon cancer care received in urban areas of the U.S. (17), and high Medicaid hospitals have been shown to have higher postoperative colon cancer mortality rates at 30 days and 1 year (18).

Racial/ethic and socioeconomic disparities have been demonstrated in every step of the colon cancer diagnosis and care spectrum. Unequal and inadequate access to care plays a large role (14).

IM2.5. Citations for data on disparities cited in IM2.4:

1. Jemal A, Clegg LX, Ward E, et al. Annual report to the nation on the status of cancer, 1975–2001, with a special feature regarding survival. Cancer. 2004;101:3–27.
2. Ball JK, Elixhauser A. Treatment differences between blacks and whites with colorectal cancer. Med Care. 1996;34:970–984.
3. Freeman HP, Alshafie TA. Colorectal carcinoma in poor blacks. Cancer. 2002;94:2327–2332.
4. Colorectal Cancer Facts & Figures 2008-2010. American Cancer Society. www5.cancer.org/downloads/STT/f861708_finalforweb.pdf.
5. Lloyd, S.C., Harvey, N.R., Hebert, J.R., et al., (2007) Racial disparities in colon cancer: Primary care endoscopy as a tool to increase screening rates among minority patients. Cancer, 109(2 Suppl): 378-85.
6. Green, A.R., Peters-Lewis, A., Percac-Lima, S., et al., (2008) Barriers to screening colonoscopy for low-income Latino and white patients in an urban community health center. Journal of General Internal Medicine, 23(6): 834-40.
7. Shih, Y.T., Zhao, L., & Etling, L.S. (2006) Does Medicare coverage of colonoscopy reduce racial/ethnic disparities in cancer screening among the elderly? Health Affairs, 25(4): 1153-62.
8. Bowman, K.C., Tabrizian, P., Telem, D.A., et al., (2010) Health disparity in complicated colorectal cancer. The American Surgeon, 76: 164-67.
9. Walsh, J., Salazar, R., Nguyen, T.T., et al., (2010) Healthy colon, healthy life: A novel colorectal cancer screening intervention. American Journal of Preventive Medicine, 39(1): 1-14.
10. Nicholson, R.A., Kreuter, M.W., Lapka, C., et al., (2008) Unintended effects of emphasizing disparities in cancer communication to African Americans. Cancer Epidemiology Biomarkers and Prevention, 17(11): 2946-2952.
11. Wong, R.J. (2010) Marked variation in proximal colon cancer survival by race/ethnicity within the United States. Journal Clinical Gastroenterology, 44(9): 625-30.
12. Laiyemo, A.O., Boubeni, C., Pinsky, P.F., et al., (2010) Race and colorectal cancer disparities: Health care utilization vs. different cancer susceptibilities. Journal of the National Cancer Institute, 102(8): 538-46.
13. Etzioni, D.A., El-Khoueiry, A.B., & Beart, R.W. (2008) Rates and predictors of chemotherapy use for stage III colon cancer. Cancer, 113(12): 3279-3289.
14. Robinson, C.N., Balentine, C.J., Marhsall, C.L., et al., (2010) Ethnic disparities are reduced in VA colon cancer patients. American Journal of Surgery, 200(5): 636-9.
15. Du, X.L., Fang, S., Vernon, S.W., et al., (2007) Racial disparities and socioeconomic status in association with survival in a large population-based cohort of elderly patients with colon cancer. Cancer, 110(3): 660-668.
16. Davidoff, A.J., Rapp, T., Omukwugha, E., et al., (2009) Trends in disparities in receipt of adjuvant therapy for elderly stage III colon cancer patients. Medical Care, 47(12): 1229-36.
17. Gorey, K.M., Luginaah, I.N., Bartfay, E., et al., (2011) Effects of socioeconomic status on colon cancer treatment accessibility and survival in Toronto, Ontario and San Francisco, California, 1996-2006. American Journal of Public Health, 101(1): 112-19.
18. Rhoads, K.F., Ackerson, L.K., Jha, A.K. et al., (2008) Quality of colon cancer outcomes in hospitals with a higher percentage of Medicaid patients. Journal of the American College of Surgeons, 207: 197-204.

IM3. Measure Intent

IM3.1. Describe intent of the measure and its components/ Rationale (including any citations) for analyzing variation in resource use in this way

The intent of the measure is to be able to identify differential resource use among those performing colonoscopy and identify reasons for these differences. For example, in our analyses we have found that the use of general anesthesia is associated with higher costs than those patients without general anesthesia. Although the use of anesthesia may make patients undergoing colonoscopy more comfortable, currently there are no evidence-based guidelines that indicate colonoscopy should be performed under general anesthesia for most of the population. Additionally, there are no data that suggest the use of general anesthesia is associated with better outcomes. From the perspective of the health care system, the use of general anesthesia for colonoscopy may represent an inefficient use of resources if the costs of the episode are higher with no difference in the rates of complications. This measure can help to identify differential resource use that can lead to actions intended to reduce the variability in costs.

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IM4. Resource use service categories are consistent with measure construct — **1d**

Refer to IM3.1. & all S9 items to evaluate this criteria.	H☐ M☐ L☐ I☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Importance to Measure and Report?*	
Steering Committee: Was the threshold criterion, *Importance to Measure and Report*, **met?** **Rationale:**	Y☐ N☐

SCIENTIFIC ACCEPTABILITY OF MEASURE PROPERTIES

Extent to which the measure, as specified, produces consistent (reliable) and credible (valid) results about the quality of care when implemented.

MEASURE SPECIFICATIONS

S1. Measure Web Page:
Do you have a web page where current detailed measure specifications can be obtained?

Yes
http://www.healthqualityalliance.org/hvhc-project/cost-care-measurement-development

Eval Rating 2a1/2b1

S2. General Approach
If applicable, summarize the general approach or methodology to the measure specification. This is most relevant to measures that are part of or rely on the execution of a measure system or applies to multiple measures.

The ABMS REF episode-based resource use measures were created in an open and transparent manner with input from a wide range of clinical experts, methodologists, health care economists and other stakeholders. The measure development process involved a series of deliberate steps where participating clinicians took into account the natural progression of a condition and existing best practices before carefully considering how to best use administrative claims data to construct the episode. They aimed to identify clinically homogenous populations so that the measures would be sensitive to provider decisions and existing practice protocols for like patients. Workgroup members were then asked to conceptualize the measure specifications based on their combined knowledge of guidelines, evidence, and clinical experience. The workgroups helped to define the denominator, duration, clinically relevant services and attribution of each episode as related to the clinical progression and treatment of the condition. Project staff then worked to translate the concepts into detailed written measure specifications and test the measures on a commercial database. The workgroups subsequently re-convened via a series of conference calls to review data analyses, share expert opinions, consider additional evidence-based literature, revise and finalize the measure specifications. Each measure was developed independently and, as such, they are not summative.

Attachment:

S3. Type of resource use measure:

Per episode

S4. Target Population:

S4.1. Subject/Topic Areas:

Cancer

S4.2. Cross Cutting Areas *(HHS or NPP National health goal/priority)*

Care Coordination
Population Health

S5. Data dictionary or code table
Please provide a web page URL or attachment if exceeds 2 pages. NQF strongly prefers URLs. Attach documents only if they are not available on a web page and keep attached file to 5MB or less.

Data Dictionary:

URL:
Please supply the username and password:
Attachment: S5_Data Dictionary-634350288283956071.pdf

Code Table:

URL:
Please supply the username and password:
Attachment:

S6.Data Protocol (Resource Use Measure Module 1)
The measure developer must determine which of the following data protocol steps: data preparation, data inclusion criteria, data exclusion criteria, and missing data, are submitted as measure specifications or as guidelines. Specifications limit user options and flexibility and must be strictly adhered to; whereas guidelines are well thought out guidance to users while allowing for user flexibility. If the measure developer determines that the requested specification approach is better suited as guidelines, please select and submit guidelines, otherwise specifications must be provided.

Data Protocol Supplemental Attachment or URL:
If needed, attach document that supplements information provided for data protocol for analysis, data inclusion criteria, data exclusion criteria, and missing data (Save file as: S6_Data Protocol). All fields of the submission form that are supplemented within the attachment must include a summary of important information included in the attachment and its intended purpose, including any references to page numbers, tables, text, etc.

URL: http://www.healthqualityalliance.org/hvhc-project/cost-care-measurement-development
Please supply the username and password:
Attachment:

S6.1. Data preparation for analysis
Detail (specify) the data preparation steps and provide rationale for this methodology.

Guidelines : Approach to Data Cleaning:
If a standardized cleaning methodology or logic for the claims data exists, users are encouraged to apply the existing methodology, or conversely, encouraged not to remove data cleaning steps already implemented. If however, organizations impute missing data, we recommend using only non-imputed data.

Rationale: Each organization will be more familiar with the nature of their data therefore any standard cleaning procedures are likely to be appropriate. Imputation can produce unpredictable biases in the results.

S6.2.Data inclusion criteria
Detail initial data inclusion criteria and rationale(related to claim-line or other data quality, data validation, e.g. truncation or removal of low or high dollar claim)

Guidelines : Paid claims with non-missing enrollee identification numbers, primary procedure and diagnosis codes should be included in the measure.
Note: The ABMS REF resource use measures are constructed based on date of service, not date of payment. Therefore, we recommend applying the measures to finalized or "closed" datasets so that complete claims histories during the

measurement period are captured in the data.

Including enrollees with at least 24 months of continuous medical and pharmacy benefit enrollment during the identification year and the measurement year is recommended. However, the measure has been tested on enrollees with at least 320 total days of coverage during each year. 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). This approach is based on the similar eligibility requirements used by NCQA for HEDIS measure denominators.

S6.3. Data exclusion criteria
Detail initial data exclusion criteria and rationale (related to claim-line or other data quality, data validation, e.g. truncation or removal of low or high dollar claim)

Guidelines : Beyond the standard data cleaning steps, we recommend that claim lines with missing or zero quantity values be set to a quantity of one and claim lines missing enrollee identification variables, primary diagnosis and procedure codes, and service date be eliminated. We also recommend eliminating all rejected or unpaid claims. Because a single provider id could have multiple specialties, we also recommend generating a uniform specialty for all providers by assigning each provider the specialty which is most frequently observed from all their Evaluation and Management visits.

Rationale: Converting missing or zero quantities to a minimum value of 1 allows for the pricing of these services. Claim lines missing enrollee identifiers, or primary procedure and diagnosis codes cannot be attributed to an individual, and without procedure and diagnosis codes, services cannot be properly identified and categorized. The resource use measures are intended to track costs to the payer, not general or societal costs, so rejected or unpaid claims should be eliminated.
Standardizing the specialty of all providers eliminates the possibility that providers are classified as one specialty for one enrollee and another specialty for others.

S6.4. Missing Data
Detail steps associated with missing data and rationale(e.g., any statistical techniques used)

Guidelines : Users are encouraged to eliminate claim lines missing enrollee identification variables or primary procedure and diagnosis codes. We do not recommend using any imputation methods to replace missing data.

Rationale: Claim lines missing enrollee identifiers cannot be attributed to an individual, and without procedure and diagnosis codes, services cannot be properly identified and categorized. Imputation of missing information could introduce bias into the measure, so we do not recommend the use of imputed data.

S7. Data Type: Administrative claims
Other

S7.1. Data Source or Collection Instrument
Identify the specific data source/data collection instrument (e.g. name of database, clinical registry, collection instrument, etc.)

Sources for administrative claims: commercial databases
Standardized price tables: Users can download tables from the NCQA website (see url below) or use the guidelines in the technical appendix of the written measure specification to create their own standardized prices.

S7.2. Data Source or Collection Instrument Reference
(Please provide a web page URL or attachment). NQF strongly prefers URLs. Attach documents only if they are not available on a web page and keep attached file to 5MB or less)

URL: http://www.ncqa.org/tabid/1092/Default.aspx
Please supply the username and password:
Attachment:

S8.Measure Clinical Logic (Resource Use Measure Module 2)
The measure's clinical logic includes the steps that identify the condition or event of interest and any clustering of diagnoses or procedures. For example, the diagnoses and procedures that qualifies for a cardiac heart failure episode, including any disease interaction, comorbid conditions, or hierarchical structure to the clinical logic of the model. (Some of the steps listed separately below may be embedded in the risk adjustment description, if so, please indicate NA and in the rationale space list 'see risk adjustment details.')

Clinical Logic Supplemental Attachment or URL:
If needed, provide a URL or document that supplements information provided for the clinical framework, co-morbid interactions, clinical hierarchies, clinical severity levels, and concurrency of clinical events

URL: http://www.healthqualityalliance.org/hvhc-project/cost-care-measurement-development
Please supply the username and password:
Attachment:

S8.1. Brief Description of Clinical Framework
Briefly describe your clinical logic approach including clinical topic area, whether or not you account for comorbid and interactions, clinical hierarchies, clinical severity levels and concurrency of clinical events.

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.

S8.2. Clinical framework
Detail any clustering and the assignment of codes, including the grouping methodology, the assignment algorithm, and relevant codes and rationale for these methodologies.

The following steps are used to create the clinical framework for the measure:

Identify the 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 one of the following procedure codes for colonoscopy during the measurement period (see also Table COL-A in the written measure specification. Colonoscopy, rigid or flexible, transabdominal via colostomy, single or multiple: CPT: 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): CPT: 45378; Colonoscopy with biopsy, single or multiple: CPT: 45380; Colonoscopy with ablation of tumor(s), polyp(s), or other lesion(s) not amenable to removal by hot biopsy forceps, bipolar cautery or snare techniques: CPT: 45383; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by hot biopsy or forceps or bipolar cautery: CPT: 45384; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by snare techniques: CPT: 45385; Colorectal cancer screening; colonoscopy on individual at high risk: HCPC: G0105; Colorectal cancer screening; colonoscopy on individual not meeting criteria for high risk: HCPC: G0121; Colonoscopy: ICD9 procedure: 45.23; Endoscopic polypectomy of large intestine: ICD9 procedure: 45.42.

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
(Do not include persons whose pharmacy benefits are dropped partway through the identification or measurement period)

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

Step 3: Identify patients with exclusion criteria
1. Identify patients that meet one or more exclusion criteria during either the identification year OR the measurement year

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A) Standard Exclusion Criteria (see also Tables COL-H1-4 in written measure specification): Active cancer (excluding melanoma, skin, prostate, and CLL): ICD9 CM: 140-208, 230-239 WITH CPT: 38230, 38240-38242, 77261-77799, 79000-79999, 96400-96549; ICD9 procedure: 41.0, 41.91, 92.2; UB Revenue: 028x, 033x, 0342, 0344, 0973; End stage renal disease (ESRD): CPT: 36145, 36800-36821, 36831-36833, 90919-90921, 90923-90925, 90935, 90937, 90939, 90940, 90945, 90947, 90989, 90993, 90997, 90999, 99512; HCPC: G0257, G0311-G0319, G0321-G0323, G0325-G0327, G0392, G0393, S9339; ICD9 CM Diagnosis code: 585.5, 585.6, V42.0, V45.1, V56; ICD9 CM Procedure: 38.95, 39.27, 39.42, 39.43, 39.53, 39.93, 39.94, 39.95, 54.98; UB Revenue: 080x, 082x-085x, 088x; UB Type of bill: 72x; Pos: 65; HIV/AIDS: ICD9: 042; Organ transplant: CPT: 32850-32856, 33930-33945, 44132-44137, 44715-44721, 47133-47147, 48160, 48550-48556, 50300-50380; HCPC: S2152, S2053-S2055, S2060, S2061, S2065; ICD9 Procedure: 33.5, 33.6, 37.5, 41.94, 46.97, 50.5, 52.8, 55.6; UB Revenue: 0362, 0367, 0810-0813, 0819

Eval Rating 2b1

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B) Persons with any of the following GI-related diagnoses in the year preceding the colonoscopy or during the colonoscopy episode are excluded (see also Table COL-H5 in written measure specification): Regional enteritis of small intestines: ICD9: 555.0; Regional enteritis of large intestines: ICD9: 555.1; Regional enteritis of small intestines with large intestine: ICD9: 555.2; Regional enteritis of unspecified site: ICD9: 555.9; Ulcerative enterocolitis: ICD9: 556.0; Ulcerative ileocolitis: ICD9: 556.1; Ulcerative proctitis: ICD9: 556.2; Ulcerative Proctosigmoiditis: ICD9: 556.3; Pseudopolyposis of colon: ICD9: 556.4; Left-sided ulcerative colitis: ICD9: 556.5; Universal ulcerative colitis: ICD9: 556.6; Other ulcerative colitis: ICD9: 556.8; Ulcerative colitis, unspecified: ICD9: 556.9;

C) Persons with colectomy with primary diagnosis of colon cancer within 2 days of colonoscopy (see also Tables COL-H6 and COL-H7). The following 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—either Malignant neoplasm of colon: ICD9: 153.x or Carcinoma in situ of colon: ICD9: 230.3: Colectomy - Open - Partial; With Anastomosis: CPT: 44140; Colectomy - Open - Partial; With Skin Level Cecostomy Or Colostomy: CPT: 44141; Colectomy - Open - Partial; With End Colostomy And Closure Of Distal Segment: CPT: 44143; Colectomy - Open - Partial; With Resection, With Colostomy Or Ileostomy And Mucous Fistula: CPT: 44144; Colectomy - Open - Partial; With Coloproctostomy: CPT: 44145; Colectomy - Open - Partial; With Coloproctostomy And Colostomy: CPT: 44146; Colectomy - Open - Partial; Abdominal And Transanal Approach: CPT: 44147; Colectomy - Open - Total; Without Proctectomy, With Ileostomy Or Ileoproctostomy: CPT: 44150; Colectomy - Open - Total; Without Proctectomy, With Continent Ileostomy: CPT: 44151; Colectomy - Open - Total ; Abdominal With Proctectomy, With Ileostomy: CPT: 44155; Colectomy - Open - Total; Abdominal With Continent Ileostomy: CPT: 44156; Colectomy - Open - Total; Abdominal With Ileoanal Anastomosis, Inlcludes Loop Ileostomy: CPT: 44157; Colectomy - Open - Total; With Creation Of Ileal Reservoir, Includes Loop Ileostomy: CPT: 44158; Colectomy - Open - Partial; With Removal Of Terminal Ileum With Ileocecostomy: CPT: Colectomy - Laparoscopic - Partial; With Anasomosis: CPT: 44204; Colectomy - Laparoscopic - Partial; With Removal Of Terminal Ileum, With Ileocolostomy: CPT: 44205; Colectomy - Laparoscopic - Partial; With End Colostomy And And Closure Of Distal Segment (Hartmann Type Procedure): CPT: 44206; Colectomy - Laparoscopic - Partial; With Anastomosis With Coloproctostomy: CPT: 44207; Colectomy - Laparoscopic - Partial; With Anastomosis With Coloproctostomy And Colostomy: CPT: 44208; Colectomy - Laparoscopic - Total; Abdominal Without Proctectomy, With Ileostomy Or Ileoproctostomy: CPT: 44210; Colectomy - Laparoscopic - Total; Abdominal With Proctectomy, With Ileoanal Anastomosis, Creation Of Ileal Reservoir, Loop Ileostomy: CPT: 44211; Colectomy - Laparoscopic - Total; Abdominal With Proctectomy, Ileostomy: CPT: 44212

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

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 also Table COL-B in the written measure specification): Vomiting (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 787.0, 787.01, 787.03, 787.04; Dehydration: ICD9: 276.51; Abdominal pain: 789.x; Fever: ICD9: 780.60, 780.61, 780.62; Perforation of intestine (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 569.83; Gastrointestinal hemorrhage (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 578; Blood in stool: ICD9: 578.1; Hemorrhage of gastrointestinal tract, unspecified: ICD9: 578.9; Cardiopulmonary complications (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): Myocardial infarction: ICD9: 410.x, except 410.x2; Angina: ICD9: 413.x; Acute coronary syndrome: ICD9: 411.1, 411.8x; Cardiac disrhythmias, arrhythmias: ICD9: 427.xx; Congestive heart failure (CHF): ICD9: 428.xx, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93; Cardiac or respiratory arrest: ICD9: 427.5, 518.81, 518.84, 799.1, 997.1; Syncope: ICD9: 780.2; Hypotension: ICD9: 458.9; Shock: ICD9: 518.5, 785.50, 785.51, 785.59, 998.0; Stroke (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 431.x-438.x; Coagulation complications (only included from day t0 to day t+14, where t is the date of the colonoscopy event date): Pulmonary embolism: ICD9: 415.1x; DVT: 453.4x; Accidental Falls (only included from day t-1 to day t+1, where t is the date of the colonoscopy event date): Fall on or from stairs or steps: ICD9: E880; Fall on or Anesthesia-related adverse effects from ladders or scaffolding: ICD9: E881; Other fall from one level to another: ICD9: E884; Anesthesia-related adverse effects: Unspecified adverse effect of anesthesia: ICD9: 995.22; Shock due to anesthesia, NEC: ICD9: 995.4; Malignant hyperthermia: ICD9: 995.86; Other specified adverse effects, NEC: ICD9: 995.89

or

hospitalizations with an eligible colonoscopy code (see also Table COL-A in written measure specification). 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: Colonoscopy, rigid or flexible, transabdominal via colostomy, single or multiple: CPT: 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): CPT: 45378; Colonoscopy with biopsy, single or multiple: CPT: 45380; Colonoscopy with ablation of tumor(s), polyp(s), or other lesion(s) not amenable to removal by hot biopsy forceps, bipolar cautery or snare techniques: CPT: 45383; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by hot biopsy or forceps or bipolar cautery: CPT: 45384; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by snare techniques: CPT: 45385; Colorectal cancer screening; colonoscopy on individual at high risk: HCPC: G0105; Colorectal cancer screening; colonoscopy on individual not meeting criteria for high risk: HCPC: G0121; Colonoscopy: ICD9 procedure: 45.23; Endoscopic polypectomy of large intestine: ICD9 procedure: 45.42.

Outpatient events

Identify all outpatient claims / encounters with a colonoscopy-related diagnostic code appearing in any position (see also Table COL-B): Vomiting (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 787.0, 787.01, 787.03, 787.04; Dehydration: ICD9: 276.51; Abdominal pain: 789.x; Fever: ICD9: 780.60, 780.61, 780.62; Perforation of intestine (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 569.83; Gastrointestinal hemorrhage (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 578; Blood in stool: ICD9: 578.1; Hemorrhage of gastrointestinal tract, unspecified:

ICD9: 578.9; Cardiopulmonary complications (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): Myocardial infarction: ICD9: 410.x, except 410.x2; Angina: ICD9: 413.x; Acute coronary syndrome: ICD9: 411.1, 411.8x; Cardiac disrhythmias, arrhythmias: ICD9: 427.xx; Congestive heart failure (CHF): ICD9: 428.xx, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93; Cardiac or respiratory arrest: ICD9: 427.5, 518.81, 518.84, 799.1, 997.1; Syncope: ICD9: 780.2; Hypotension: ICD9: 458.9; Shock: ICD9: 518.5, 785.50, 785.51, 785.59, 998.0; Stroke (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 431.x-438.x; Coagulation complications (only included from day t0 to day t+14, where t is the date of the colonoscopy event date): Pulmonary embolism: ICD9: 415.1x; DVT: 453.4x; Accidental Falls (only included from day t-1 to day t+1, where t is the date of the colonoscopy event date): Fall on or from stairs or steps: ICD9: E880; Fall on or Anesthesia-related adverse effects from ladders or scaffolding: ICD9: E881; Other fall from one level to another: ICD9: E884; Anesthesia-related adverse effects: Unspecified adverse effect of anesthesia: ICD9: 995.22; Shock due to anesthesia, NEC: ICD9: 995.4; Malignant hyperthermia: ICD9: 995.86; Other specified adverse effects, NEC: ICD9: 995.89

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): 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: Colonoscopy, rigid or flexible, transabdominal via colostomy, single or multiple: CPT: 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): CPT: 45378; Colonoscopy with biopsy, single or multiple: CPT: 45380; Colonoscopy with ablation of tumor(s), polyp(s), or other lesion(s) not amenable to removal by hot biopsy forceps, bipolar cautery or snare techniques: CPT: 45383; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by hot biopsy or forceps or bipolar cautery: CPT: 45384; Colonoscopy with removal of tumor(s), polyp(s), or other lesion(s) by snare techniques: CPT: 45385; Colorectal cancer screening; colonoscopy on individual at high risk: HCPC: G0105; Colorectal cancer screening; colonoscopy on individual not meeting criteria for high risk: HCPC: G0121; Colonoscopy: ICD9 procedure: 45.23; Endoscopic polypectomy of large intestine: ICD9 procedure: 45.42; Vomiting (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 787.0, 787.01, 787.03, 787.04; Dehydration: ICD9: 276.51; Abdominal pain: 789.x; Fever: ICD9: 780.60, 780.61, 780.62; Perforation of intestine (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 569.83; Gastrointestinal hemorrhage (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 578; Blood in stool: ICD9: 578.1; Hemorrhage of gastrointestinal tract, unspecified: ICD9: 578.9; Cardiopulmonary complications (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): Myocardial infarction: ICD9: 410.x, except 410.x2; Angina: ICD9: 413.x; Acute coronary syndrome: ICD9: 411.1, 411.8x; Cardiac disrhythmias, arrhythmias: ICD9: 427.xx; Congestive heart failure (CHF): ICD9: 428.xx, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93; Cardiac or respiratory arrest: ICD9: 427.5, 518.81, 518.84, 799.1, 997.1; Syncope: ICD9: 780.2; Hypotension: ICD9: 458.9; Shock: ICD9: 518.5, 785.50, 785.51, 785.59, 998.0; Stroke (only included from day t-1 to day t+14, where t is the date of the colonoscopy event date): ICD9: 431.x-438.x; Coagulation complications (only included from day t0 to day t+14, where t is the date of the colonoscopy event date): Pulmonary embolism: ICD9: 415.1x; DVT: 453.4x; Accidental Falls (only included from day t-1 to day t+1, where t is the date of the colonoscopy event date): Fall on or from stairs or steps: ICD9: E880; Fall on or Anesthesia-related adverse effects from ladders or scaffolding: ICD9: E881; Other fall from one level to another: ICD9: E884; Anesthesia-related adverse effects: Unspecified adverse effect of anesthesia: ICD9: 995.22; Shock due to anesthesia, NEC: ICD9: 995.4; Malignant hyperthermia: ICD9: 995.86; Other specified adverse effects, NEC: ICD9: 995.89; Diagnostic Imaging - Gastrointestinal Tract - Radiologic Examination - Colon, Barium Enema, With Or Without Kub: CPT: 74270; Diagnostic Imaging - Gastrointestinal Tract - Radiologic Examination - Colon, Air Contrast With High Density Barium, With Or Without Glucagon: CPT: 74280; Computed tomographic (CT) colonography (ie, virtual colonoscopy); screening: HCPC: 0066T; Computed tomographic (CT) colonography (ie, virtual colonoscopy); diagnostic: HCPC: 0067T; Diagnostic Imaging - Abdomen - Radiologic Examination - Single Anteroposterior View: CPT: 74000; Diagnostic Imaging - Abdomen - Radiologic Examination - Anteroposterior And Additional Oblique And Cone Views: CPT: 74010; Diagnostic Imaging - Abdomen - Radiologic Examination - Complete, Including Decubitus And/Or Erect Views: CPT: 74020; Diagnostic Imaging - Abdomen - Radiologic Examination - Complete Acute Abdomen Series, Including Supine, Erect, Decubitus, Chest: CPT: 74022; Diagnostic Imaging - Abdomen - Computed Tomography - Without Contrast Material: CPT: 74150; Diagnostic Imaging - Abdomen - Computed Tomography - With Contrast Material: CPT: 74160; Diagnostic Imaging - Abdomen - Computed Tomography - Without Contrast Material, Followed By Contrast Material: CPT: 74170; Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - Without Contrast Material: CPT: 74181; Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - With

Contrast Material: CPT: 74182; Diagnostic Imaging - Abdomen - Magnetic Resonance Imaging - Without Contrast Material, Followed By Contrast Material: CPT: 74183; Clinical Pathology Consultation, Limited, Without Review Of Patient´s History And Medical Records: CPT: 80500; Clinical Pathology Consultation, Comprehensive, For A Complex Diagnostic Problem, With Review Of Records: CPT: 80502; Level I - Surgical Pathology, Gross Examination Only: CPT: 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): CPT: 88305; Level V - Surgical Pathology, Gross And Microscopic (Colon, Segmental Resection, Other Than For Tumor, Liver Biopsy Or Partial Resection): CPT: 88307; Level VI - Surgical Pathology, Gross And Micoscopic (Colon, Resection For Tumor, Total Colon Resection): CPYT: 88309; Special Stains, Histochemical With Frozen Section: CPT: 88314; Consultation And Report On Referred Slides Prepared Elsewhere: CPT: 88321; Consultation And Report On Referred Material Requiring Preparation Of Slides: CPT: 88323; Consultation, Comprehensive, With Review Of Records And Specimens: CPT: 88325; Immunohistochemistry (including tissue immunoperoxidase), each antibody: CPT: 88342; Anesthesia for lower intestinal endoscopic procedures, endoscope introduced distal to duodenum: CPT: 00810; Unlisted anesthesia procedure: CPT: 01999; Sedation with or without analgesia (conscious sedation); intravenous, intramuscular or inhalation (Code deleted for 2006. To report, see 99143...99145): CPT: 99141; Sedation with or without analgesia (conscious sedation); oral, rectal and/or intranasal (Code deleted for 2006. To report, see 99143...99145): CPT: 99142; 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: CPT: 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: CPT: 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): CPT: 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: CPT: 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 sedation supports; age 5 years or older, first 30 minutes intra-service time: CPT: 99149; 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): CPT: 99150.

Prescription drugs

Identify colonoscopy-related medications and J-codes during the measurement period (see also Table COL-G): Benzodiazepines: alprazolam, bromazepam, chlordiazepoxide, clonazepam, clorazepate, diazepam, lorazepam, medazepam, nordazepam, oxazepam, prazepam: Redbook THERCLS: 64; Antibiotics: Redbook THERCLS: 4, 6, 7, 9, 10, 11, 12, 16, 17; Pain medications: Redbook THERCLS: 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: Redbook THERCLS: 153 (not all meds in this class); Anesthesia-related: Droperidol/fentanyl, meperidine, midazolam, fentanyl, diprivan, ketamine: HCPC: J1810, J2175, J2180, J2250, J3010; Antiemetics, NEC: Redbook THERCLS: 160 J-code medications: INJECTION, DROPERIDOL AND FENTANYL CITRATE, UP TO 2 ML AMPULE: HCPC: J1810; INJECTION, MEPERIDINE HYDROCHLORIDE, PER 100 MG: HCPC: J2175; INJECTION, MEPERIDINE AND PROMETHAZINE HCL, UP TO 50 MG: HCPC: J2180; INJECTION, MIDAZOLAM HYDROCHLORIDE, PER 1 MG: HCPC: J2250; INJECTION, FENTANYL CITRATE, 0.1 MG: HCPC: J3010; INJECTION, PROCHLORPERAZINE, UP TO 10 MG: HCPC: J0780; INJECTION, DOLASETRON MESYLATE, 10 MG: HCPC: J1260; INJECTION, GRANISETRON HYDROCHLORIDE, 100 MCG: HCPC: J1626; INJECTION, ONDANSETRON HYDROCHLORIDE, PER 1 MG: HCPC: J2405; INJECTION, PALONOSETRON HCL, 25 MCG: J2469; INJECTION, PROMETHAZINE HCL, UP TO 50 MG: HCPC: J2550; INJECTION, METOCLOPRAMIDE HCL, UP TO 10 MG: HCPC: J2765; INJECTION, CHLORPROMAZINE HCL, UP TO 50 MG: HCPC: J3230; INJECTION, TRIMETHOBENZAMIDE HCL, UP TO 200 MG: HCPC: J3250; INJECTION, THIETHYLPERAZINE MALEATE, UP TO 10 MG: HCPC: J3280; INJECTION, PERPHENAZINE, UP TO 5 MG: HCPC: J3310;

ANTIEMETIC DRUG, RECTAL/SUPPOSITORY, NOT OTHERWISE SPECIFIED: HCPC: J8498; INFUSION, NORMAL SALINE SOLUTION , 1000 CC: HCPC: J7030; INFUSION, NORMAL SALINE SOLUTION, STERILE (500 ML=1 UNIT): HCPC: J7040; 5% DEXTROSE/NORMAL SALINE (500 ML = 1 UNIT): HCPC: J7042; INFUSION, NORMAL SALINE SOLUTION , 250 CC: HCPC: J7050; STERILE SALINE OR WATER, UP TO 5 CC: HCPC: J7051; 5% DEXTROSE/WATER (500 ML = 1 UNIT): HCPC: J7060; INFUSION, D5W, 1000 CC: HCPC: J7070; INFUSION, DEXTRAN 40, 500 ML: HCPC: J7100; INFUSION, DEXTRAN 75, 500 ML: HCPC: J7110; RINGERS LACTATE INFUSION, UP TO 1000 CC: HCPC: J7120; HYPERTONIC SALINE SOLUTION, 50 OR 100 MEQ, 20 CC VIAL: HCPC: J7130

Rationale:
The details of the development process and the logic underlying the development of this measure have been detailed in a peer reviewed publication appearing in Gastrointestinal Endoscopy Clinics of North America. (1) The primary focus of this measure was to examine the resource use around colonoscopies that are used for colorectal cancer screening. Therefore, we focus on a cohort of patients that are at least 40 years and older in the measure.

The inclusion criteria for this measure are relatively straightforward. We are identifying the first occurring colonoscopy during the measurement period and evaluating the resource use during that episode. Because the costs associated with the event are time limited and proximal to the event, the entire duration of the episode is constrained to 21 days. This period was used to capture the work-up costs prior to the procedure and extend long enough following the procedure to identify any acute complications that resulted from the procedure.
We use the exclusion criteria to help to define a relatively homogeneous group of patients. A key goals of cost-of-care measurement is to quantify and assess unwarranted variation in costs. As such, it is important to identify a relatively homogeneous population to which the measure is most applicable and that will not have systematically different health care use because of coexisting conditions. Therefore, active cancer, end-stage renal disease (ESRD), organ transplantation, and HIV/AIDS are routinely used as exclusion criteria for many quality and cost-of-care measures (eg .HEDIS) because of the impact these conditions have on patients' health care use overall. In addition, the colon cancer clinical work group recommended the exclusion of patients with ulcerative colitis, Crohn's disease, or inflammatory bowel disease from the measure because these conditions can lead to colonoscopy procedures that would not be done for colorectal cancer screening. These conditions have different known health care resource use patterns associated with colonoscopy as compared with the general population at large.
The procedure codes used in the measure to identify colonoscopies were selected by the workgroup and were similar to those used by Warren et al.(2) The majority of the diagnostic codes that are included as related to the episode are based on the identification of complications associated with the colonoscopy. The codes and conditions selected for inclusion were again largely based on the previous work by Warren et al. and the clinical input of the workgroup. Several of the diagnostic codes were time limited in terms of when they were used to identify services related to the colonoscopy. Vomiting, vomiting following gastrointestinal surgery, perforation, gastrointestinal hemorrhage, cardiopulmonary complications and stroke claims were included from the day preceding the colonoscopy to the end of the follow-up period. These diagnoses were largely considered a potential complication of the procedure and therefore the intent was to capture any occurrence during the entire observation period. In addition, these events also could occurred during the preparation for the procedure and therefore the day before is also included in the timeframe. Coagulation complications are included from the day of the procedure to the final day of the follow-up period for the episode because events occurring during that time frame were attributed to a complication of the procedure. Falls were only included from the day before to the day following the procedure and so as to capture falls associated with preparation for the procedure and falls associated with recent performance of the procedure. Finally, there were a set of diagnostic codes include over the entire duration of the study period which could capture complications associated with the procedure or signs and symptoms that may have led to the colonoscopy.

The imaging, laboratory and pathology codes included as part of the episode are all related to the performance of the colonoscopy. The exception is the inclusion of virtual colonoscopy for patients that might undergo a subsequent virtual colonoscopy during the measurement period. Each of these codes represents typical practice associated with the performance of a colonoscopy.

The next set of codes capture the use of anesthesia when performing the colonoscopy. The workgroup suspected that the use of general anesthesia would be highly variable and associated with large differences in the costs associated with colonoscopy. Therefore, these codes are included to be able to identify differences in costs based on the use of general anesthesia.

The final set of included codes are for medications related to the colonoscopy procedure. These codes include

medications used for preparation for the colonoscopy procedure which are clearly linked to the episode. In addition, benzodiazepines dispensed during the measurement period are included as these may have been prescribed to treat anxiety associated with the procedure. Both antibiotics and pain medications can be commonly used around the colonoscopy and were included as part of the measure. Medication codes were also used to capture use of anesthetics. Finally, antiemetics were included which might be used in the management of symptoms associated with complications or management of symptoms that may have led to the procedure.

References:
1. Brennan NJ, Lee TA, Wilk AS, Lyttle CS, Weiss KB. Defining an episode of care for colonoscopy: work of the High Value Health Care Project characterizing episodes and costs of care. Gastrointest Endosc Clin N Am. 2010 Oct;20(4):735-50.

2. 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 Jun 16;150(12):849-57.

S8.3. Comorbid and interactions
Detail the treatment of co-morbidities & disease interactions and provide rationale for this methodology.

See risk adjustment details—Section S10.1

S8.4. Clinical hierarchies
Detail the hierarchy for codes or condition groups used and provide rationale for this methodology.

We do not provide specifications for clinical hierarchies.
The only clinical hierarchies used in the measure are associated with the identification of comorbid conditions that are used in risk adjustment. Details are provided in Section 10.1 of this submission form and in the risk adjustment section of the technical appendix in the written measure specification. In short, we use the CMS hierarchical condition categories (HCC) for assignment of comorbid conditions which utilizes a hierarchy of codes based on the ICD-9 codes present during the pre-index period. We rely on the HCC system for identifying comorbid conditions in our risk adjustment procedure. The hierarchies are important for our risk adjustment as they are intended to identify different levels of severity of conditions that may be differentially associated with resource use. We used the HCC system because it is a previously developed and validated system for use in resource use measures.

Within our episode measure there are no hierarchies assigned to any of the codes.

S8.5. Clinical severity levels
Detail the method used for assigning severity level and provide rationale for this methodology.

We do not provide specifications for clinical severity levels.
No clinical severity levels are assigned for the measure. This measure is based on the performance of a procedure and not diagnostic criteria. Therefore, clinical severity levels are not relevant for this measure.

S8.6. Concurrency of clinical events (that may lead to a distinct measure)
Detail the method used for identifying concurrent clinical events, how to manage them, and provide the rationale for this methodology.

We do not provide specifications for concurrency of clinical events.
Each of the measures developed as part of the ABMS measure set was intended as a standalone measure. The measures were not designed to be combined into a single composite measure of resource use for providers. Because the focus during the development of these measures was there eventual pairing with quality measures, each of the measures is considered as a unique measure. Therefore, the concurrency of events and the fact that events may be counted in more than one measure is not an issue. We were not trying to account for the overall resource use of a population but rather focused on resource use within specific cohorts of patients. The relative resource information produced is intended to result in actionable information which is not possible when all of the episodes are combined into a single composite measure.

S9. Measure Construction Logic (Resource Use Measure Module 3)
The measure's construction logic includes steps used to cluster, group or assign claims beyond those associated with the measure's clinical logic. For example, any temporal or spatial (i.e., setting of care) parameters used to determine if a particular diagnosis or event qualifies for the measure of interest.

Construction Logic Supplemental Attachment or URL:
If needed, attach supplemental documentation (Save file as: S9_Construction Logic). All fields of the submission form that are supplemented within the attachment must include a summary of important information included in the attachment and its intended purpose, including any references to page numbers, tables, text, etc.)

URL: http://www.healthqualityalliance.org/hvhc-project/cost-care-measurement-development
Please supply the username and password:
Attachment:

S9.1. Brief Description of Construction Logic
Briefly describe the measure's construction logic.

The following sequence is used to construct the measures:
1. Eligible population identification
2. Identification of related resources
3. Assignment of standardized prices
4. Creation of episode specific strata (if applicable)

S9.2. Construction Logic
Detail logic steps used to cluster, group or assign claims beyond those associated with the measure's clinical logic.

The date of the first occurring colonoscopy during the measurement period is the key date in the identification of related resources. Qualifying resources in the 7 days before the event, on the day of the event and in the 14 days following the event are included. The 7 days preceding the event is intended to capture the work-up leading to the colonoscopy and costs associated with any care that might be related to the symptoms that led to the colonoscopy. The two weeks after the event is used to capture any complications of the colonoscopy. Work group members felt that such complication-related resource use would most likely be captured during the 2-week period immediately following the procedure.

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 colonscopy 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.

The following steps are used to complete the construction sequence (for specific codes, see Section S8.2 clinical framework of this submission form as well as the written measure specification/technical appendix accessed via URL).

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 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 Section S8.2 above or 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 age, eligibility and continuous enrollment criteria

1. Eligibility
a. Identify benefits during both the identification year and the measurement year. 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. (To be eligible, persons must have both medical and pharmacy coverage for the measurement period and prior period (do not include persons whose pharmacy benefits are dropped partway through the identification or measurement period).
b. Identify (or estimate) total days of coverage in each year. (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
1. Identify patients that meet one or more exclusion criteria during either the identification year OR the measurement year:

a. Standard Exclusion Criteria (see Section S8.2 above or Tables COL-H1-4):
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 (see Section S8.2 above or 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 Section S8.2 above or 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

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

Referring to the codes listed in Section S8.2 above, 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

Referring to the codes listed in Section S8.2 above, identify all outpatient claims / encounters with a colonoscopy-related diagnostic code appearing in any position (see Table COL-B).

Procedures and laboratory

Referring to the codes listed in Section S8.2 above, identify all claims / encounters with colonoscopuy-related CPT, HCPCs, or ICD-9 procedure codes (see Tables COL-A, COL-B, COL-C through COL-F).

Prescription drug

Referring to the codes listed in Section S8.2 above, identify colonoscopy-related medications and J-codes during the measurement period (see Table COL-G).

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. For further details, see section S10.3 below.

CREATION OF EPISODE-SPECIFIC STRATA

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

S9.3. Measure Trigger and End mechanisms
Detail the measure's trigger and end mechanisms and provide rationale for this methodology.

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 colonscopy 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.

Rationale:
The events that are captured as part of this episode are time limited and proximal to the colonoscopy. The measure only includes the first qualifying event during the measurement period to avoid differences in the population that may have more than one colonoscopy during the measurement period. The measurement period ends early for patients that have a colectomy and primary diagnosis of colon cancer within the 14 day period following the colonoscopy. These patients will have screened positive for cancer and been treated soon after the colonoscopy. The cost profile of these patients will be markedly different than all other patients included in the measure. Therefore, these patients are only included up to the two days before their colectomy. This is done to avoid costs associated with the diagnosis of the cancer and the work-up surrounding the colectomy. If patients had their colectomy two days or less after their colonoscopy they are excluded from the measure. All other patients are included with the duration of follow-up stopping either at 14 days after the colonoscopy or two days before the colectomy in patients with colectomies.

S9.4.Measure redundancy or overlap
Detail how redundancy and overlap of measures can be addressed and provide rationale for this methodology.

We do not provide specifications for measure redundancy or overlap.
The measures developed by ABMS REF were developed as standalone measures to address all relevant services associated with a particular health care condition. Collectively, the measures do not sum-up to a single total and there is the potential for overlap and redundancy to occur when multiple measures are applied simultaneously.

S9.5.Complementary services
Detail how complementary services have been linked to the measure and provide rationale for this methodology.

We do not provide specifications for linking complementary services.
All services included in the measure are included based on the presence of diagnosis codes, procedure codes, or medications.
Services are identified based on presence of qualifying codes. There is no effort to link complementary services to the episode. The strategy for all of our measures was to rely on the presence of codes to qualify for inclusion in the episode rather than to make assumptions about temporal or other associations between events.

S9.6.Resource Use Service Categories

Inpatient services: Inpatient facility services
Inpatient services: Evaluation and management
Inpatient services: Procedures and surgeries
Inpatient services: Imaging and diagnostic
Inpatient services: Lab services
Inpatient services: Admissions/discharges
Ambulatory services: Outpatient facility services
Ambulatory services: Emergency Department
Ambulatory services: Pharmacy
Ambulatory services: Evaluation and management
Ambulatory services: Procedures and surgeries
Ambulatory services: Imaging and diagnostic
Ambulatory services: Lab services

S9.7.Identification of Resource Use Service Categories
For each of the resource use service categories selected above, provide the rationale for their selection and detail the method or algorithms to identify resource units, including codes, logic and definitions.

At the claim line level, the user should identify all relevant codes specified in the clinical framework Section 8.2 above (see also written measure specification). For inpatient services, these include all relevant ICD9, DRG v24, DRGv25, CPT codes; for ambulatory services, these in clued all relevant ICD9, and CPT codes; for procedures and laboratory these include all relevant ICD9 procedure codes, HCPCs, and CPT codes, and for prescription drugs, these include relevant HCPCs and NDCs.

The above categories were selected because they represent the vast majority of resource use for the episode and the measure developers examined the distribution of costs between categories to evaluate the face validity of the measure. Developers also reasoned that resource use variation between providers by category would be informative. Please refer to Section S8.2 Clinical Framework for the algorithms used to identify/assign some services.

Measure developers also applied the Berenson-Eggers Types of Service (BETOS) system which categorizes all HCPCS codes into resource use areas (e.g. Evaluation and Management, Procedures, Imaging, etc). In addition to the BETOS category there is an additional category included for medications related resource use that is determined using pharmacy data and HCPCs.

Rationale: The BETOS classification system is a widely used, publically available system for classifying healthcare services. These categories can be used to examine cost patterns across providers to identify differences across the different categories of service. This system provides a sufficient number of categories to make meaningful comparisons across patterns of resource use and yet is not too broad so as not to be able to draw conclusions based on differences. Furthermore, identification of important differences allows users to drill down within those categories to identify cost drivers within BETOS categories that may ultimately provide actionable information for providers.

If needed, provide specifications URL (preferred) or as an attachment:

URL:

Please supply the username and password:
Attachment:

S9.8. Care Setting; *provides information on which care settings the measure encompasses.*

Ambulatory Care : Ambulatory Surgery Center (ASC)
Ambulatory Care : Clinic/Urgent Care
Ambulatory Care : Clinician Office
Hospital/Acute Care Facility
Imaging Facility
Laboratory
Pharmacy

S10.Adjustments for Comparability (Resource Use Measure Module 4)
External factors can mingle and affect or confound a measure's result. Confounding occurs if an extraneous factor causes or influences the outcome (e.g., higher resource use) and is associated with the exposure of interest (e.g., episode of diabetes with multiple co-morbidities). Measure developers often include steps to adjust the measure to increase comparability of results among providers, employers, and health plans.

S10.1. Risk adjustment method
Define risk adjustment variables and describe the conceptual, statistical, or other relevant aspects of the model and provide rationale for this methodology.

Calculation of risk adjusted costs (see also the risk adjustment section in the technical appendix of the written measure specification).

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 (see Table –COL RA1 in technical appendix of written measure specification), 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 >=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 >=1% identified as "Test HCCs" by the condition-specific workgroup. The fourth model was a reduction of the third model and included only those HCCs where $p<0.1$. The next set of four models (Models 5-8) repeated the process of the first four models but used a normal distribution and identity link function. Model 9 used all of the HCCs, with the exception of the HCC for the episode being evaluated (e.g., heart failure for the CHF post hospitalization episode), 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.

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

Summary estimates of the average cost for the unstable COPD episode 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.

Comorbidity Adjustment Strategy Rationale:

We acknowledge that risk adjustment is an important part of the development of an episode of care measure. Risk adjustment is intended to account for variation in episode costs that are not due to differences in practice patterns but rather are due to differences in the case mix of patients. When reporting episode costs at the provider level, risk adjustment attempts to account for differences in the case mix of patients across providers and minimizes the assertion that one providers patients are sicker than the comparator patients. An additional advantage of episode-based measurement is that focusing on costs related to care only for that episode may be a form of risk adjustment because we are not looking at the overall healthcare costs of the patients. Our risk adjustment strategy was not to attempt to account for all of the variation within an episode; however we want to be able to control for resource use variation that is attributed to the episode that may result from differences in patient case mix.

We selected to use Hierarchical Condition Categories (HCC) as our primary strategy for identification of comoribid conditions and for risk adjustment. We selected HCCs because of their use in risk adjustment methodology used by CMS and recently evaluated by NCQA for their Relative Resource Use (RRU) measures. We felt that many users of our episodes would be familiar with HCCs and the use of these measures in administrative data. Moreover, the analytic programmers for generating HCCs are freely available on the CMS website and therefore we mitigate issues of access to code for creating the risk adjustment groups.

While we use HCC as the starting point for our risk adjustment models, there is an important distinction between the use of HCCs by CMS and the model evaluated by NCQA and our episode definitions. The CMS and NCQA model use HCCs to adjust for TOTAL costs of care whereas, we are focused on the episode-specific costs of care. Briefly, NCQA has created weights for each of the HCCs on total costs of care using data from a large population that has one of the conditions in their RRU measure. These weights can then be applied to different populations to adjust for the presence of comorbid conditions when estimating total costs. The primary concern with applying the adjustment factors available from either CMS or NCQA are the fact they are total costs and not related to the episode-specific costs of care. This would lead to very different risk adjustment models that would not account for as much of the variability within the episode as a risk adjustment model focused on episode-specific costs. We compared the use of the 'off the shelf' HCC values with a risk adjustment model developed specifically for our episode.

See attached supplemental document for illustrative example of comparison of "off the shelf" HCC values to the risk adjustment model developed specifically for our episode (note: diabetes is used for purposes of illustration).

Given the disparity in the means and distributions of the off the shelf HCC values, we felt this justified our approach to develop risk adjustment models for each of our episodes that were focused on episode specific costs.

If needed, provide supplemental information via a web URL (preferred) or attachment with the risk adjustment specifications.

URL:
Please supply the username and password:
Attachment: 10.1_Risk adjustment method-634350294325063237.pdf

S10.2. Stratification Method

Detail the stratification method including all variables, codes, logic or definitions required to stratify the measure and rationale for this methodology

Population will be stratified based on age (40-75 yrs and = 76 yrs).

Rationale:
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.

S10.3. Costing Method

Detail the costing method including the source of cost information, steps to capture, apply or estimate cost information, and provide rationale for this methodology.

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 related.

Standard Cost Calculation

Step 1 Identify all claims paid for services rendered during the measurement period and with positive non-zero paid amounts for all patients, regardless as to whether they have been included in the measure population (rejected or unadjudicated claims should be dropped). Categorize these claims as follows (in accordance with the BETOS classification process):

- 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, multiply the 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 period. Include stays that may have started before the measurement period or ended after the close of the measurement period. 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 period. Also identify the stay's LOS group based on the stay's LOS and the information below.

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 period, use the total number of paid days as the per diem multiplier. If the inpatient stay does not fall completely inside the measurement period, count only the days within the measurement period (including the last day of the period) to compute the per diem multiplier.

Step 5 Download the HEDIS RRU standardized daily price tables from the NCQA website (http://www.ncqa.org/tabid/1092/Default.aspx) for the corresponding measurement periods. Note that there is a one period lag in the file and data periods (i.e. files designated 2007 are based on 2006 data). Some periods may have two sets of tables if there is a significant change in DRG versions. Note: 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 wish to implement their own methodology that does not rely on a price list from NCQA.

Step 6 Calculate the DRG-specific per-diem payment rate by adjusting the standard daily prices for inflation to a reference period 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. (Note: Figures presented in this example are arbitrary and do not reflect any particular dataset or patient. Additionally, the DRG XXX is intended to be used as an illustrative example for calculating inpatient costs. Only DRGs related to the episode should be included in this calculation).

Example:

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 period 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 x 8 = $7,201.36.

Example:

Again assume the calculated DRG-specific per-diem payment rate for DRG XXX for FY 2007 is $900.17. An eligible member had an inpatient stay with the following characteristics:
- A principal diagnosis with an eligible ICD-9 code
- A DRG of XXX (DRG associated with an eligible inpatient stay for the episode)
- Date of admission of December 28, 2006 and date of discharge of January 2, 2007 (fiscal period 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 x 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 (http://www.ncqa.org/tabid/1092/Default.aspx) 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. 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 period using the CPI. Between this ADSC methodology and the previously described DRG-based methodology, each inpatient hospital stay should now have an associated standardized price.

Example:

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

Using Sample Table SPT-INP-ADSC, we determine this event has a standard per-diem payment rate of $1,474.00. Therefore this event has a calculated total standard cost of $1,474 x 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 period. The following pharmacy services should also be included:
- Prescriptions that may have been dispensed before the measurement period and had days supply that extended into the measurement period (e.g., a prescription with a dispensed date of December 15, 2007 and 30 days supply would extend 13 days into the measurement period beginning January 1, 2008)
- Prescriptions that may have been dispensed during the measurement period and had days supply that extended into the following period (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 period.
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 period, 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 period, count only the days within the measurement period (including the last day of the period) 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 period. 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 period.
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 period. Calculate procedure/modifier-specific payment rates by dividing total procedure/modifier-specific payments by the frequency for each procedure-modifier combination.

Example:
Assume that there are 3 non-inpatient-hospital, non-pharmacy claims during the measurement period with the following characteristics:
Patient: 1111, Procedure (CPT-4): 71010, Modifier: Date: 2/1/2007, Payment: $21
Patient: 1111, Procedure (CPT-4): 72240, Modifier: TC, Date: 2/18/2007, Payment: $90
Patient: 2222, Procedure (CPT-4): 71010, Modifier: Date: 1/5/2007, Payment: $25

For the procedure/modifier combination: 71010
The total payment is $21 + $25 = $46
The total frequency is 2
Therefore the procedure/modifier-specific payment rate is $46/2 = $23
For the procedure/modifier combination: 72240/TC
The total payment is $90
The total frequency is 1
Therefore the procedure/modifier-specific payment rate is $90/1 = $90

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.

Calculation of total individual episode costs

The resource use identified as diabetes-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 diabetes-related events occurring during the measurement period at the BETOS service category level. This will provide an estimate of the costs of each category of service over the measurement period.

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

Step 3: Exclude individuals that do not have positive, non-zero costs (e.g. outpatient visit, hospitalization, medication use) during the measurement period.

Rationale for costing method

We used standardized prices to estimate the costs for all components of care in the claims data that a patient received data during the measurement period. Because costs in claims data reflect both the quantity and mix of services delivered as well as the prices paid for those services, some of the cost variation is due to price differences across providers (Thomas et al., 2005). Variations in cost data among organizations and over time can obscure real cost differences (Ritzwoller, et al., 2004) and impede comparisons across providers. To ensure that comparisons are made on the basis of differences in practice patterns and resource use, we developed standardized prices, such that a given service would have the same price across all providers (Thomas et al., 2005). We used separate methods to estimate standardized price that were used to calculate for inpatient facility costs, pharmacy costs, and cost for all other care.
For the inpatient facility use, we developed standardized prices using diagnosis-related group (DRG) information. For hospitalizations without DRG-level information, we used aggregate diagnostic service category (ADSC) level information. In each case, we adjusted for length-of-stay (LOS) during the measurement period so as to more closely mirror the payment systems typically applied among commercial health plans. Both approaches use relative resource use (RRU) HEDIS standardized daily price tables developed by NCQA. We worked in collaboration with NCQA in development of this methodology; however, users of the measure may need to implement their own methodology that does not rely on a price list from NCQA.
For pharmacy use, we determined the days supply for each medication that was dispensed during the measurement period identified by a unique national drug code (NDC). We calculated a standardized price per diem for each NDC in

our data by dividing the total payments in the claims data by the total days supply in the claims data for that NDC. We then estimated patient's pharmacy costs by multiplying the standardized price per diem for each NDC by the patient's days supply during the measurement period for that NDC. Standardized prices for pharmacy was estimated using this approach rather than an average whole price (AWP) because the AWP is not defined by law or regulation and does not reflect discounts obtained by most purchasers. As a result, the ultimate price paid by purchasers is often significantly lower than the AWP (Pereira, 2005).
For all other use, we identify the primary procedure code (CPT, HCPCs, ICD-9, etc.) and the first modifier code for each service. We calculated a standardized price for each procedure/modifier by dividing the total procedure/modifier-specific payments by the frequency for each procedure/modifier combination in the claims data. We then applied this standardized price to each patient's procedure/modifier combination that occurred during the measurement period. This approach allowed for a consistent methodology to be applied to each procedure/modifier combination in the claims data to achieve the same price for a service across all providers.

References:
Pereira BJG. Medicare Prescription Drug, Improvement and Modernization Act: Average Wholesale Price (AWP) Medscape Nephrology.2005;2(1)

Ritzwoller DP, Goodman MJ, Maciosek MV, Lafata JE, Meenan R, Hornbrook MC, Fishman PA. Creating Standard Cost Measures Across Integrated Health Care Delivery Systems. J Natl Cancer Inst Monogr 2005;35:80 – 87

Thomas JW, Grazier KL, Ward K. Economic Profiling of Primary Care Physicians: Consistency among Risk-Adjusted Measures. Health Services Research. 2004;39(4):985- 1004

S11. Measure Reporting (Resource Use Measure Module 5)
The measure developer must determine which of the following Measure Reporting functions: attribution approach, peer group, outliers and thresholds, sample size, and benchmarking and comparative estimates, are submitted as measure specifications or as guidelines. Specifications limit user options and flexibility and must be strictly adhered to; whereas guidelines are well thought out guidance to users while allowing for user flexibility. If the measure developer determines that the requested specification approach is better suited as guidelines, please select and submit guidelines, otherwise specifications must be provided.

S11.1. Detail attribution approach
Detail the attribution rule(s) used for attributing costs to providers and rationale for this methodology (e.g., a proportion of total measure cost or frequency of visits during the measure's measurement period) and provide rationale for this methodology.

Resource use and costs for colonoscopy episodes are attributed to the provider identified as performing the colonoscopy.

The focus of the measure on a screening colonoscopy and a time limited period around that event makes it appropriate to attribute the care to the provider that performed the colonoscopy.

S11.2.Identify and define peer group
Identify the peer group and detail how peer group is identified and provide rationale for this methodology

Guidelines : Peer group comparisons should be based on physician specialty as providers should only be compared to those of the same specialty.

Focusing on comparing physicians of the same specialty is another mechanism to ensure the severity of patients is similar across providers. It is quite possible that patients predominantly seen by specialists may be more complex or sicker patients than those seen by primary care physicians. Additionally, research has shown differences in the care provided by specialists versus generalists (1.2). Therefore, comparisons should be made to providers of similar specialties.

References:

1. Nash IS, Corrato RR, Dlutowski MJ, O´Connor JP, Nash DB. Generalist versus specialist care for acute myocardial infarction. Am J Cardiol. 1999 Mar 1;83(5):650-4.
2. Schreiber TL, Elkhatib A, Grines CL, O´Neill WW. Cardiologist versus internist management of patients with unstable angina: treatment patterns and outcomes. J Am Coll Cardiol. 1995 Sep;26(3):577-82.

S11.3. Level of Analysis:

Clinician : Individual

S11.4.Detail measure outliers or thresholds
Detail any threshold or outlier rules and decisions based on measure resource use and provide rationale for this methodology

Guidelines : For the physician reports, total observed episode costs are winsorized at the 2nd and 98th percentile, but claim line outliers are not removed and the use of risk adjusted results are intended to correct for any extreme outliers. The only exception is inpatient admissions. Extremely high admissions costs are winsorized at the 99th percentile (i.e. any value higher than the 99th percentile are set to the 99th percentile cost).

Rationale: Winsorizing and risk adjustment limits the influence of outliers. Episodes with extremely high admission costs skews mean costs for the entire episode. Winsorizing admissions at the 99th percentile reduces this effect without eliminating information on the distribution of total episode costs.

S11.5.Detail sample size requirements
Detail the sample size requirement including rules associated with the type of measure

We do not provide specifications or guidelines for sample size requirements : The ABMS REF episode-based resource use measures do not randomly sample enrollees nor do we recommend that implementers construct measures from a random sample. Regarding the issue of sample size determination. It is well known that the nature of resource use measurement at the level of individual providers will often lead to unstable estimations. There have been a number of efforts to derive a single number for which such measures might be stable enough for comparison of providers or individual providers over time. Yet to date there is no commonly accepted minimum. At this time we have not attempted to derive a minimal sample size for measure use.

S11.6.Define benchmarking or comparative estimates
Detail steps to produce benchmarking and comparative estimates and provide rationale for this methodology

Guidelines : Creation of provider summaries
The provider summaries are a report of the resource use for an attributable unit (hospital or 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 (or ID for the attributable unit if at the hospital level), 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.
O-to-E = Sum of Observed Costs / Expected Costs from Risk Adjustment Model

Step 3: If applicable, create indicators for the strata the episodes fall into so that separate summaries can be created for each of the strata.

Step 4: Summarize the observed, expected and observed-to-expected ratio for each attributable provider. Report minimum, maximum, median and mean values of the observed-to-expected ratio for all episodes attributed to the provider.

Step 5: Summarize the observed, expected and observed-to-expected ratio for each provider type, overall, and within each strata (if applicable). Report summary statistics for each of the provider types so the data are summarized for all providers of the same type. For example, report the summary statistics for the observed-to-expected ratio for all of the family practice physicians to facilitate peer group comparisons.

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

Step 7: For each of the individual attributable units (hospital or provider), determine the proportion of O-to-E ratios that are greater than or equal to the 75th percentile of the O-to-E ratio for the peer group. Calculate the 95% confidence interval for the proportion. For example, if the provider for which summary statistics are being calculated is a general internist and it is Dr. Y, the 75th percentile of O-to-E ratios for all episodes attributable to general interests is determined. The proportion of Dr. Y´s O-to-E ratio that are above the 75th percentile for all general interest episodes is determined and a 95% confidence interval is calculated for that proportion.

Step 8: Create provider summary reports for each attributable provider in the dataset

S12.Type of Score:

Ratio

If available, please provide a sample report:

S12_sample score report colonoscopy.pdf

S12.1. Interpretation of Score.
(Classifies interpretation of score (s) according to whether higher or lower resource use amounts is associated with a higher or lower score, a score falling within a defined interval, or a passing score, etc)

The summary score calculated for the measure is the ratio of the observed cost to the expected cost or the O-to-E ratio. The O-to-E ratio is calculated for each patient for the attributable provider and summary statistics are calculated for the O-to-E ratio. The O-to-E ratio provides an estimate of the observed cost for a patient to the expected cost based on the patient's mix of chronic conditions. Expected costs for each patient are the calculation of their risk adjusted costs. A value of 1 for the O-to-E ratio indicates that the observed costs are equal to the expected costs. A value greater than 1 indicates that observed costs are more than what would be expected based on the patient's mix of chronic conditions. A value less than 1 indicates that the observed costs are less than what would be expected based on the patient's mix of chronic conditions. Calculation of the O-to-E ratio incorporates our approach to risk adjustment by determining the expected costs from the risk adjustment model. A summary O-to-E ratio is calculated for each of the attributable providers which combines all the episodes for that provider. Summary statistics are calculated for each provider for the raw (unadjusted) costs for the episode, expected costs and the O-to-E ratio. Each summary measure includes minimum, maximum, median, and mean values.

S12.2. Detail Score Estimation
Detail steps to estimate measure score.

Creation of provider summaries
The provider summaries are a report of the resource use for an attributable unit (hospital or 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 (or ID for the attributable unit if at the hospital level), 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.
O-to-E = Sum of Observed Costs / Expected Costs from Risk Adjustment Model

Step 3: If applicable, create indicators for the strata the episodes fall into so that separate summaries can be created for each of the strata.
Step 4: Summarize the observed, expected and observed-to-expected ratio for each attributable provider. Report minimum, maximum, median and mean values of the observed-to-expected ratio for all episodes attributed to the provider.

Step 5: Summarize the observed, expected and observed-to-expected ratio for each provider type, overall, and within each strata (if applicable). Report summary statistics for each of the provider types so the data are summarized for all providers of the same type. For example, report the summary statistics for the observed-to-expected ratio for all of the family practice physicians to facilitate peer group comparisons.

Step 6: Summarize the observed, expected, and observed-to-expected ratio for all of the episodes.
Step 7: For each of the individual attributable units (hospital or provider), determine the proportion of O-to-E ratios that are greater than or equal to the 75th percentile of the O-to-E ratio for the peer group. Calculate the 95% confidence interval for the proportion. For example, if the provider for which summary statistics are being calculated is a general internist and it is Dr. Y, the 75th percentile of O-to-E ratios for all episodes attributable to general interests is determined. The proportion of Dr. Y´s O-to-E ratio that are above the 75th percentile for all general interest episodes is determined and a 95% confidence interval is calculated for that proportion.
Step 8: Create provider summary reports for each attributable provider in the dataset

S12.3. Describe discriminating results approach
Detail methods for discriminating differences (reporting with descriptive statistics--e.g., distribution, confidence intervals)

Summary reports are generated at the attribution level that includes a summary estimate for the provider or hospital, the peer group, the non-peer group and the overall summary for the episode in the entire population. For each attributable provider / hospital the observed, expected and O-to-E ratio are summarized. The summaries are created to facilitate comparisons for the attributable provider or hospital with other providers in the same peer group and overall. The most meaningful comparisons are likely those between the provider or hospital and the peer group. Even though the results are risk adjusted, this may help to further balance the case mix or severity of the patients being compared. The summary statistics for the O-to-E ratios can be compared in order to provide a sense of the relative performance of the provider or hospital compared to peers. In addition, the proportion of O-to-E ratios about thresholds of 2.0 and 2.5 are provided for comparisons. Finally, for the attributable unit (hospital or provider) the proportion of O-to-E ratios that are greater than or equal to the 75th percentile of the O-to-E ratio for the peer group is determined and the 95% confidence interval calculated. The expectation would be that 25% of the estimates for the attributable provider would fall about this value if the distribution of O-to-E ratios is similar to the peer group. A statistically significant difference would be found between the groups if the 95% confidence interval did not include 25% in the range. For example, if the proportion at or above the 75th percentile of the peer group is 38% and the 95% confidence interval ranges from 28% to 48% than this provider would have significantly more O-to-E ratios at the upper end of the distribution than the peer providers. Alternatively, if the proportion at or above the 75th percentile was 8% and the 95% confidence interval ranged from 3% to 16% then the provider would have significantly fewer O-to-E ratios in the upper end of the distribution than the peer group. The 75th percentile in our testing was selected as an illustrative cut-point and it will be important to evaluate this threshold for comparing providers.

TESTING/ANALYSIS	
Measure testing must demonstrate adequate reliability and validity in order to be recommended for endorsement. Testing may be conducted for data elements and/or the computed measure score. See guidance on measure testing.	**Eval Rating**
TESTING ATTACHMENT (5MB or less) or URL: *If needed, attach supplemental documentation (Save file as: SA_Reliability_Validity Testing) All fields of the submission form that are supplemented within the attachment must include a summary of important information included in the attachment and its intended purpose, including any references to page numbers, tables, text, etc.*	

URL:
Please supply the username and password:
Attachment: SA_Reliability_Validity Testing Colonoscopy.pdf

SA1. Reliability Testing
For each module tested or for the overall measure score:

SA1.1. Data/sample
(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)

Thomson Reuter´s Marketscan Dataset was used in the testing of the ABMS REF episode-based resource use measures.

The MarketScan Commercial Database provides a rich, comprehensive source of longitudinal administrative claims data, offering the largest convenience sample available in proprietary databases with over 30 million covered lives in each of the three most current years of data. The MarketScan Commercial Claims and Encounters (Commercial) Database is constructed from data contributed from over 100 medium and large size employers and health plans, representing over 130 unique carriers. The MarketScan Databases' large sample size constitutes a nationally representative data sample of the U.S. population under the age of 65 with employer-sponsored health insurance.

The stability of MarketScan data sources provides superior continuity of patients over multiple years, generally longer than other claims databases because the majority of the MarketScan data are sourced from large employers. As long as individuals remain with the same employer, they can be tracked across health plans.

Features of the MarketScan Research Databases include:
- Fully paid and adjudicated claims including inpatient, outpatient, and prescription drug claims
- Complete payment/charge information, including amount of patient responsibility
- Validated diagnosis, procedure, and other standard codes on claims where applicable (CPT, ICD-9, DRG, NDC, etc)
- Demographic information on enrollees including age, gender, and geographic information (three-digit zip codes and MSA)
- Plan-type identifiers in the database include major medical, comprehensive, PPO, EPO, HMO, consumer-driven health plan, capitated or part-capitated POS and non capitated POS
- Standardized data elements and definitions, ensuring accurate comparisons
- Clinical data enhancements, such as Therapeutic Class and Generic Product Identifiers on drug records, and Major Diagnostic Categories and Diagnosis Related Groups on inpatient and outpatient records
- Case records linking all of the hospital, physician, and ancillary services provided during an inpatient stay, allowing for comparisons based on such statistics as average length of stay, cost per admission, etc.

These data reflect the real world of treatment patterns and costs by tracking millions of patients as they travel through the healthcare system, offering detailed information about all aspects of care. Data from individual patients are integrated from all providers of care, maintaining all healthcare utilization and cost record connections at the patient level.

SA1.2. Analytic Methods
(Describe method of reliability testing and rationale)

2a2

The iterative development process that was employed in defining the episode of care resulted in episode measures being examined and modified several different times. As the workgroup would suggest changes to the specifications, modifications would be made in the programming language to reflect these changes. This would allow us to examine the reliability of our implementation of the episode measures as we would not anticipate large changes in the observed costs with only small changes in the logic of the episode measure. For example, if we added a new diagnosis code to our episode that only had a small number of associated claims in our Level 1 analysis we would not expect large changes in the overall cost of the episode. Conversely, if large changes were made in the logic of the episode we would expect similar changes in the overall resource use and cost. In addition, our focus on defining condition specific episodes that are not intended for combining into a single composite measure could result in improved reliability relative combining condition episodes into a single profile for a provider where reliability of physician profiling was

H☐ M☐ L☐ I☐

wide ranging (Adams et al. NEJM 2010)

Citation: Adams JL, Mehrota A, Thomas JW, McGlynn EA. Physician cost profiling – reliability and risk of misclassification. N Engl J Med 2010;362:1014-1021.

SA1.3.Testing Results
(reliability statistics, assessment of adequacy in the context of norms for the test conducted)

The iterative modification of measure specifications resulted in several runs of the episode programming. Comparisons between results showed expected changes in overall resource use. The addition of a new diagnosis code that was previously included as unrelated but only had a minimal number of claims associated with it did not change the overall results associated with the episode.

SA1.4.Finding statement(s)—*(i.e., is the measure deemed reliable, limitations identified)*

We were able to produce consistent results within the episode.

SA2.Validity Testing
For each module tested or for the overall measure score:

SA2.1. Data/Sample
(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)

See section SA1.1 for description of Thomson Reuters Marketscan dataset.

SA2.2.Analytic Method
(Describe method of validity testing and rationale; if face validity, describe systematic assessment)

The iterative process of developing the specification with the clinical workgroup represented as assessment of the face validity of the results. Summary findings from the specifications would be presented to the workgroup to determine if results met their expectations or if there were modifications that were necessary. Specifically, the workgroup would assess whether the type of care being included in the measure would make sense in terms of the clinical condition. Moreover, the most frequently and highest cost services that were not related to the episode but were appearing in the data would also be examined. If there were services in this grouping that belonged in the related list modifications would be made. This was facilitated by the Level 1 and Level 2 testing that was done as part of the measure evaluation process.

Validity testing focused primarily on face validity. Initial testing included:
Level 1 analyses
- Examined impact of inclusion/exclusion criteria on episode denominator
- Examined total episode spending by type of service
- Identified top 20 "condition-related" and "non-condition-related" E&M, procedures, imaging, tests, inpatient admissions (by ICD-9 and DRG) and drugs, by service counts and dollar volume
- Tested proposed attribution logic, examined variability in per-episode resource use at individual provider level (as relevant) and by provider specialty.

Level 2 analyses
- Incorporated risk adjustment
- Produced sample physician-level reports in which observed-to-expected ratios are computed and the distribution of each physician's episodes is compared to the peer group's distribution.
- Examined specific drivers of resource use variation
- Examined variability in per-episode resource use across regions, states and the specialties of attributed providers.

Throughout the process of empirically testing the measures, summary analyses were presented to the workgroups for review and discussion. The workgroups reviewed denominator attrition diagrams to assess how the measure's inclusion

2b2

H☐ M☐ L☐ I☐

and exclusion criteria affected the episode's denominator. They also reviewed summaries of costs by type of service (inpatient hospital care, outpatient care, procedures, imaging, tests, and prescription drugs) and were asked to assess whether the distributions matched the clinical expectations for the condition's treatment. The clinicians were also presented with analyses of diagnosis and procedure level details in order to ensure that appropriate services were being captured and grouped to the episodes. At each step in the process, the measure specifications were revised based on workgroup feedback.
In addition to workgroup feedback results of the preliminary testing were also shared with a Technical Advisory Committee and the QASC Episodes Work Group and the measures revised according to feedback.

SA2.3.Testing Results
(statistical results, assessment of adequacy in the context of norms for the test conducted; if face validity, describe results of systematic assessment)

A detailed description of the results of the measure testing for this episode has been described in a previous publication.(1) There were 390,827 episodes that qualified for inclusion in the colonoscopy measure. As would be expected, nearly all of the costs were associated with the qualifying event. 86% of the overall episode costs were in the procedure and outpatient facility service categories. It is likely that nearly all of these costs are a result of the qualifying procedure. While the inpatient admissions were a small component of overall costs, it is likely they captured complications of the procedure. The most frequently occurring diagnoses among hospitalizations were for GI bleeding or coronary events. While they are only a small fraction of overall costs, avoidance of complications could be an important means of reducing overall costs for providers that have high cost episodes. Gastroenterologists were attributed nearly 2/3rds of all episodes included in the measure. This is consistent with the expectations regarding the performance of colonoscopies.
The overall average cost for an episode was $1,192. The median costs was slightly over $1000 and the interquartile range was $830 going from $625 to $1455. The cost ratios in both the north central and west were less than one (0.93 and 0.92, respectively). The cost ratio in the northeast was 1.11 which indicates there is variability across the regions of the United States, again affording an opportunity to examine the reasons for the variability in order and reduce this variability to reduce overall healthcare costs.
One of the primary factors for variability in costs was the use of anesthesia with the episode triggering colonoscopy. Approximately three fourths of episodes (288,603) showed no claims associated with anesthesia on the date of the colonoscopy; one fourth (100,585) showed at least one claim for anesthesia-related services on that date. On average, episodes with general anesthesia have 42% higher total costs than episodes with no anesthesia services provided on the day of the colonoscopy ($1523 vs $1075, respectively). Aside from the costs of the anesthesia services themselves, however, average costs are not materially different between the 2 groups across the other types of service provided. Although the use of anesthesia may make patients undergoing colonoscopy more comfortable, currently there are no evidence-based guidelines that indicate colonoscopy should be performed under general anesthesia for most of the population. Additionally, there are no data that suggest the use of general anesthesia is associated with better outcomes. From the perspective of the health care system, the use of general anesthesia for colonoscopy may represent an inefficient use of resources if the costs of the episode are higher with no difference in the rates of complications. One question for future study may be whether or not patients would be willing to pay out of pocket for the additional cost of general anesthesia if they believed that it would increase the comfort of having the procedure done.

Reference:
1.Brennan NJ, Lee TA, Wilk AS, Lyttle CS, Weiss KB. Defining an episode of care for colonoscopy: work of the High Value Health Care Project characterizing episodes and costs of care. Gastrointest Endosc Clin N Am. 2010 Oct;20(4):735-50.

SA2.4. Finding statement(s)—(*i.e., is the measure deemed reliable, limitations identified)*

The analyses conducted indicate that our measure has strong face validity for the measurement of colonoscopy-related costs.

SA3.Testing for Measure Exclusions

2b3

SA3.1. Describe how the impact of exclusions (if specified) is transparent as required in the criteria

In the attached data summary, we have detailed how the exclusions impacted the resulting size of the cohort (see attached data summary Slide 4).

SA3.2. Data/sample for analysis of exclusions
(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)

See section SA1.1 for description of Thomson Reuters Marketscan datasets.

SA3.3. Analytic Method
(Describe type of analysis and rationale for examining exclusions, including exclusion related to patient preference)

We examined the impact of several types of exclusions. In order to ensure that data are available for assessing the episode of care, we excluded individuals without continuous insurance coverage including medical and pharmacy benefits. We also excluded individuals who met standard NCQA exclusions for conditions that are resource intensive, which could potentially have a larger impact on resource use than the condition being studied (i.e., end stage renal disease, active cancer management, etc.) There were also exclusion criteria that were specified for this condition by the clinical workgroup: ulcerative colitis, inflammatory bowel disease, Crohn's disease, history of colectomy within 2 days of the trigger colonoscopy. We examined the impact of these and other conditions on the resulting cohort size.

SA3.4. Results
(statistical results for analysis of exclusions, e.g., frequency, variability, sensitivity analyses)

The identification period used to examine the colonoscopy measure in the Marketscan data was from January 8, 2007 through December 17, 2007. Only the first occurring event during this time period was eligible for inclusion in the measure. During this identification period there were 798,430 individuals that had a code for the colonoscopies included in the measure. There were 44% of the potentially eligible patients that were excluded as a result of discontinuous medical coverage between 2006-2007 or lack of prescription medication coverage over this time period. From this group, there were a total of 447,953 potentially eligible events. From these events, 9.4% were in an individual younger than 40 years of age, 4.7% were in an individual with a history of inflammatory bowel disease, 2.6% were in an individual that had standard co-existing condition exclusions applied to all measures (i.e. Standard NCQA Exclusions) and 0.04% were in individuals that had a colectomy or colon cancer diagnosis within 2 days of the colonoscopy. This results in a total of 390,827 colonoscopies in the final cohort that were included in our measure testing.

SA3.5. Finding statement(s)-- *(i.e., is the measure deemed reliable, limitations identified)*

Based on the findings from our cohort attrition analysis described above and feedback from the clinical workgroup, the measure is identifying the appropriate group for inclusion. The exclusions due to continuous enrollment are a function of the data that is available and necessary criteria to fully implement the measure.

SA4. Testing Population
Which populations were included in the testing data? (Check all that apply)

Commercial

H☐ M☐ L☐ I☐

SA5. Risk adjustment strategy

Refer to items S10.1 and S10.2 to rate this criterion.

2b4

H☐ M☐ L☐ I☐

SA6. Data analysis and scoring methods

Refer to items S12-S12.3 to rate this criterion.

2b5

H☐ M☐ L☐ I☐

SA7. Multiple data sources *Refer to S7 & all SA1 items to evaluate this criterion.*	**2b6** **H☐** **M☐** **L☐** **I☐** **NA☐**
SA6. Stratification of Disparities (if applicable) *Refer to item S10.2 to rate this criterion.*	**2c** **H☐** **M☐** **L☐** **I☐**
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Scientific Acceptability of Measure Properties?*	
Steering Committee: Overall, was the criterion, *Scientific Acceptability of Measure Properties*, **met?** **Rationale:**	**Y☐** **N☐**
USABILITY	
Extent to which intended audiences (e.g., consumers, purchasers, providers, policy makers) can understand the results of the measure and are likely to find them useful for decision making.	**Eval Rating**
Meaningful, Understandable, and Useful Information **U1. Current Use:** Public reporting (disclosure to performance results to the public at large) Quality improvement with external benchmarking **U1.1. Use in Public Reporting Initiative Use in Public Reporting.** *Disclosure of performance results to the public at large (If used in a public reporting program, provide name of program(s), locations, Web page URL(s). If not publicly reported in a national or community program, state the plans to achieve public reporting, potential reporting programs or commitments, and timeline, e.g., within 3 years of endorsement)* The ABMS REF has only recently completed the development and testing of its Episode-based Resource Use Measures. The Robert Wood Johnson Foundation (RWJF) has provided follow-up funding in the form of technical assistance to Aligning Forces for Quality communities for continued testing of the measures—a 15-month award to Brookings Institute with a subcontract to ABMS REF for continued field testing of select measures in up to four Aligning Forces for Quality (AF4Q) communities toward the goal of public reporting and quality improvement benchmarking. **U1.2. Use in QI** *(If used in improvement programs, provide name of program(s), locations, Web page URL(s)).* See Section U1.1 **U1.3. Use for other Accountability Functions (payment, certification, accreditation)** *(If used in a public accountability program, provide name of program(s), locations, Web page URL(s).* See Section U1.1	**3a** **H☐** **M☐** **L☐** **I☐**

U2. Testing of Interpretability *(Provide a rationale for why the measure performance results are meaningful, understandable, and useful to the intended audience(s) for both public reporting and quality improvement).* **U2.1. If understanding or usefulness was demonstrated** *(e.g., through systematic feedback from users, focus group, cognitive testing, analysis of quality improvement initiatives) describe the data, methods, and results.* The ABMS REF measures have not yet been tested for usefulness or interpretability. They are currently undergoing continued testing in up to four RWJF AF4Q communities	**3b** **H☐** **M☐** **L☐** **NA☐**
U2.2. Resource use data and result can be decomposed for transparency and understanding. *Refer to items S11 -S12.3.*	**3c** **H☐** **M☐** **L☐** **I☐**
U3. If there are similar or related measures (either same measure focus or target population) measures (both the same measure focus and same target population), list the NQF # and title of all related and/or similar measures. **U3.1. If this measure has EITHER the same measure focus OR the same target population as NQF-endorsed measure(s): Are the measure specifications completely harmonized?** **U3.2. If the measure specifications are not completely harmonized identify the differences, rationale, and impact on interpretability and data collection burden.** *Describe why this measure is superior to competing measures (e.g., a more valid or efficient way to measure quality); OR provide a rationale for the additive value of endorsing an additional measure. (Provide analyses when possible.)*	**3d** **H☐** **M☐** **L☐** **I☐** **NA☐**
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Usability?*	
Steering Committee: Overall, to what extent was the criterion, *Usability***, met?** **Rationale:**	**H☐** **M☐** **L☐**
FEASIBILITY	
Extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement.	Eval Rating
F1. Data Elements Generated as Byproduct of Care Processes *How are the data elements needed to compute measure scores generated? Data used in the measure are:* Coded by someone other than person obtaining original information (e.g., DRG, ICD-9 codes on claims)	**4a** **H☐** **M☐** **L☐** **I☐**

F2. Electronic Sources
Are the data elements needed for the measure as specified available electronically? (Elements that are needed to compute measure scores are in defined, computer-readable fields)

4b

ALL data elements in electronic claims

F2.1. If ALL data elements are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources.

H☐ M☐ L☐ I☐

F3. Susceptibility to Inaccuracies, Errors, or Unintended Consequences
Identify susceptibility to inaccuracies, errors, or unintended consequences of the measurement identified during testing and/or operational use and strategies to minimize or prevent. If audited, provide results.

- The majority of measures developed for this project are of 12 months duration or less with identification of the population in one year and measurement in the following. This resulted in eligibility criteria requiring a minimum of 24 months of continuous data (full medical and pharmacy benefit enrollment). Often, clinical workgroup members expressed a desire to extend the duration of a measure to encompass more longitudinal clinical outcomes (e.g. cardiac complications for diabetes) however this was not practical due to the typical enrollment patterns in the commercial population.
- Sample size may be of concern for implementers seeking to measure resource use at the level of the individual provider. Many of the measures, when tested on commercial datasets, resulted in small sample sizes that may prohibit meaningful attribution. Discontinuous medical coverage and missing pharmacy coverage were responsible for significant (often greater than 50%) decreases in eligible populations, emphasizing the trade-offs between ensuring adequate sample size and achieving specificity/homogeneity in the measure denominator. If users are unable to achieve adequate sample size at the level of the individual provider, the measures specifications may still provide valuable information at the level of group, system or region.
- Administrative claims lack the detail necessary to fully understand appropriateness of resource use in relation to severity of disease (e.g. bundled hospital payments, absence of cancer staging information, absence of cardiac severity indicators, Type 1 v. Type 2 diabetes). Future efforts should consider the integration of administrative claims with other sources of clinical information such as registries and electronic health records.
- Resource use is only one component of efficiency measurement. The measures created in this project are not intended to be used in isolation to evaluate physician performance; rather they are intended to complement quality measures as an important component of performance evaluation.
- The measures developed in this project represent a small subset of clinical conditions, and do not address the full range of patient and provider experience. Each measure was developed independently and, as such, they are not summative. Efforts to sum multiple measures will result in double counting of services.
- The standardized pricing algorithms used for testing the measures were developed for use in the Marketscan dataset. The technical appendices accompanying the measures provide a guide to assist users in developing their own set of standardized prices unique to their datasets. Until a national list of standardized prices is made available to the general public, the methods employed in the testing phase of this project do not allow for national benchmarking.

4c

H☐ M☐ L☐ I☐

F4. Data Collection Strategy
Describe what you have learned/modified as a result of testing regarding barriers to operational use of the measure (e.g., availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, cost of proprietary measures).

4d

Administrative claims lack the detail necessary to fully understand appropriateness of resource use in relation to severity of disease (e.g. bundled hospital payments, absence of cancer staging information, absence of cardiac severity indicators, Type 1 v. Type 2 diabetes). Future efforts should consider the integration of administrative claims with other sources of clinical information such as registries and electronic health records.

There were several lessons learned throughout the development and testing of the ABMS REF episode-based resource use measures. First, was the importance of garnering a diverse range of clinical input in a transparent manner to foster

H☐ M☐ L☐ I☐

face validity and acceptance in the clinical community. Second was the importance of adequate resources for data acquisition, preparation and analyses (time and personnel). Not all datasets are formatted the same which can lead to significant amounts of programmer time for re-formatting code or datasets. It is also important to allow 2-6 months lead time to negotiate data use agreements as use of health care data–even de-identified data--often involves complex contract negotiations.

TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Feasibility*?

Steering Committee: Overall, to what extent was the criterion, *Feasibility*, met? H☐ M☐ L☐
Rationale:

RECOMMENDATION

Steering Committee: Do you recommend for endorsement? Y☐ N☐ A☐
Comments:

CONTACT INFORMATION

Co.1 Measure Steward (Intellectual Property Owner)

Co.1 Organization

American Board of Medical Specialties Research and Education Foundation, 222 N. LaSalle St., Suite 1500, Chicago, Illinois, 60601

Co.2 Point of Contact

Kevin, Weiss, MD, kweiss@abms.org, 312-436-2600-

Measure Developer If different from Measure Steward

Co.3 Organization

American Board of Medical Specialties Research and Education Foundation, 222 N. LaSalle St., Suite 1500, Chicago, Illinois, 60601

Co.4 Point of Contact

Kevin, Weiss, kweiss@abms.org, 312-436-2600-

Co.5 Submitter If different from Measure Steward POC

Robin, Wagner, rwagner@abms.org, 312-436-2605-, American BOard of Medical Specialties Research and Education Foundation

Co.6 Additional organizations that sponsored/participated in measure development
Development of the ABMS REF Episode-based Resource Use Measures was supported by the Robert Wood Johnson Foundation under the High Value Healthcare Project: Characterizing Episodes and Costs of Care. Grant number 63609.

ADDITIONAL INFORMATION

Workgroup/Expert Panel involved in measure development
Ad.1 Provide a list of sponsoring organizations and workgroup/panel members' names and organizations.

Describe the members' role in measure development.

Colon Cancer Workgroup Members
John Allen, MD, American Gastroenterological Association
William Bowman, MD, Moses Cone Health System
Samuel Durso, MD, American Geriatrics Society
C. Daniel Johnson, MD, American College of Radiology
David Kirlin, MD, American Society of Clinical Oncology
Bruce Minsky, MD, American Society for Radiation Oncology
Amita Rastogi, MD, Prometheus Payment
Stephen Scott, MD, American Academy of Family Physicians
Anthony Senagore, MD, American Society of Colon and Rectal Surgeons
V. O. Speights, MD, College of American Pathologists

Workgroups consisting of a panel of experts were assembled for each condition. In collaboration with the AMA PCPI, a formal call for nominations was issued to the PCPI membership. This process was supplemented with direct outreach to relevant organizations in an effort to achieve representation from a wide range of clinical expertise (medical, nursing, pharmacy, other allied health professionals). Workgroup members were selected based on their clinical knowledge and administrative experience—many also had significant experience in developing quality measures. Where possible, groups also included technical expertise from the health plan perspective.
The measure development process involved a series of deliberate steps where participating clinicians took into account the natural progression of a condition and existing best practices before carefully considering how to best use administrative claims data to construct the episode.

Each clinical workgroup initially convened for a two-day in-person meeting that began with an introduction to the concepts of episodes of care and resource use measurement-- including a review of the NQF framework for evaluating efficiency across episodes of care. The groups were then asked to conceptualize one or more episodes based on the phases of the NQF model. They aimed to identify clinically homogenous populations so that the measures would be sensitive to provider decisions and existing practice protocols for like patients. Workgroup members were then asked to conceptualize the measure specifications based on their combined knowledge of guidelines, evidence, and clinical experience. The workgroups helped to define the denominator, duration, clinically relevant services and attribution of each episode as related to the clinical progression and treatment of the condition.

Throughout the months following the in-person meeting, project staff then worked to translate the concepts into detailed written measure specifications. The workgroups subsequently re-convened via a series of conference calls to review data analyses, share expert opinions, consider additional evidence-based literature, revise and finalize the measure specifications.

Measure Developer/Steward Updates and Ongoing Maintenance

Ad.2 Year the measure was first released:

2010

Ad.3 Month and Year of most recent revision:

12, 2010

Ad.4 What is your frequency for review/update of this measure?

every 3 years

Ad.5 When is the next scheduled review/update for this measure?

12, 2013

Ad.6 Copyright statement/disclaimers:

The Episode-based Resource Use Measures (Measures) and related data specifications, developed by the American Board of Medical Specialties Research and Education Foundation (ABMS REF), are intended to facilitate quality improvement activities

by physicians.
These Measures are intended to assist physicians in enhancing quality of care. Measures are designed for use by any physician who manages the care of a patient for a specific condition or for prevention. These Measures are not clinical guidelines and do not establish a standard of medical care. The ABMS REF has not tested its Measures for all potential applications. The ABMS REF encourages the testing and evaluation of its Measures. Measures are subject to review and may be revised or rescinded at any time by the ABMS REF. The Measures may not be altered without the prior written approval of the ABMS REF. The Measures developed by the ABMS REF, while copyrighted, can be reproduced and distributed, without modification, for noncommercial purposes, e.g., use by health care providers in connection with their practices. Commercial use is defined as the sale, license, or distribution of the Measures for commercial gain, or incorporation of the Measures into a product or service that is sold, licensed or distributed for commercial gain. Commercial uses of the Measures require a license agreement between the user and ABMS REF. Neither the ABMS REF nor its members shall be responsible for any use of these Measures.
Portions of the exclusion criteria in the ABMS REF episode-based resource use measures were adapted from HEDIS ® measure specifications.
Limited proprietary coding is contained in the Measure specifications for convenience. Users of the proprietary code sets should obtain all necessary licenses from the owners of these code sets. The ABMS REF disclaims all liability for use or accuracy of coding contained in the specifications.

Ad. 7 Date of Submission (*MM/DD/YY*)**:**

04/18/2011

Variable Name	Variable Description	Required Data Sources*
admdate	Date of Admission	A
age	Age	E
billtyp	Facility Bill Type Code	C
days	Length of Stay	A
daysupp	Day's Supply	D
disdate	Date of Discharge	A
drg	Diagnosis related group	A,B
dstatus	Discharge status	A
egeoloc	Geographic Location	E
enrolid	Enrollee ID	All
fachdid	Facility Header Record ID	C
facprof	Professional/Facility Indicator	C
gennme	Generic Drug Name	D
mastfrm	Master Form Code	D
memdays	Member Days	E
ndcnum	National Drug Code (ndc_code in Redbook)	D
pay	Payment	A,B,C,D
pdx,dx1,dx2,…,dxn	Diagnosis Codes	A,B,C
physid	Physician ID	A,B
pproc, pproc1,…, pprocn	Procedure/Service Codes	A,B,C
procmod	Procedure Code Modifier	A,C
proctyp	Procedure Code Type	B,C
prodnme	Product Name	D
provid	Provider ID	A
qty	Quantity of Services	A,B,C,D
region	Region	E
revcode	Revenue Code	C
rx	Cohort Drug Indicator	D
sex	Gender	E
stdplac	Place of Service	C
stdprov	Provider Type	C
svcdate	Service Date	A,B,C,D
thercls	Therapeutic Class	D
tsvcdat	Date Service Ending	C

Data Sources*

A. Administrative claims data – inpatient (facility)
B. Administrative claims data – inpatient (professional)
C. Administrative claims data – outpatient/ambulatory (professional and facility)
D. Administrative claims data – pharmacy
E. Enrollment/coverage data (2 or more years)

Measure Component	**Required Variables**
Standardized Prices*	enrolid, ndcnum, pay, qty, drg, pproc,…,pprocn.
Exclusions and standard coverage definition	enrolid, pdx,dx1,…,dxn, age, svcdate, pproc, pproc1,…, pprocn, pay, qty, revcode, memdays, rx, stdplac, proctyp.
Cohort Definition	enrolid, svcdate, pdx, pdx1,…,pdxn, pproc1,…, pprocn, pay, qty, sex, age, thercls, dstatus, stdplac, billtyp, fachdid, revcode.
Related Resource Use	enrolid, facprof, pay, qty, pproc1,…, pprocn, svcdate, admdate, disdate, pdx, dx1,…, dxn, drg, ndcnum, thercls, gennme, prodnme, daysupp, procmod, mastfrm.
Output and Attribution	enrolid, svcdate, standardized price variables*, BETOS**, pproc1,…,pprocn, pdx, dx1,…,dxn, egeoloc, region, provid, stdprov, age, sex, physid.

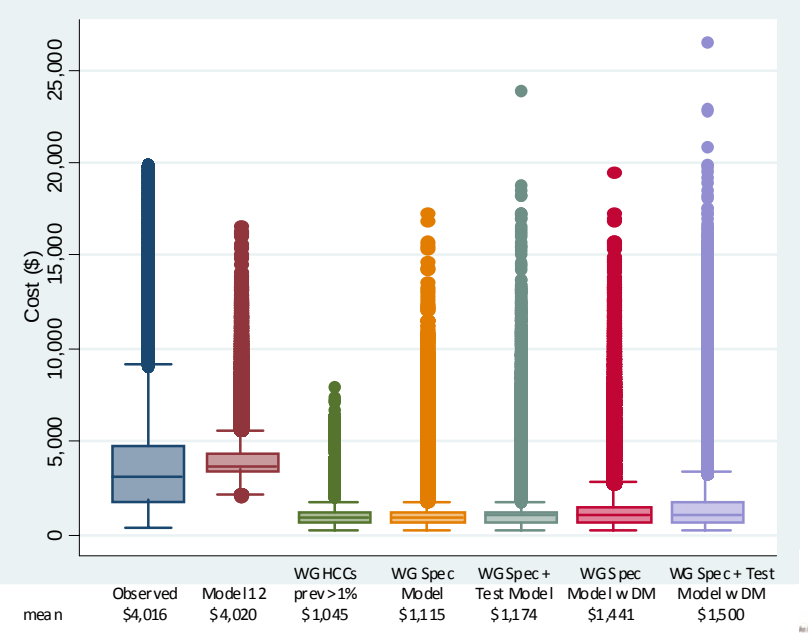
* For internal testing and validation purposes, drug prices were calculated by taking the average of 2006 and 2007 Marketscan prices, inpatient facility prices were computed by calculating average daily price by DRG from 2007, and outpatient and service prices were constructed by calculating the mean price by procedure code within the Marketscan dataset.
** Berenson-Eggers Type of Service – Categorizes Health Care Procedure Coding System (HCPCS) procedure codes in order to analyze health care expenditures. See link for full description.
http://www.cms.hhs.gov/hcpcsreleasecodesets/20_betos.asp

Condition (Workgroup)	***Measure Name***	***Abbreviation***
Acute Myocardial Infarction (AMI)	Episode-of-Care for 30 days Following Onset	AMI1
Acute Myocardial Infarction (AMI)	Episode-of-Care for Post-Acute Period (Days 31-365 Days Post-Event)	AMI2
Asthma	Episode-of-Care for Patients with Asthma over a 1-year Period	ASTH
Breast Cancer	Episode-of-Care for 60-Day Period Preceding Breast Biopsy	BB
Breast Cancer	Episode-of-Care for Treatment in Newly Diagnosed Cases of Breast Cancer over a 15-month Period	BCT
Chronic Obstructive Pulmonary Disease (COPD)	Episode-of-Care for Patients with Stable COPD over a 1-year Period	COPD1
Chronic Obstructive Pulmonary Disease (COPD)	Episode-of-Care for Patients with Unstable COPD over a 1-year Period	COPD2
Colon Cancer	Episode-of-Care for 21-Day Period Around Colonoscopy	COL
Colon Cancer	Episode-of-Care for Treatment of Localized Colon Cancer	CCT
Congestive Heart Failure (CHF)	Episode-of-Care for Management of CHF Over 1-Year Period	CHF1
Congestive Heart Failure (CHF)	Episode-of-Care for Post Hospitalization Management of CHF over 4-Month Period	CHF2
Coronary Artery Disease (CAD)	Episode-of-Care for Management of Chronic CAD Over 1-Year Period	CAD1
Coronary Artery Disease (CAD)	Episode-of-Care for Management of CAD Post Revascularization Over 1-Year Period	CAD2
Diabetes	Episode-of-Care for Diabetes Over 1-Year Period	DIAB
Low Back Pain	Episode-of-Care for Simple Non-Specific Lower Back Pain (Acute and Sub-Acute)	LBP1
Low Back Pain	Episode-of-Care for Acute/Sub-Acute Lumbar Radiculopathy With or Without Lower Back Pain	LBP2
Pneumonia	Episode-of-Care for Community-Acquired Pneumonia Hospitalization	PN1
Pneumonia	Episode-of-Care for Ambulatory Pneumonia Episode	PN2

Comparison 'off the shelf' HCC Values with Episode-specific Risk Adjustment Model

Below we show the figure for the comparison of the diabetes risk adjustment model with diabetes risk adjustment models if we had used HCC values. The first box plot in the figure shows the observed costs in for the episode. The second box plot shows the risk adjustment model that we developed for our diabetes episode that is focused on diabetes-related costs. The final five box plots show the distribution of predicted costs including different HCCs for our diabetes episode if we had relied on the off the shelf HCC values. The mean predicted value for all of the off the shelf HCCs models is $1500 or less, while the observed episode costs were slightly more than $4,000. Given the disparity in the means and distributions of the off the shelf HCC values we felt this justified our approach to develop risk adjustment models for each of our episodes that were focused on episode specific costs

Observed and Predicted Values – Diabetes Episode with "off the shelf HCCs"



For this reason, we have developed separate risk adjustment models for each of our episodes that are based on episode-specific costs. We realize this increases the complexity of implementing our measures; however, we feel it is a more appropriate approach for risk adjustment within our episodes. Within our risk adjustment approach, we control for different comorbidities for each condition because patients with each of the measurement conditions often had very different risk profiles.

We used the following risk adjustment strategy in the development of our risk adjustment 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 before the measurement year.

3. Tested 12 different model specifications shown in Table 1 (below), 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. This functional form of the model was selected as cost data are typically skewed and we wanted to account for that in the analysis. The first model included all HCCs identified by the condition-specific workgroup as "Include HCCs" with a prevalence in the population of >=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 >=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. We opted to include this functional form of the model so that the model output could be interpreted in dollars without requiring a transformation. We followed this strategy as we felt it would be easier for those implementing our measure to create their own risk adjustment models using this functional form of the model if they decided to create their own models. Finally, we opted to evaluate models that included all of the HCCs in case the work group may have failed to include HCCs that were influential on the overall episode costs. Model 9 used all of the HCCs, with the exception of the HCC for the episode being evaluated (e.g., diabetes for the diabetes episode; however HCCs for complications of diabetes were included), and a gamma distribution with log link function. Model 10 was a reduction of Model 9 where only the HCCs with $p<0.1$ were included. The final two models (Models 11-12) used the same process as Models 9 and 10 with a normal distribution and identity link function.

Table 1. 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.

Example Colonoscopy Episode Report

Colonoscopy Episode

Report for Physician #24426403

Provider type = Internal Medicine

	MD	Peer Group	Non-Peer Group	National Avg
Episodes	17	8,598	381,993	390,608
Observed Costs*				
Average	$ 776	$ 1,068	$ 1,152	$ 1,150
Min	$ 426	$ 426	$ 426	$ 426
Median	$ 644	$ 888	$ 1,023	$ 1,020
Max	$ 1814	$ 3,365	$ 3,365	$ 3,365
Predicted Costs				
Average	$ 1,156	$ 1,150	$ 1,150	$ 1,150
Min	$ 1,105	$ 1,105	$ 1,105	$ 1,105
Median	$ 1,154	$ 1,141	$ 1,141	$ 1,141
Max	$ 1,284	$ 1,738	$ 2,296	$ 2,296
Observed-to-Expected Ratio				
Average	0.67	0.93	1.00	1.00
Min	0.37	0.29	0.24	0.24
Median	0.58	0.77	0.89	0.89
Max	1.60	3.05	3.05	3.05
% ≥ 2.0	0%	5.5%	6.8%	6.8%
% ≥ 2.5	0%	2.7%	3.2%	3.2%
% ≥ 75th percentile peers	11.8%	(1.5%, 36.4%)		

* Observed costs adjusted for outliers (winsorized)

Notes:

- Uses Model 12

Example Colonoscopy Episode Report

Colonoscopy Episode

Report for Physician #320162519

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)

Notes:

- Uses Model 12

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Analytic Findings: Colonoscopy Episode of Care

NQF Submission

Overview of Analyses Presented for Colonoscopy Episode*

- Denominator Attrition
- Related and Non-related Services
- Resource Use, Attribution and
- Risk Adjustment

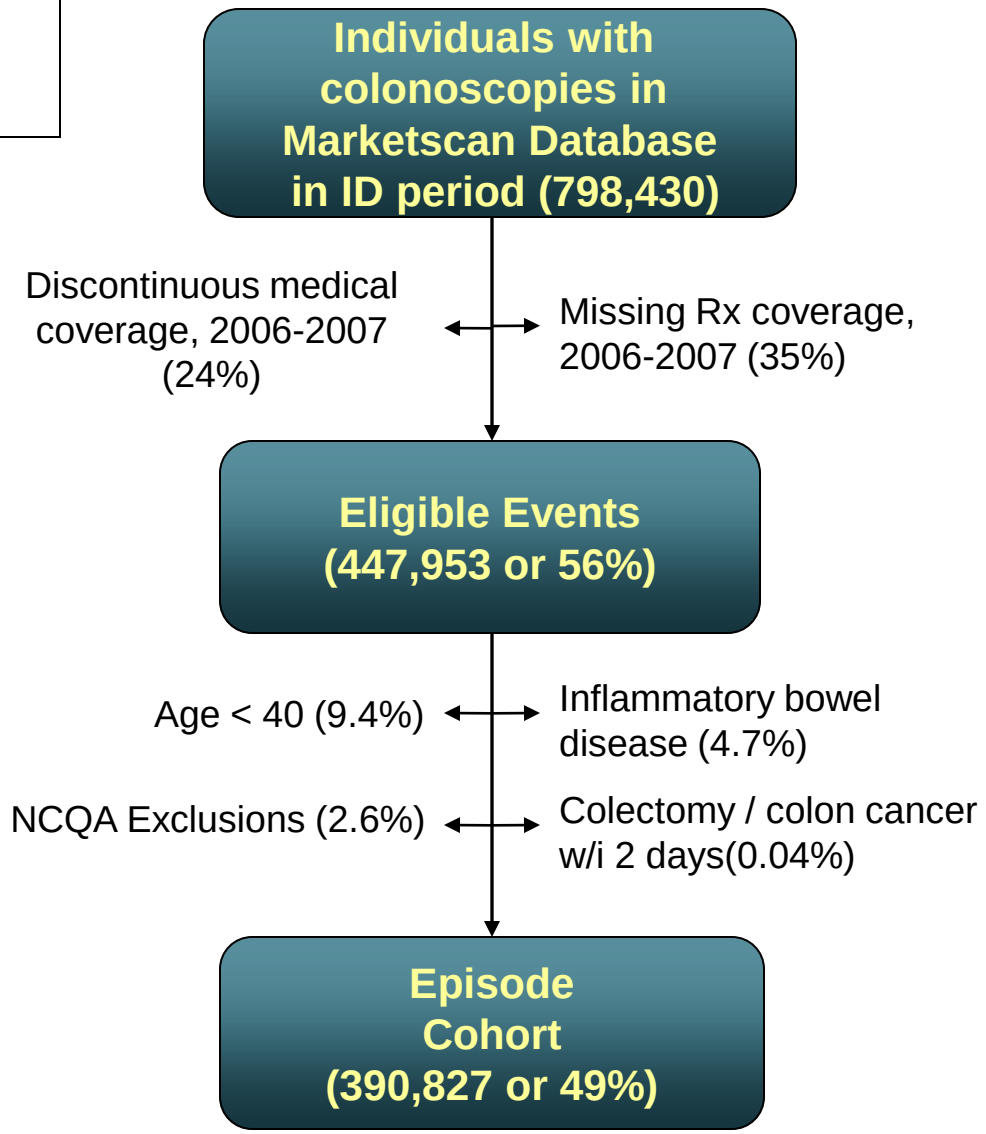
** The following results are based on the measure specification at different points in time, so the numbers are not always consistent, but they are not substantively different.*

Denominator Attrition

- Summarizes the initial denominator based on the workgroup's specifications
- Describes the percentage of enrollees removed from the analysis due to NCQA exclusions or other criteria.

Colonoscopy Measure Denominator

- Procedure codes for colonoscopy
- Identification period: 8 Jan 2007 – 17 Dec 2007. Only 1st is eligible.
- Age 40 years or more
- NCQA Exclusions: Active cancer (except colon cancer), ESRD, dialysis, Renal failure, organ transplant, HIV / AIDS
- Colectomy with colon cancer within two days following colonoscopy
- Inflammatory bowel disease. Including:
  - ulcerative colitis,
  - Crohn's disease,
  - Other inflammatory bowel disease
- Note: exclusions are not additive (double-counting occurs often); figures do not exclude episodes with $0 in related resource use



Related and Non-Related Services

- Examines most frequent related and non-related resource use by BETOS category
  - Evaluation and Management Visits, Procedures, Imaging, Tests, Admissions and Medications.
- Results are presented to the workgroup to examine the face validity of episodes.

Top 20, Colonoscopy-related E&M

- 1% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
99285	1,826	$534,547	4.6%	10.8%	Emergency department visit
99232	6,601	$514,649	16.8%	10.4%	Subsequent hospital care, per day
99244	1,849	$376,368	4.7%	7.6%	Office consultation for a new or established patient
99214	3,501	$338,354	8.9%	6.9%	Office or other outpatient visit, established patient
99213	5,170	$335,957	13.1%	6.8%	Office or other outpatient visit, established patient
99222	765	$316,221	1.9%	6.4%	Initial hospital care, per day
99233	2,458	$274,597	6.2%	5.6%	Subsequent hospital care, per day
99254	1,479	$264,950	3.8%	5.4%	Inpatient consultation for a new or established patient
99223	1,209	$244,633	3.1%	5.0%	Initial hospital care, per day
99243	1,433	$210,280	3.6%	4.3%	Office consultation for a new or established patient
99284	910	$174,263	2.3%	3.5%	Emergency department visit
99238	1,566	$139,744	4.0%	2.8%	Hospital discharge day management; 30 minutes or less
99291	424	$135,908	1.1%	2.8%	Critical care, critically ill or critically injured patient
99231	2,489	$131,433	6.3%	2.7%	Subsequent hospital care, per day
99255	481	$116,163	1.2%	2.4%	Inpatient consultation for a new or established patient
99245	437	$114,183	1.1%	2.3%	Office consultation for a new or established patient
99253	833	$109,006	2.1%	2.2%	Inpatient consultation for a new or established patient
99239	717	$89,861	1.8%	1.8%	Hospital discharge day management; more than 30 minutes
99215	510	$70,335	1.3%	1.4%	Office or other outpatient visit, established patient
99204	401	$60,724	1.0%	1.2%	Office or other outpatient visit, new patient, 45 min.
Total	39,375	$4,932,434	100.0%	100.0%	

Non-colonoscopy Related E&M, Top 20 ICD-9 Codes

ICD-9 Code	Related	Not Related	Related Costs	Non-Related Costs
5693 -Rectal & Anal Hemorrhage	144	5,351	$23,153	$734,537
2113 -Benign Neoplasm Lg Bowel	53	7,736	$4,905	$616,768
V7231-Routine Gyn Examination	12	4,632	$1,439	$567,852
4011 -Benign Hypertension	66	6,351	$7,032	$530,646
V700 -Routine Medical Exam	4	3,857	$498	$474,838
V7651-Screen Malig Neop-Colon	3	3,446	$424	$443,024
5789 -Gastrointest Hemorr NOS	3,958	2,173	$579,526	$412,521
4019 -Hypertension NOS	79	4,666	$8,852	$402,096
78791-Diarrhea	170	3,330	$23,264	$393,591
25000-Dm ll wo Cmp Nt St Uncntr	63	4,217	$6,520	$377,506
53081-Esophageal Reflux	40	3,305	$5,087	$349,111
2859 -Anemia NOS	212	2,652	$26,294	$335,623
5781 -Blood in Stool	1,543	2,249	$205,304	$333,473
78650-Chest Pain NOS	110	2,142	$18,923	$313,965
78799-Digestve Syst Symptm NEC	30	2,044	$4,142	$279,086
56210-Dvrtclo Colon wo Hmrhg	41	3,397	$3,536	$273,145
2724 -Hyperlipidemia NEC/NOS	13	3,190	$1,380	$262,078
56400-Constipation NOS	49	2,180	$5,838	$262,062
2809 -Iron Defic Anemia NOS	105	1,955	$13,474	$237,821
5589 -Noninf Gastroenterit NEC	93	1,655	$13,581	$193,911

Top 20, Colonoscopy-related Procedures

- 56% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
45378	199,524	$86,805,751	35.9%	33.9%	Colonoscopy, flexible, proximal to splenic flexure; diagnostic
45385	81,766	$47,876,659	14.7%	18.7%	Colonoscopy, flexible, proximal to splenic flexure; snare technique
00810	120,210	$47,816,403	21.6%	18.7%	Anesthesia for lower intestinal endoscopic procedures
45380	94,300	$45,421,491	16.9%	17.7%	Colonoscopy, flexible, proximal to splenic flexure; with biopsy(s)
45384	31,378	$15,849,063	5.6%	6.2%	Colonoscopy, flexible, proximal to splenic flexure; bipolar cautery
45383	7,687	$4,483,847	1.4%	1.8%	Colonoscopy, flexible, proximal to splenic flexure; with ablation
G0105	5,001	$1,968,175	0.9%	0.8%	Colorectal cancer screening; colonoscopy, high risk
43239	4,973	$1,488,276	0.9%	0.6%	Upper gastrointestinal endoscopy; with biopsy(s)
00902	2,790	$1,362,812	0.5%	0.5%	Anesthesia for; anorectal procedure
00740	1,803	$778,760	0.3%	0.3%	Anesthesia for upper gastrointestinal endoscopic procedures
43235	1,923	$530,520	0.3%	0.2%	Upper gastrointestinal endoscopy; diagnostic
99144	1,029	$114,119	0.2%	0.0%	Moderate sedation services; first 30 min.
00790	119	$103,067	0.0%	0.0%	Anesthesia for intraperitoneal procedures in upper abdomen
00840	124	$102,072	0.0%	0.0%	Anesthesia for intraperitoneal procedures in lower abdomen
45382	124	$71,249	0.0%	0.0%	Colonoscopy, flexible, proximal to splenic flexure
44140	33	$62,116	0.0%	0.0%	Colectomy, partial; with anastomosis
93510	114	$49,783	0.0%	0.0%	Left heart catheterization, retrograde; percutaneous
92980	35	$47,840	0.0%	0.0%	Transcatheter placement of an intracoronary stent(s)
33533	21	$42,544	0.0%	0.0%	Coronary artery bypass, using arterial graft(s); single graft
44604	31	$30,272	0.0%	0.0%	Suture of large intestine (colorrhaphy); without colostomy
Total	556,413	$256,157,628	100.0%	100.0%	;

Common Non-colonoscopy Related Procedures, CPT Codes

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
43239	Upper gastrointestinal endoscopy including esophagus, stomach,	4,973	41,009	$1,488,276	$12,299,565
00740	Anesthesia for upper gastrointestinal endoscopic procedures, end	1,803	10,411	$778,760	$4,144,206
43235	Upper gastrointestinal endoscopy including esophagus, stomach,	1,923	7,632	$530,520	$2,085,792
00790	Anesthesia for intraperitoneal procedures in upper abdomen inclu	119	1,325	$103,067	$1,082,750
97110	Therapeutic procedure, one or more areas, each 15 minutes; thera	30	14,476	$2,037	$800,171
44204	Laparoscopy, surgical; colectomy, partial, with anastomosis	9	193	$12,745	$758,039
45381	Colonoscopy, flexible, proximal to splenic flexure; with directed sub	73	2,581	$21,234	$717,818
00840	Anesthesia for intraperitoneal procedures in lower abdomen inclu	124	767	$102,072	$597,690
47562	Laparoscopy, surgical; cholecystectomy	15	482	$13,337	$461,702
97140	Manual therapy techniques (eg, mobilization/ manipulation, manua	12	10,707	$552	$424,585
43248	Upper gastrointestinal endoscopy including esophagus, stomach,	37	1,608	$9,663	$416,248
44140	Colectomy, partial; with anastomosis	33	242	$62,116	$383,484
00902	Anesthesia for; anorectal procedure	2,788	8	$1,361,812	$4,037
00810	Anesthesia for lower intestinal endoscopic procedures, endoscope	120,112	7	$47,768,274	$3,191
45378	Colonoscopy, flexible, proximal to splenic flexure; diagnostic, with	199,293	2	$86,705,057	$798
45385	Colonoscopy, flexible, proximal to splenic flexure; with removal of t	81,738	1	$47,859,901	$583

Top 20, Colonoscopy-related OP Facility Claims

- 30% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
45378	74,067	$57,133,880	29.6%	41.1%	Colonoscopy, flexible, proximal to splenic flexure; diagnostic
45380	37,906	$29,211,422	15.1%	21.0%	Colonoscopy, flexible, proximal to splenic flexure; with biopsy
45385	28,572	$22,181,770	11.4%	16.0%	Colonoscopy, flexible, proximal to splenic flexure; snare technique
45384	12,464	$9,671,356	5.0%	7.0%	Colonoscopy, flexible, proximal to splenic flexure; bipolar cautery
88305	29,948	$5,971,913	12.0%	4.3%	Level IV - Surgical pathology, gross and microscopic examination
G0121	3,695	$2,795,266	1.5%	2.0%	Colorectal cancer screening; colonoscopy
45383	2,563	$2,071,243	1.0%	1.5%	Colonoscopy, flexible, proximal to splenic flexure; with ablation
G0105	1,644	$1,254,665	0.7%	0.9%	Colorectal cancer screening; colonoscopy, high risk
43239	1,659	$1,158,521	0.7%	0.8%	Upper gastrointestinal endoscopy; with biopsy, single or multiple
J2250	16,999	$876,317	6.8%	0.6%	Injection, midazolam hydrochloride, per 1 mg
74160	1,017	$797,687	0.4%	0.6%	Computed tomography, abdomen; with contrast material(s)
74170	567	$542,027	0.2%	0.4%	Computed tomography, abdomen; with and w/out contrast
72193	636	$502,987	0.3%	0.4%	Computed tomography, pelvis; with contrast material(s)
J2175	7,407	$312,665	3.0%	0.2%	Injection, meperidine hydrochloride, per 100 mg
J3010	9,589	$306,591	3.8%	0.2%	Injection, fentanyl citrate, 0.1 mg
43235	529	$294,541	0.2%	0.2%	Upper gastrointestinal endoscopy; diagnostic
74150	267	$184,093	0.1%	0.1%	Computed tomography, abdomen; without contrast material
00810	541	$163,094	0.2%	0.1%	Anesthesia for lower intestinal endoscopic procedures
88342	864	$150,537	0.3%	0.1%	Immunohistochemistry (including tissue immunoperoxidase)
78223	224	$148,509	0.1%	0.1%	Hepatobiliary ductal system imaging
Total	250,532	$138,849,354	100.0%	100.0%	

Common Non-colonoscopy Related OP Facility Claims, CPT Codes

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
43239	Upper gastrointestinal endoscopy including esophagus, stomach,	1,657	14,509	$1,157,572	$10,346,077
43235	Upper gastrointestinal endoscopy including esophagus, stomach,	529	2,249	$294,541	$1,328,139
45381	Colonoscopy, flexible, proximal to splenic flexure; with directed sub	34	808	$17,177	$506,040
72193	Computed tomography, pelvis; with contrast material(s)	636	613	$502,987	$469,000
47562	Laparoscopy, surgical; cholecystectomy	3	143	$10,307	$359,906
43248	Upper gastrointestinal endoscopy including esophagus, stomach,	27	593	$18,681	$340,142
80053	Comprehensive metabolic panel This panel must include the follov	579	2,801	$58,462	$258,270

Top 20, Colonoscopy-related Imaging

- 2% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
G0121	9,905	$3,953,083	21.8%	43.0%	Colorectal cancer screening; colonoscopy
74160	5,888	$1,206,288	12.9%	13.1%	Computed tomography, abdomen; with contrast material(s)
74170	2,784	$737,830	6.1%	8.0%	Computed tomography, abdomen; with and without contrast
72193	3,386	$612,251	7.4%	6.7%	Computed tomography, pelvis; with contrast material(s)
74150	1,806	$268,182	4.0%	2.9%	Computed tomography, abdomen; without contrast material
74183	401	$259,280	0.9%	2.8%	MRI, abdomen; with and without contrast material(s)
76700	1,683	$190,132	3.7%	2.1%	Ultrasound, abdominal, real time with image documentation
91110	172	$146,564	0.4%	1.6%	Gastrointestinal tract imaging, intraluminal
72194	487	$120,032	1.1%	1.3%	Computed tomography, pelvis; with and without contrast
72192	801	$119,191	1.8%	1.3%	Computed tomography, pelvis; without contrast material
74280	1,034	$112,310	2.3%	1.2%	Radiologic exam, colon; air contrast with barium
76705	1,287	$88,500	2.8%	1.0%	Ultrasound, abdominal, real time with image documentation
78223	773	$87,284	1.7%	0.9%	Hepatobiliary ductal system imaging, including gallbladder
78465	175	$71,226	0.4%	0.8%	Myocardial perfusion imaging; tomographic (SPECT)
74270	865	$69,428	1.9%	0.8%	Radiologic examination, colon; barium enema
93307	431	$63,236	0.9%	0.7%	Echocardiography, transthoracic; complete
74181	218	$59,483	0.5%	0.6%	MRI, abdomen; without contrast material(s)
74022	1,595	$54,706	3.5%	0.6%	Radiologic examination, complete acute abdomen series
93880	331	$53,413	0.7%	0.6%	Duplex scan of extracranial arteries; complete bilateral study
74000	1,773	$42,253	3.9%	0.5%	Radiologic examination, abdomen; anteroposterior view
Total	45,504	$9,201,268	100.0%	100.0%	

Common Non-colonoscopy Related Imaging, CPT Codes

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
78465	Myocardial perfusion imaging; tomographic (SPECT), multiple stu	175	2,242	$71,226	$1,061,911
77057	Screening mammography, bilateral (2-view film study of each brea	6	8,546	$395	$643,066
72193	Computed tomography, pelvis; with contrast material(s)	3,386	3,481	$612,251	$617,447
93307	Echocardiography, transthoracic, real-time with image documenta	431	2,979	$63,236	$571,084
77080	Dual-energy X-ray absorptiometry (DXA), bone density study, 1 or	6	4,527	$468	$475,498
70553	Magnetic resonance (eg, proton) imaging, brain (including brain st	69	597	$32,179	$415,077
G0202	Screening mammography, producing direct digital image, bilateral	8	4,165	$832	$408,308
72148	Magnetic resonance (eg, proton) imaging, spinal canal and conter	12	858	$3,622	$371,902
73721	Magnetic resonance (eg, proton) imaging, any joint of lower extren	3	728	$819	$308,192
93325	Doppler echocardiography color flow velocity mapping (List separa	432	3,116	$27,470	$300,034
93320	Doppler echocardiography, pulsed wave and/or continuous wave v	451	3,202	$30,512	$281,321
71020	Radiologic examination, chest, two views, frontal and lateral;	647	8,525	$18,063	$268,382
71260	Computed tomography, thorax; with contrast material(s)	101	1,231	$17,999	$255,475
91110	Gastrointestinal tract imaging, intraluminal (eg, capsule endoscopy	172	187	$146,564	$180,320
72194	Computed tomography, pelvis; without contrast material, followed	487	672	$120,032	$168,599
76700	Ultrasound, abdominal, real time with image documentation; comp	1,683	1,100	$190,132	$121,345
74160	Computed tomography, abdomen; with contrast material(s)	5,885	123	$1,205,945	$15,247
74150	Computed tomography, abdomen; without contrast material	1,803	51	$267,872	$5,459
74170	Computed tomography, abdomen; without contrast material, follov	2,784	36	$737,830	$4,896

Top 20, Colonoscopy-related Tests

- 8% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
88305	230,057	$35,061,133	84.5%	93.4%	Level IV - Surgical pathology, gross and microscopic exam
88342	8,027	$1,120,451	2.9%	3.0%	Immunohistochemistry (including tissue immunoperoxidase)
88307	1,264	$253,308	0.5%	0.7%	Level V - Surgical pathology, gross and microscopic exam
88185	114	$198,906	0.0%	0.5%	Flow cytometry, cell surface, cytoplasmic, or nuclear marker
88304	2,492	$140,204	0.9%	0.4%	Level III - Surgical pathology, gross and microscopic exam
88312	1,114	$72,551	0.4%	0.2%	Special stains; Group I for microorganisms, each
88309	246	$58,113	0.1%	0.2%	Level VI - Surgical pathology, gross and microscopic exam
93010	1,759	$31,295	0.6%	0.1%	Electrocardiogram, routine ECG with at least 12 leads
88321	247	$30,756	0.1%	0.1%	Consultation and report on referred slides prepared elsewhere
85025	2,611	$28,644	1.0%	0.1%	Blood count; complete (CBC)
88313	452	$24,936	0.2%	0.1%	Special stains; Group II, all other (eg, iron, trichrome)
93015	146	$22,219	0.1%	0.1%	Cardiovascular stress test
93000	606	$21,731	0.2%	0.1%	Electrocardiogram, routine ECG with at least 12 leads
80053	1,419	$21,457	0.5%	0.1%	Comprehensive metabolic panel
88189	93	$17,189	0.0%	0.0%	Flow cytometry, interpretation; 16 or more markers
36415	2,343	$13,969	0.9%	0.0%	Collection of venous blood by venipuncture
93224	48	$11,696	0.0%	0.0%	Electrocardiographic monitoring for 24 hours, ECG waveform
83516	216	$11,503	0.1%	0.0%	Immunoassay for analyte; multiple step method
0066T	14	$11,316	0.0%	0.0%	Computed tomographic (CT) colonography; screening
93236	12	$10,730	0.0%	0.0%	Electrocardiographic monitoring for 24 hours
Total	272,105	$37,546,826	100.0%	100.0%	

Common Non-colonoscopy Related Tests, CPT Codes

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
88312	Special stains (List separately in addition to code for primary servi	1,114	20,092	$72,551	$1,429,937
88313	Special stains (List separately in addition to code for primary servi	452	11,639	$24,936	$665,861
95811	Polysomnography; sleep staging with 4 or more additional parame	1	736	$271	$459,617
95810	Polysomnography; sleep staging with 4 or more additional parame	1	730	$811	$421,732
93015	Cardiovascular stress test using maximal or submaximal treadmill	146	2,647	$22,219	$393,337
80061	Lipid panel This panel must include the following: Cholesterol, seru	348	16,882	$6,492	$336,992
93000	Electrocardiogram, routine ECG with at least 12 leads; with interpr	605	7,015	$21,696	$250,111
85025	Blood count; complete (CBC), automated (Hgb, Hct, RBC, WBC a	2,611	19,278	$28,644	$220,720
80053	Comprehensive metabolic panel This panel must include the follow	1,419	13,593	$21,457	$217,666
80050	General health panel This panel must include the following: Comp	251	4,648	$10,403	$191,451
95904	Nerve conduction, amplitude and latency/velocity study, each nerv	3	771	$1,116	$186,255
84443	Thyroid stimulating hormone (TSH)	266	6,710	$6,167	$177,781
36415	Collection of venous blood by venipuncture	2,343	28,342	$13,969	$168,579
84153	Prostate specific antigen (PSA); total	96	5,586	$2,585	$160,113
93350	Echocardiography, transthoracic, real-time with image documenta	40	772	$7,271	$152,440
93010	Electrocardiogram, routine ECG with at least 12 leads; interpretati	1,758	8,464	$31,277	$147,753
88305	Level IV - Surgical pathology, gross and microscopic examination	229,998	111	$35,052,615	$14,151
88307	Level V - Surgical pathology, gross and microscopic examination A	1,263	38	$253,147	$8,166
88342	Immunohistochemistry (including tissue immunoperoxidase), each	8,024	21	$1,120,170	$4,355

Related Inpatient Admissions, Colonoscopy Episode

- 2% of total episode costs

ICD-9 Diagnosis	N	Amount
5789 -Gastrointest Hemorr NOS	166	$1,089,845
27651-Dehydration	77	$669,619
78900-Abdmnal Pain Unspcf Site	52	$371,894
5781 -Blood in Stool	56	$365,038
78909-Abdmnal Pain Oth Spcf St	48	$360,909
41071-Subendo Infarct, Initial	18	$315,722
78904-Abdmnal Pain Lt Lwr Quad	43	$302,528
42731-Atrial Fibrillation	32	$287,015
4280 -Chf NOS	21	$263,586
78903-Abdmnal Pain Rt Lwr Qua	39	$258,079
78906-Abdmnal Pain Epigastric	34	$253,799
56983-Perforation of Intestine	16	$252,934
41011-AMI Anterior Wall, Init	8	$225,310
78901-Abdmnal Pain Rt Upr Quad	29	$211,084
51881-Acute Respiratry Failure	11	$154,064
43491-Crbl Art Ocl NOS w Infrc	11	$151,819
41041-AMI Inferior Wall, Init	6	$146,072
41519-Pulm Embol/Infarct NEC	15	$132,205
45341-DVT/Emb Prox Lower Ext	9	$98,214
7802 -Syncope & Collapse	16	$93,956
Top 10	552	$4,284,235
Grand Total	823	$7,249,544

DRGlabel	N	Amount
392-Esophagitis, gastroent & misc digest di	254	$1,410,328
379-G.I. hemorrhage w/o CC/MCC	137	$596,735
641-Nutritional & misc metabolic disorders v	69	$483,109
378-G.I. hemorrhage w CC	77	$382,285
189-Pulmonary edema & respiratory failure	10	$273,936
249-Perc cardiovasc proc w non-drug-elutin	11	$200,498
065-Intracranial hemorrhage or cerebral infa	8	$153,923
003-ECMO or trach w MV 96+ hrs or PDX e	1	$149,040
330-Major small & large bowel procedures v	8	$140,454
310-Cardiac arrhythmia & conduction disord	26	$133,164
391-Esophagitis, gastroent & misc digest dis	19	$130,542
216-Cardiac valve & oth maj cardiothoracic	1	$110,640
166-Other resp system O.R. procedures w M	1	$107,800
640-Nutritional & misc metabolic disorders v	7	$103,889
233-Coronary bypass w cardiac cath w MCC	1	$88,011
247-Perc cardiovasc proc w drug-eluting ste	5	$87,849
176-Pulmonary embolism w/o MCC	10	$85,236
228-Other cardiothoracic procedures w MCC	2	$78,168
312-Syncope & collapse	16	$75,776
309-Cardiac arrhythmia & conduction disord	10	$74,466
Top 10	601	$3,923,472
Grand Total	823	$7,249,544

Non-Related Inpatient Admissions, Colonoscopy Episode

ICD-9 Diagnosis	N	Amount
56211-Dvrtcli Colon wo Hmrhg	341	$3,720,951
41401-Crnry Athrscl Natve Vssl	122	$2,853,980
56212-Dvrtclo Colon w Hmrhg	307	$2,549,896
5579 -Vasc Insuff Intest NOS	213	$2,115,881
5789 -Gastrointest Hemorr NOS	218	$1,953,392
99811-Hemorrhage Complic Proc	232	$1,793,864
2113 -Benign Neoplasm Lg Bowe	180	$1,593,917
5589 -Noninf Gastroenterit NEC	194	$1,464,150
2809 -Iron Defic Anemia NOS	160	$1,302,352
4552 -Int Hemrrhoid w Comp NE	153	$1,274,434
5849 -Acute Renal Failure NOS	79	$1,033,280
9982 -Accidental Op Laceration	56	$955,648
5770 -Acute Pancreatitis	78	$924,371
5570 -Ac Vasc Insuff Intestine	82	$859,431
V553 -Atten to Colostomy	51	$822,958
0389 -Septicemia NOS	36	$796,462
5781 -Blood in Stool	83	$757,460
V5789-Rehabilitation Proc NEC	44	$671,614
1533 -Mal Neo Sigmoid Colon	55	$653,922
4280 -Chf NOS	36	$653,891
Top 10	2,120	$20,622,817
Grand Total	7,230	$79,011,838

DRGlabel	N	Amount
330-Major small & large bowel procedures v	395	$6,411,160
392-Esophagitis, gastroent & misc digest di	764	$4,385,254
394-Other digestive system diagnoses w CC	449	$2,830,223
379-G.I. hemorrhage w/o CC/MCC	510	$2,670,569
329-Major small & large bowel procedures v	95	$2,518,908
378-G.I. hemorrhage w CC	373	$2,468,006
331-Major small & large bowel procedures v	203	$1,814,840
812-Red blood cell disorders w/o MCC	263	$1,595,635
871-Septicemia w/o MV 96+ hours w MCC	41	$1,253,340
470-Major joint replacement or reattachmen	76	$1,126,259
920-Complications of treatment w CC	202	$1,053,285
003-ECMO or trach w MV 96+ hrs or PDX e	7	$983,380
907-Other O.R. procedures for injuries w MC	48	$918,108
393-Other digestive system diagnoses w MC	105	$835,452
743-Uterine & adnexa proc for non-maligna	134	$830,929
853-Infectious & parasitic diseases w O.R. p	13	$810,180
391-Esophagitis, gastroent & misc digest di	82	$756,024
981-Extensive O.R. procedure unrelated to p	19	$752,247
249-Perc cardiovasc proc w non-drug-elutin	41	$746,065
982-Extensive O.R. procedure unrelated to p	37	$741,376
Top 10	3,169	$27,074,194
Grand Total	7,230	$79,011,838

Colonoscopy-related Drug Costs by Generic Name

- Note: Drugs compose 1% of total episode costs

Generic Name	N	Amount	% of N	% of Amount
Bisacodyl/Polyethylene Glycol 3350/Potas	33,585	$1,847,003	18.8%	29.3%
K Cl/Na Bicarb/Na Cl/Polyethylene Glycol	41,362	$1,287,008	23.1%	20.4%
PEG Electrolyte Lavage Solution	15,450	$676,893	8.6%	10.7%
Amoxicillin/Clarithromycin/Lansoprazole	1,493	$246,772	0.8%	3.9%
K Cl/Na Bicarb/Na Cl/Na Sulf/PEG	12,704	$214,310	7.1%	3.4%
Levofloxacin	2,678	$201,803	1.5%	3.2%
Azithromycin	3,536	$142,967	2.0%	2.3%
Amoxicillin/Clavulanate Potassium	1,310	$84,534	0.7%	1.3%
Celecoxib	2,053	$77,691	1.1%	1.2%
Levofloxacin	528	$62,774	0.3%	1.0%
Clarithromycin	978	$56,870	0.5%	0.9%
Meloxicam	1,093	$46,888	0.6%	0.7%
Moxifloxacin Hydrochloride	610	$45,668	0.3%	0.7%
Ciprofloxacin Hydrochloride	3,270	$43,666	1.8%	0.7%
Acetaminophen/Hydrocodone Bitartrate	6,405	$42,912	3.6%	0.7%
Rifaximin	396	$39,409	0.2%	0.6%
Oxycodone Hydrochloride	120	$39,215	0.1%	0.6%
Acetaminophen/Propoxyphene Napsylate	3,416	$36,277	1.9%	0.6%
Meloxicam	846	$32,477	0.5%	0.5%
Fentanyl	121	$31,517	0.1%	0.5%
Grand Total	**178,941**	**$6,310,849**	**100.0%**	**100.0%**

Colonoscopy-related Drug Costs by Class

- Note: Drugs compose 1% of total episode costs

Therapeutic Class	N	Amount	% of N	% of Amount
153-Cath & Lax, Laxatives, Enemas	69,576	$2,178,771	38.9%	34.5%
162-Gastrointestinal Drugs Misc, NEC	23,232	$1,319,801	13.0%	20.9%
060-Anal/Antipyr, Opiate Agonists	25,454	$615,994	14.2%	9.8%
999-Other/unavailable	7,546	$396,096	4.2%	6.3%
010-Antibiot, Penicillins	8,671	$394,171	4.8%	6.2%
016-Quinolones, NEC	7,967	$379,562	4.5%	6.0%
059-Analg/Antipyr, Nonsteroid/Antiinflam	11,905	$265,735	6.7%	4.2%
009-Antibiot, Erythromycin & Macrolide	5,771	$245,412	3.2%	3.9%
012-Antibiotics, Misc	1,469	$134,509	0.8%	2.1%
155-Cath & Lax, Laxatives, Stimulant	2,807	$131,106	1.6%	2.1%
006-Antibiot, Cephalosporin and Rel.	3,052	$80,636	1.7%	1.3%
062-Analgesics/Antipyretics, NEC	3,593	$69,346	2.0%	1.1%
011-Antibiot, Tetracyclines	2,322	$39,634	1.3%	0.6%
064-Anticonvulsants, Benzodiazepines	2,722	$19,563	1.5%	0.3%
017-Sulfonamides & Comb, NEC	1,832	$14,925	1.0%	0.2%
061-Anal/Antipyr, Opiate Part Agonist	214	$13,136	0.1%	0.2%
058-Analg/Antipyr, Salicylates	369	$7,592	0.2%	0.1%
004-Antibiot, Aminoglycosides	438	$4,692	0.2%	0.1%
057-General Anesthetics, NEC	1	$167	0.0%	0.0%
Grand Total	**178,941**	**$6,310,849**	**100.0%**	**100.0%**

Non-related Drug Costs, Colonoscopy Episode

Generic Name	N	Amount	% of N	% of Amount
Na Phos, Dibasic/Na Phos, Monobasic	22,575	$940,305	4.4%	5.8%
Esomeprazole Magnesium	11,537	$600,539	2.3%	3.7%
Etanercept	288	$323,528	0.1%	2.0%
Omeprazole	7,033	$304,073	1.4%	1.9%
Cetirizine Hydrochloride	3,149	$279,006	0.6%	1.7%
Lansoprazole	4,893	$258,819	1.0%	1.6%
Polyethylene Glycol 3350	20,112	$222,006	3.9%	1.4%
Adalimumab	191	$207,936	0.0%	1.3%
Simvastatin	4,095	$200,288	0.8%	1.2%
Pantoprazole Sodium	4,545	$190,926	0.9%	1.2%
Bupropion Hydrochloride	1,539	$187,861	0.3%	1.2%
Simvastatin	3,716	$186,091	0.7%	1.1%
Sitagliptin Phosphate	720	$163,395	0.1%	1.0%
Atorvastatin Calcium	4,397	$160,976	0.9%	1.0%
Zolpidem Tartrate	3,740	$148,574	0.7%	0.9%
PEG Electrolyte Lavage Solution	4,450	$144,407	0.9%	0.9%
Rabeprazole Sodium	2,708	$140,069	0.5%	0.9%
Atorvastatin Calcium	5,201	$132,947	1.0%	0.8%
Clopidogrel Hydrogen Sulfate	2,276	$128,895	0.4%	0.8%
Enoxaparin Sodium	193	$125,907	0.0%	0.8%

Non-related Drug Costs, Colonoscopy Episode by Class

Therapeutic Class	N	Amount	% of N	% of Amount
053-Antihyperlipidemic Drugs, NEC	48,940	$1,898,170	9.4%	11.6%
162-Gastrointestinal Drugs Misc, NEC	37,153	$1,801,903	7.2%	11.0%
069-Psychother, Antidepressants	32,804	$1,080,895	6.3%	6.6%
234-Unclassified Agents, NEC	18,698	$1,049,112	3.6%	6.4%
154-Cath & Lax, Laxatives, Saline	22,583	$941,454	4.4%	5.7%
174-Antidiabetic Agents, Misc	14,808	$672,919	2.9%	4.1%
052-Cardiac, Calcium Channel	14,295	$530,680	2.8%	3.2%
001-Antihistamines & Comb, NEC	13,124	$476,456	2.5%	2.9%
039-Coag/Anticoag, Anticoagulants	2,618	$394,949	0.5%	2.4%
046-Cardiac Drugs. NEC	16,696	$362,814	3.2%	2.2%
999-Other/unavailable	12,827	$353,124	2.5%	2.2%
068-Anticonvulsants, Misc	5,485	$338,161	1.1%	2.1%
051-Cardiac, Beta Blockers	21,069	$327,784	4.1%	2.0%
075-Anxiolytic/Sedative/Hypnotic NEC	9,716	$322,676	1.9%	2.0%
166-Adrenals & Comb, NEC	9,018	$286,877	1.7%	1.7%
014-Antivirals, NEC	2,805	$265,269	0.5%	1.6%
181-Immunosuppressants, NEC	505	$263,760	0.1%	1.6%
047-Cardiac, ACE Inhibitors	22,569	$257,854	4.3%	1.6%
195-Antiinflam S/MM Agnts & Comb, Misc	10,641	$253,325	2.1%	1.5%
032-Vascular 5HT1 Agonist, NEC	2,532	$242,912	0.5%	1.5%

Colonoscopy Provider Attribution

- Episodes are attributed to the physician who performed the Colonoscopy.

- Support a comparison across providers rather than simply across all episodes, which may be reflective of a normal distribution of costs population-wide

Colonoscopy Episodes by Specialty – Top 10

Specialty Description	Grand Total	% of Tot.
275-Gastroenterology	245,273	63.6%
500-Surgeon (NEC)	33,004	8.6%
204-Internal Medicine (NEC)	30,710	8.0%
200-Medical Doctor - MD (NEC)	23,008	6.0%
206-MultiSpecialty Phys Group	13,424	3.5%
510-Colon & Rectal Surgery	11,536	3.0%
240-Family Practice	8,649	2.2%
005-Treatment Center	5,707	1.5%
208-Proctology	3,417	0.9%
040-Other Facility (NEC)	2,528	0.7%
Other	8,690	2.3%
Grand Total	385,946	100.0%

Colonoscopy Episodes by Specialty, by Region – Top 10

Specialty Description	1-Northeast	% of Tot.	2-North Central	% of Tot.	3-South	% of Tot.	4-West	% of Tot.
275-Gastroenterology	29,110	69.1%	63,015	59.4%	125,320	71.4%	27,828	44.7%
500-Surgeon (NEC)	1,989	4.7%	13,716	12.9%	14,231	8.1%	3,068	4.9%
204-Internal Medicine (NEC)	4,796	11.4%	9,565	9.0%	8,664	4.9%	7,685	12.3%
200-Medical Doctor - MD (NEC)	1,957	4.6%	4,949	4.7%	10,473	6.0%	5,629	9.0%
206-MultiSpecialty Phys Group	328	0.8%	2,082	2.0%	393	0.2%	10,621	17.1%
510-Colon & Rectal Surgery	1,761	4.2%	2,397	2.3%	5,938	3.4%	1,440	2.3%
240-Family Practice	534	1.3%	3,055	2.9%	3,512	2.0%	1,548	2.5%
005-Treatment Center	357	0.8%	1,206	1.1%	1,126	0.6%	3,018	4.8%
208-Proctology	130	0.3%	2,010	1.9%	1,189	0.7%	88	0.1%
040-Other Facility (NEC)	332	0.8%	1,410	1.3%	693	0.4%	93	0.1%
Other	818	1.9%	2,612	2.5%	4,024	2.3%	1,236	2.0%
Grand Total	42,112	100.0%	106,017	100.0%	175,563	100.0%	62,254	100.0%

Identifying Variability in Colonoscopy Resource Use

- Analyses intended to identify trends in the observed variability in resource use for colonoscopy episodes
- Variability measured at the following levels:
  - Region
  - State
  - Specialty

Colonoscopy: Mean Resource Use by Type of Service, All Episodes

Description	Mean	%	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Procedures	$658	55.2%	$426	$426	$516	$852	$1,243
Outpatient Facility	$359	30.1%	$0	$0	$0	$589	$1,511
Tests	$97	8.1%	$0	$0	$50	$109	$356
Imaging	$25	2.1%	$0	$0	$0	$0	$160
Inpatient Facility	$20	1.7%	$0	$0	$0	$0	$0
Drug Costs	$16	1.4%	$0	$0	$0	$26	$57
E&M	$15	1.2%	$0	$0	$0	$0	$65
Other Services	$2	0.2%	$0	$0	$0	$0	$0
DME	$0	0.0%	$0	$0	$0	$0	$0
Unclassified	$0	0.0%	$0	$0	$0	$0	$0
Total Costs	**$1,192**	**100.0%**	**$426**	**$625**	**$1,020**	**$1,455**	**$2,519**

n = 390,608

Colonoscopy: Resource Use by Type of Service vs. Overall Mean, by Region

Description	Mean	South	North Central	West	Northeast
N	390,608	176,529	106,806	62,708	42,923
Procedures	$658	1.02	0.98	0.94	1.05
Outpatient Facility	$359	1.05	0.83	0.92	1.33
Tests	$97	1.10	0.92	0.92	0.90
Imaging	$25	1.07	1.06	0.74	0.94
Inpatient Facility	$20	1.09	1.07	0.68	0.88
Drug Costs	$16	1.17	0.84	0.87	0.90
E&M	$15	1.11	1.02	0.83	0.74
Other Services	$2	1.13	0.81	1.02	0.91
DME	$0	1.12	1.20	0.43	0.89
Unclassified	$0	0.83	1.25	1.32	0.65
Total Costs	**$1,192**	**1.04**	**0.93**	**0.92**	**1.11**

Colonoscopy: Resource Use by Type of Service vs. Overall Mean, by State

Description	Mean	TX	MI	CA	GA	TN	OH	FL	SC	IL	IN
N	390,608	41,394	31,550	31,284	26,119	18,795	18,636	16,061	14,056	12,523	10,589
Procedures	$658	0.96	1.06	0.82	1.13	1.04	0.89	1.29	0.93	0.95	0.88
Outpatient Facility	$359	1.68	0.54	1.04	0.62	0.65	0.91	0.78	0.83	0.89	1.40
Tests	$97	1.26	0.80	0.85	0.96	1.02	0.97	1.23	1.02	1.10	0.90
Imaging	$25	1.08	1.36	0.74	0.72	2.25	0.81	1.11	0.54	0.97	0.83
Inpatient Facility	$20	1.11	1.02	0.78	1.18	0.70	1.22	1.11	1.19	1.30	1.01
Drug Costs	$16	1.37	0.92	0.84	1.05	1.11	0.91	1.06	1.08	0.92	0.72
E&M	$15	1.27	0.87	0.83	1.07	0.91	1.18	1.35	1.00	1.30	1.00
Other Services	$2	0.98	0.75	0.99	3.00	1.03	0.64	1.07	0.66	1.52	0.48
DME	$0	0.87	0.12	0.34	3.15	2.02	4.27	0.75	0.31	1.71	1.47
Unclassified	$0	1.37	0.95	0.59	0.96	0.11	1.39	0.53	1.03	2.82	0.22
Total Costs	**$1,192**	**1.21**	**0.88**	**0.89**	**0.95**	**0.94**	**0.91**	**1.12**	**0.90**	**0.96**	**1.04**

Colonoscopy: Resource Use by Type of Service vs. Overall Mean, by Specialty

- Results presented for high-volume specialties: Top 1-5

Description	Mean	Gastroen-terology	Surgeon_ NEC	Internal Medicine	Medical Doctor_NEC	Multi-Specialty Group
N	390,608	246,538	33,054	30,798	23,026	13,426
Procedures	$658	1.00	1.01	0.96	0.93	0.83
Outpatient Facility	$359	1.00	0.96	0.93	1.39	0.29
Tests	$97	1.06	0.81	1.02	0.90	0.82
Imaging	$25	1.03	0.99	0.97	0.91	0.86
Inpatient Facility	$20	1.01	1.29	1.04	1.05	0.51
Drug Costs	$16	1.06	0.81	1.00	0.96	0.80
E&M	$15	1.06	0.99	0.98	1.03	0.59
Other Services	$2	1.04	0.16	0.06	0.03	0.05
DME	$0	1.25	5.12	5.91	3.80	10.89
Unclassified	$0	1.01	0.47	1.60	1.14	0.61
Total Costs	**$1,192**	**1.01**	**0.98**	**0.96**	**1.07**	**0.66**

Colonoscopy: Resource Use by Type of Service vs. Overall Mean, by Specialty

- Results presented for high-volume specialties: 6-10

Description	Mean	Colon/Rectal Surgery	Family Practice	Treatment Center	Proctology	Other Facility_NEC
N	390,608	11,612	8,679	5,709	3,426	2,533
Procedures	$658	1.04	0.96	1.69	1.05	1.06
Outpatient Facility	$359	1.48	0.95	0.14	0.40	0.61
Tests	$97	0.71	1.00	0.93	0.60	0.86
Imaging	$25	0.61	0.99	0.80	0.75	1.23
Inpatient Facility	$20	0.70	1.15	0.08	0.64	0.91
Drug Costs	$16	0.92	0.85	0.92	0.74	0.81
E&M	$15	0.57	0.95	0.42	0.52	1.01
Other Services	$2	0.03	0.11	0.00	0.00	0.03
DME	$0	5.12	10.97	3.44	1.17	10.31
Unclassified	$0	1.26	0.67	0.89	0.00	2.69
Total Costs	**$1,192**	**1.12**	**0.97**	**1.09**	**0.79**	**0.91**

Cost-Driving Service Utilization: Anesthesia Services

- Colonoscopy episodes were divided into those with and those without evidence of anesthesia services on the day of the episode-triggering colonoscopy
- Approximately three fourths of episodes (288,603) showed no claims associated with anesthesia on the date of the colonoscopy; one fourth (100,585) showed at least one claim for anesthesia-related services on that date
  - A small number of “non-anesthesia episodes” showed anesthesia claims on other dates during the episode

Colonoscopy: Cost-Drivers, Anesthesia Services

Description	No Anesthesia		General Anesthesia	
	Mean Costs per Episode	Percent of Total	Mean Costs per Episode	Percent of Total
Procedures	$538	50.1%	$513	33.7%
Outpatient Facility	$361	33.6%	$347	22.8%
General Anesthesia	$2	0.2%	$485	31.9%
Tests	$96	8.9%	$100	6.5%
Imaging	$25	2.3%	$25	1.7%
Inpatient Facility	$20	1.9%	$18	1.2%
Drug Costs	$16	1.5%	$17	1.1%
Evaluation and Management	$15	1.4%	$13	0.9%
Other Services	$2	0.2%	$3	0.2%
Durable Medical Equipment	$0	0.0%	$1	0.0%
Unclassified	$0	0.0%	$0	0.0%
Conscious Sedation	$0	0.0%	$0	0.0%
Total Costs	**$1,075**	**100.0%**	**$1,523**	**100.0%**

** Note other general anesthesia services rendered on other dates within the measurement window (i.e., for repeat colonoscopies or other related procedures) may still be captured as related to the episode – hence the $2 of general anesthesia services captured for the "No Anesthesia" group's episodes, on average.

Risk Adjustment

- Testing of risk adjustment models

- Apply risk adjusted results to produce a provider specific summary report.

Risk Adjustment Model Specification

- Test 12 different model specifications
  - Logged GLM model using gamma distribution
    - Full list of recommended comorbidities (> 1% prevalence)
    - Only recommended comorbidities that are statistically significant
    - Only recommended comorbidities that are statistically significant + additional comorbidities flagged for “empirical analysis” (all, significant only)
    - All HCCs & all statistically significant HCCs (regardless of prevalence)
  - Normal GLM model (estimates in dollars)
    - Same tweaks as above
- Fit models for the entire cohort, then for each of the age strata separately (total of 48 risk adjustment models)

Colonoscopy Episode Risk Adjustment Matrix – Overall Cohort Model

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

Example Colonoscopy Episode Report

Colonoscopy Episode

Report for Physician #24426403

Provider type = Internal Medicine

	MD	Peer Group	Non-Peer Group	National Avg
Episodes	17	8,598	381,993	390,608
Observed Costs*				
Average	$ 776	$ 1,068	$ 1,152	$ 1,150
Min	$ 426	$ 426	$ 426	$ 426
Median	$ 644	$ 888	$ 1,023	$ 1,020
Max	$ 1814	$ 3,365	$ 3,365	$ 3,365
Predicted Costs				
Average	$ 1,156	$ 1,150	$ 1,150	$ 1,150
Min	$ 1,105	$ 1,105	$ 1,105	$ 1,105
Median	$ 1,154	$ 1,141	$ 1,141	$ 1,141
Max	$ 1,284	$ 1,738	$ 2,296	$ 2,296
Observed-to-Expected Ratio				
Average	0.67	0.93	1.00	1.00
Min	0.37	0.29	0.24	0.24
Median	0.58	0.77	0.89	0.89
Max	1.60	3.05	3.05	3.05
% ≥ 2.0	0%	5.5%	6.8%	6.8%
% ≥ 2.5	0%	2.7%	3.2%	3.2%
% ≥ 75th percentile peers	11.8%	(1.5%, 36.4%)		

* Observed costs adjusted for outliers (winsorized)

Notes:
- Uses Model 12

Example Colonoscopy Episode Report

Colonoscopy Episode

Report for Physician #320162519

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)

Notes:
- Uses Model 12

Defining an Episode of Care for Colonoscopy: Work of the High Value Health Care Project Characterizing Episodes and Costs of Care

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KEYWORDS

• Colonoscopy • Resource use • Episode

Numerous studies have indicated that the United States spends significantly more per person on health care than any other nation in the world. Additionally, research has documented significant variation in spending by provider and by region in the United States and that this variation often has little or no correlation with the quality of care provided or with patient outcomes.[1,2] Although reducing health care spending is a central goal of the health care reform debate, clear evidence on the best ways to do so remains out of reach.

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Although documentation of variability in the overall costs of care at regional levels points out that inefficiencies exist in the health care system, it does not provide actionable information on what may be the underlying cause of the differences and how these differences can be reduced. One potential solution is to focus on episode-based resource use and costs so that differences within a particular clinical area can be examined and areas in need of action can be identified. Moreover, episode-based measures may be combined with quality of care measures to provide some insights in identifying efficient care in which quality is high and costs are low. Such information would allow all parties involved (consumers, purchasers, and providers) to better understand how treatment decisions affect the costs and quality of their care. Data gathered from such analyses have the potential to provide clear and actionable information on what components of care can (or should) be reduced and what components of care can (or should) be increased, thereby helping to reduce spending while at the same time maintaining or even improving clinical quality and outcomes.[3,4]

Ideally, in order for a given condition or procedure to be a candidate for an episode-based measure of health care costs, a clear body of evidence that supports the relevant clinical management and treatment decisions should be readily available. The use of colonoscopy in colon cancer screening is one of these areas highly suitable for such episode-based measure development. We have developed an episode-based measure of costs of care associated with screening colonoscopy, and our subsequent analytic findings of the measure suggest that it can serve as a helpful tool for identifying, and potentially addressing, unwarranted variability in resource use related to the performance of such procedures.

Colorectal cancer is one of the most commonly diagnosed cancers in the United States. In 2005, more than 140,000 men and women were diagnosed with colorectal cancer, and approximately 52,000 died from of the condition.[5] Both the Institute of Medicine and the Ambulatory Care Quality Alliance (AQA) have identified colon cancer as 1 of 20 condition-specific priority areas in need of quality improvement, based on its relevance to a considerable volume of patients, its impact on those patients, and the perception of opportunity to significantly improve the quality and efficiency of related care.[6] The complete list of priority condition-specific areas is included as follows.

- Acute Myocardial Infarction
- Angina/Coronary Artery Disease
- Asthma
- Breast Cancer
- Bronchitis
- Chronic Obstructive Pulmonary Disease
- Colon Cancer
- Congestive Heart Failure
- Depression
- Diabetes
- Hiatal Hernia (Gastroesophageal Reflux Disease)
- Hip Fracture
- Hypertension
- Hysterectomy
- Low Back Pain
- Osteoarthritis
- Pneumonia
- Prostate Cancer

- Sinusitis
- Stroke.

Colorectal cancer screening has been shown to reduce colorectal cancer mortality by as much as 60%.[7,8] Although there are a variety of ways to screen for colorectal cancer, the most popular method used today is colonoscopy. This procedure involves the insertion through the rectum of a flexible videoscope, which is then advanced proximally through the entire length of the colon to search for the presence of polyps.[9] Colonoscopy is the preferred colorectal cancer screening strategy of both the American College of Gastroenterology (ACG) and the American Society of Colon and Rectal Surgeons (ASCRS), receiving a Grade 1B recommendation in the ACG's most recent guidelines (issued in 2008).[10] Colon cancer screening is similarly recommended by the US Preventive Services Task Force and has also been identified as a priority area in other national initiatives, including the Health Resources and Services Administration's (HRSA) Health Disparities Collaboratives and the Centers for Medicare and Medicaid Services' (CMS) Quality Improvement Program.[11]

Although the role of colonoscopy in detecting and preventing colon cancer is clear, concerns have been raised in recent years about the overall rising costs of the procedure. These concerns are in part based on the increasing total volume of colonoscopy procedures performed as well as the increasing costs of each individual procedure. In 2003, for example, 30% of eligible women and 32% of eligible men 50 years and older had undergone the procedure.[12,13] The rising costs of each procedure may largely be attributable to increasing costs of ancillary resources that are used. For example, because patient discomfort during the procedure can be considerable, some sort of sedation or anesthesia is typically administered. However, the type of sedation given, whether or not more complete anesthesia should be used, and whether or not sedation is even necessary at all in every circumstance is of some debate. As a result, considerable individual provider discretion is the norm.[14] Furthermore, the procedure has some inherently associated potential complications (eg, bleeding and bowel perforation), and the potential for these complications to occur may also vary depending on the level of sedation. Whereas procedures performed with sedation have higher risks of respiratory depression, falls, and other sedation-related complications, those performed without sedation have higher failure rates in part because of patient discomfort.[15–17]

MEASURING RESOURCE USE AND COSTS OF CARE

Alternative methodologies exist that can be used to measure the resource use associated with a colonoscopic examination and individual health care costs in general. The 2 primary approaches are per-capita measurement and per-episode measurement. Per-capita measurement captures the cumulative health care costs for a given population. Examples of this methodology include measures of total costs per member per month (PMPM) and measures of service use per 1000 patients per year. Although this methodology is relatively easy to implement and interpret, the measures themselves are population-level measures, and accurately establishing and assigning accountability for such population-level measures can be difficult. One reason for this difficulty is the dispersed nature of the medical care that many patients receive. Researchers have found that because many patients see multiple providers for multiple conditions over the course of a given year, assigning meaningful accountability for the total costs of their care can be problematic.[18]

Per-episode measurement quantifies the services involved in the diagnosis, management, and treatment of unique clinical conditions. These measures can

capture the total costs associated with any acute or chronic condition of interest. Episode-based measures can also be more focused and precise—as in the case of the colonoscopy measure we describe later in this article. This particular episode-based measure focuses on the patient's preparation before the colonoscopy, the procedure itself, and any related complications following the procedure. Any postprocedure patient management or treatment that may be related to a newly established diagnosis, however, would not be included here; such patient management or treatment could potentially be included in other measurement efforts. Although significantly more complex to develop than per-capita measures, episode-based measures have the advantage of increased clinical specificity and are potentially much more actionable for providers and consumers.

Although commercial vendors currently offer tools that rely on per-episode measurement structures to generate estimates of physician performance based on cost (most prominently Ingenix's Episode Treatment Groups[19] and Thomson-Reuters' Medical Episode Grouper[20]), early efforts to implement these tools have experienced only limited success. Key issues affecting these implementation efforts have included a lack of transparency in the measurement methodologies, inconsistent or ineffective communication with patients and providers during the implementation process, and provider resistance to cost-of-care measurement in any form.[21]

The High Value Health Care (HVHC) Project, funded by the Robert Wood Johnson Foundation and overseen by the Quality Alliance Steering Committee (QASC), is working to make valid, timely, and consistent information about the quality and cost of health care widely available in the United States through furthering the development and use of a performance measurement infrastructure. One component of this effort specifically focuses on the development of a fully transparent set of cost-of-care measures developed with the input and clinical guidance of key stakeholders (including practicing physicians). The goal of structuring the measure development process in this way is to alleviate many of the concerns providers have expressed about other, less transparent, cost-of-care measurement algorithms, such as the proprietary efforts cited previously.[a]

Under this component of the HVHC project called Characterizing Episodes and Cost of Care (C3), the American Board of Medical Specialties Research and Education Foundation (ABMS REF), in conjunction with The Brookings Institution, undertook the development of episode-based cost-of-care measures for 12 of the most prevalent and important acute and chronic conditions in the United States that were identified by the AQA.[6]

Here, we discuss the process by which an episode-based measure of the costs of care associated with colonoscopy has been developed as part of the C3 project and show some of the effort's preliminary analytic findings.

BUILDING AN EPISODE OF CARE FOR COLONOSCOPY

For each of the 12 high-priority conditions included in the HVHC Project, a group of expert clinicians and other stakeholders was convened for a 2-day in-person meeting followed by a series of teleconference meetings. During the in-person meeting, the workgroup focused initially on conceptually defining one or more important measures for the condition, reaching a broad consensus on the cohort definition (including which patients should be excluded from the measure). Then the work group sought to

[a] More information regarding the HVHC cost-of-care measure development effort can be found here: http://www.healthqualityalliance.org/hvhc-project/cost-care-measurement-development.

identify the services and resource use that were "related" to the clinical condition of interest for each measure. In this context, "related" services and resource use were defined as all of the medical care provided with the intent of treating or managing the clinical condition of interest as well as all of the care involved in the management of any resulting complications. Notably, this definition does not distinguish any care that is appropriate from any care that is not, nor does it distinguish any care that is in compliance with generally accepted clinical treatment guidelines from care that is not. Relative to the colonoscopy episode, "related" resource use consists of all the care pertinent to the performance of the examination (eg, the procedure itself, sedatives and other medications, attendant supervision), any immediate preparations for the procedure (eg, the bowel preparations, other medications), and any pertinent conditions that may arise in the immediate postprocedure period (eg, bowel perforations, bleeding, repeat colonoscopies).

Following the in-person meeting, the concepts were translated into detailed measure specifications for further review by the clinician work groups. The measure specifications were then developed into a series of computer algorithms and tested using a large administrative claims dataset, benchmark statistics from national research organizations, and pertinent information from the clinical literature.[b] The variability of costs across regions and provider specialties associated with the episode or episodes developed through this process was examined to determine whether each measure was effective in identifying unwarranted variation in costs (ie, variation not attributable to underlying variation in patient complexity or morbidity).

Through this process, a measure was developed that focuses on variation in resource use observed in the 22-day period surrounding a screening colonoscopic examination with the clinical input of the colon cancer clinical work group; primarily methodological input was also provided by the C3 Project's Technical Advisory Committee and the QASC's Episodes Workgroup. The measure includes the resources used during a 7-day period preceding the colonoscopy, those used on the day of the examination, and those used during a 14-day period following the procedure. Members of the work group anticipated that some variability might be observed in the measure's resource use across episodes both as a result of the type of colonoscopy performed (eg, no biopsies, biopsies or polypectomies) and as a result of the types of ancillary services used (eg, no sedation, conscious sedation, or general anesthesia). Additional variation might be seen if there were complications (eg, antibiotics and other medications, lab tests, radiographic examinations, corrective surgical procedures) or if there was a need to repeat the colonoscopy examination itself.[22] Work group members felt that such complication-related resource use would most likely be captured during the 2-week period immediately following the procedure.

COLONOSCOPY EPISODE-OF-CARE COHORT DEFINITION

Accurately defining the population of interest is critical to identifying meaningful variation in resource use for any condition's treatment. Although it may seem a straightforward choice to capture all colonoscopies in a given year, this approach

[b] The dataset used for these analyses was the MarketScan Commercial Claims & Encounters Database provided by Thomson Reuters (Healthcare), Inc. The MarketScan data contain claims information for a large population of individuals aged 0 to 64 who were enrolled in a commercial insurance plan during the calendar year 2006 or 2007. In total, the data reflect the health care experience of approximately 15 million covered lives per year. Although all regions of the United States are represented, patients in the database are disproportionately from the South.

can lead to the inclusion of individuals who receive colonoscopies for reasons other than the early detection of colon cancer. Doing so could introduce confounding variability in resource use into the measure. For this and other related reasons, the clinicians participating in the measure development elected to define the colonoscopy measure's eligible population as follows.

Inclusion Criteria

Patients are included in the measure if they had a colonoscopy billed using any of the codes listed in **Table 1** during the 22-day period covered by the episode and if they are 40 years or older at the time of the procedure.[c] As **Table 1** illustrates, CPT code 45378 (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]) accounts for 46% of all colonoscopies in our sample, followed by CPT code 45380 (Colonoscopy, with biopsy, single or multiple) which represents 28% of colonoscopies in our sample. Of the remaining types of colonoscopy, only CPT 45385 (Colonoscopy with removal of tumor[s], polyp[s], or other lesion[s] by snare techniques) accounts for more than 10% of cases.

Table 1
Frequency of triggering colonoscopy codes for colonoscopy episode of care

Description	CPT/HCPCS	Frequency	Percent
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	368,860	46%
Colonoscopy, with biopsy, single or multiple	45380	220,663	28%
Colonoscopy, 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	12,259	2%
Colonoscopy, with removal of tumor(s), polyp(s), or other lesion(s) by hot biopsy or forceps or bipolar cautery	45384	51,448	6%
Colonoscopy, with removal of tumor(s), polyp(s), or other lesion(s) by snare techniques	45385	121,146	15%
Colorectal cancer screening; colonoscopy on individual at high risk	G0105	8,125	1%
Colorectal cancer screening; colonoscopy on individual not meeting criteria for high risk	G0121	15,845	2%
Total		798,346	100%

The data presented precede exclusions for methodological or clinical reasons.

[c] We acknowledge that the existing clinical guidelines for colonoscopy recommend screening only for those aged 50 years and older (45 years for African Americans); however, it was the opinion of the clinical expert panel that there are many patients who undergo screening before age 50, usually because of a family history of colon cancer. Additionally, resource use for colonoscopy was not expected to differ significantly by age.

Although **Table 1** illustrates the total number of colonoscopies that can be identified in our data, a number of exclusions need to be made to reach a final analytic sample. These exclusions are made both for methodological and clinical reasons.

Methodological Exclusion Criteria

Because of the fragmented nature of health insurance coverage in the United States, many people, including those with commercial insurance and those with Medicaid coverage, can experience frequent changes in health insurance status. These changes can occur for reasons such as an employment change or, in the case of Medicaid, a loss of eligibility, which is generally calculated on a month-to-month basis. These breaks in coverage pose a major challenge from a measurement perspective because noncontinuous health insurance coverage leads to missing data, making it impossible to accurately calculate either quality- or cost-of-care measures in this population. For example, suppose an individual with diabetes has insurance coverage from January to June of a given year and is uninsured from July to December. In this case, any performance measure spanning more than a 6-month time period will have insufficient data for calculation. Likewise, patients are excluded from the HVHC colonoscopy measure if they did not have medical and prescription drug coverage throughout the measurement window.

Clinical Exclusion Criteria

As discussed previously, one of the key goals of cost-of-care measurement is to quantify and assess *unwarranted* variation in costs. As such, it is important to identify a relatively homogeneous population to which the measure is most applicable and that will not have systematically different health care use because of coexisting conditions. Therefore, active cancer, end-stage renal disease (ESRD), organ transplantation, and HIV/AIDS are routinely used as exclusion criteria for many quality and cost-of-care measures (like the National Committee for Quality Assurance's [NCQA's] Healthcare Effectiveness Data and Information Set [HEDIS] measures, as noted in **Fig. 1**) because of the impact these conditions have on patients' health care use overall. In addition, the colon cancer clinical work group recommended the exclusion of patients with ulcerative colitis, Crohn's disease, or inflammatory bowel disease from the measure because these conditions can lead to colonoscopy procedures that would not be done for colorectal cancer screening. These conditions have different known health care resource use patterns associated with colonoscopy as compared with the general population at large.

Fig. 1 details the impact of the exclusion criteria on the eligible cohort. Although **Fig. 1** identifies almost 800,000 colonoscopies that can be identified during the approximately 11-month identification period[d] using eligible colonoscopy codes, 44% are excluded because of insufficient medical or prescription drug coverage, reducing the number of eligible colonoscopies to slightly less than 450,000.[e] Clinical and demographic exclusions further result in the attrition of an additional 57,126

[d] The term "identification period" refers to the period of time during which sufficient data are available both beforehand and afterward to compute the measure using the 2 years of data available for the effort's testing and validation purposes. For the colonoscopy episode, the identification period is January 8, 2007, to December 17, 2007.

[e] It should be noted that requiring 2 years of continuous medical and prescription drug coverage may seem an excessive requirement for a measure of 22 days' duration and unnecessarily limits sample size. We intend to test the sensitivity of our measure results to relaxing the continuous coverage criteria before the conclusion of the project, but for consistency with other measures of a longer duration, we have imposed the same continuous coverage criteria across all measures.

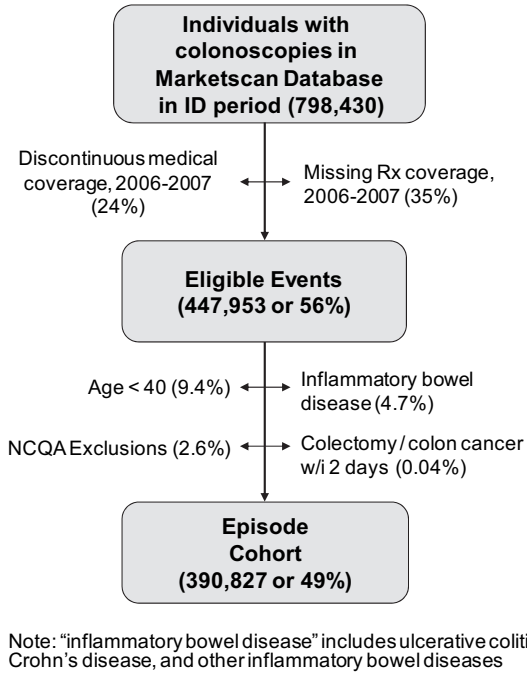

Fig. 1. Number of colonoscopies in a large claims dataset.

colonoscopies. The final analytic sample consists of 390,827 colonoscopies. Of the clinical and demographic exclusions, those with the largest impact on the measure's denominator are based on age and the presence of inflammatory bowel disease (see **Fig. 1**).

CAPTURING RESOURCE USE RELATED TO COLONOSCOPY

As discussed previously, a key distinguishing characteristic of episode-based measurement methodologies is that they define "related" resource use for a given denominator population over a defined time period. In the case of the colonoscopy measure defined through our process, related resource use and costs are identified in the 7 days before the colonoscopy and in the 14 days following a colonoscopy.

There are several strategies for capturing related resource use for a given condition. The most commonly used strategy is to analyze claims data for occurrences of specific ICD-9 codes that are deemed to be clinically related to the episode of care. For example, the codes for unspecified gastrointestinal hemorrhage (ICD-9 578.9), perforation of the intestine (ICD-9 569.83), and abdominal pain (ICD-9 789.x) were all judged to be clinically related to a colonoscopy, provided they occurred within the episode's measurement window.[f]

[f] For a complete list of ICD-9 codes specified as related to colonoscopy, please refer to the measure specification available at the Web site of the Quality Alliance Steering Committee: http://www.healthqualityalliance.org/.

Once all clinically related resource use has been identified, each service is allocated a standard price to ensure that observed differences are a result of variability in provider practice patterns and resource use and are not a result of variations attributable to regional differences in the cost of living or contracted pricing differences.[g] With standard prices applied, all colonoscopy episodes in the sample can be analyzed and compared to see if there is meaningful variation in resource use across episodes and, if so, what specific services drive the observed variations in episode costs.

RESULTS

Table 2 details resource use by type of service for episodes of colonoscopy as calculated using the 2007 MarketScan database. Resource use is broken out into its component parts (ie, by type of service): inpatient facility, outpatient facility, evaluation and management services (E&M), imaging, procedures, tests, prescription drugs, durable medical equipment (DME), and "other services."[h] **Table 2** also details the distribution of costs for each type of service. Average standardized costs for colonoscopy-related services in 2007 were $1192. Unsurprisingly, the 2 dominant type-of-service categories were procedures and outpatient facility costs, comprising 55% and 30% of total colonoscopy episode resource use, respectively. Of the remaining categories of service, only laboratory tests (8%) account for more than 3% of total episode costs.

To evaluate the variability in resource use seen in the colonoscopy episode, we observe that the measure's coefficient of variation is 84% of 85%. As such, compared with episodes of care that have been developed for many other conditions,[i] the overall variation in resource use for episodes of colonoscopy is actually quite modest. However, more significant variability can be observed above the median in per-episode resource use. For example, resource use is 22% higher than the mean ($1455 vs $1192) at the 75th percentile and is 70% higher at the 90th percentile.

Table 3 illustrates the most commonly appearing procedures during these colonoscopy episodes. Among the procedures occurring during these episodes, most are very much as expected, given the codes used to capture colonoscopies for the episode denominator initially. The significance of the anesthesia costs are noteworthy, as are the relatively infrequent but expensive cardiovascular procedures, likely related to complications of the colonoscopy procedure.

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[g] Standard prices were derived for professional services by calculating mean per-unit costs across all unique Healthcare Common Procedure Coding System (HCPCS) codes and HCPCS modifiers within the MarketScan dataset. Similarly, standard prices for drugs were derived by calculating mean per-day-supply costs within the MarketScan dataset. For inpatient facility costs, the standard prices were based on CMS' per diem costs for each diagnosis-related group (DRG), which were multiplied by the hospital admission's length of stay.

[h] In part, we assign services to type of services categories using the Berenson-Eggers Type of Service (BETOS) Classification system. For more information on the BETOS classification system please refer to http://www.cms.hhs.gov/hcpcsreleasecodesets/20_betos.asp.

[i] The HVHC episodes of asthma (1-year measure of costs associated with the management of asthma), coronary artery disease postrevascularization (1-year management of coronary artery disease following a coronary artery bypass graft [CABG] or percutaneous coronary intervention [PCI] procedure), low back pain with radiculopathy (3-month episode following an office visit with a radiculopathy diagnosis), and community-acquired pneumonia hospitalizations (2-week episode with the patient admitted for pneumonia) saw preliminary median-to-mean cost ratios of 264%, 110%, 263%, and 130%, respectively. Additional information about these other measures is available on the Web site of the Quality Alliance Steering Committee: http://www.healthqualityalliance.org.

Table 2
Distribution of resource use for colonoscopies, by type of service

Description	Mean Costs per Episode	Percent of Total	5th Percentile	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	95th Percentile
Procedures	$658	55.2%	$426	$426	$426	$516	$852	$1056	$1243
Outpatient facility	$359	30.1%	$0	$0	$0	$0	$589	$1077	$1511
Tests	$97	8.1%	$0	$0	$0	$50	$109	$267	$356
Imaging	$25	2.1%	$0	$0	$0	$0	$0	$0	$160
Inpatient facility	$20	1.7%	$0	$0	$0	$0	$0	$0	$0
Drug costs	$16	1.4%	$0	$0	$0	$0	$26	$45	$57
Evaluation and management	$15	1.2%	$0	$0	$0	$0	$0	$0	$65
Other services	$2	0.2%	$0	$0	$0	$0	$0	$0	$0
Durable medical equipment	$0	0.0%	$0	$0	$0	$0	$0	$0	$0
Unclassified	$0	0.0%	$0	$0	$0	$0	$0	$0	$0
Total costs	$1192	100.0%	$426	$426	$625	$1020	$1455	$2030	$2519

Table 3
Frequently occurring procedures for in an episode of colonoscopy

Procedure Code	Description	Total Services	Total Costs
45378	Diagnostic colonoscopy	199,524	$86,805,751
45385	Colonoscopy with removal of tumor, polyp, or lesion by snare technique	81,766	$47,876,659
00810	Anesthesia for lower intestinal endoscopic procedures	120,210	$47,816,403
45380	Colonoscopy with biopsy, single or multiple	94,300	$45,421,491
45384	Colonoscopy with removal of tumor, polyp, or lesion by hot biopsy forceps	31,378	$15,849,063
45383	Colonoscopy with ablation of tumor, polyp, or lesion	7687	$4,483,847
G0105	Colonoscopy on individual at high risk	5001	$1,968,175
43239	Upper GI endoscopy with biopsy, single or multiple	6508	$1,938,227
00902	Anesthesia for anorectal procedure	2790	$1,362,812
00740	Anesthesia for upper IG procedure	1969	$851,864
43235	Diagnostic upper GI endoscopy	2229	$612,813
99144	Moderate sedation services	1029	$114,119
00790	Anesthesia for intraperitoneal procedures in upper abdomen	123	$106,387
00840	Anesthesia for intraperitoneal procedures in lower abdomen	129	$105,431
45382	Colonoscopy with control of bleeding	156	$89,291
44140	Colectomy, partial, with anastomosis	38	$69,036
93510	Left heart catheterization, percutaneous	151	$68,437
92980	Transcatheter placement of an intracoronary stent	38	$51,744
33533	Coronary artery bypass, single arterial graft	21	$42,544
46934	Destruction of hemorrhoids, any method	119	$42,176
Total		559,372	$257,025,768

Approximately three-fourths of the episodes in the final denominator (288,603) showed no claims associated with anesthesia on the date of the colonoscopy, and one-fourth (100,585) showed at least 1 claim associated with general anesthesia on that date.[j] **Table 4** presents resource use by type of service for episodes in these 2 groups, with the costs of anesthesia services and conscious sedation services separated out from the procedures category as presented in **Table 2**. On average, episodes with general anesthesia have 42% higher total costs than episodes with no anesthesia services provided on the day of the colonoscopy ($1523 vs $1075, respectively). Aside from the costs of the anesthesia services themselves, however,

[j] The remaining 1420 episodes showed evidence of conscious sedation only during the procedure. This group's resource use was not included in **Table 4** because of its comparatively small sample size.

Table 4
Variation in resource use for colonoscopies, by level of anesthesia

	No Anesthesia		General Anesthesia	
Description	Mean Costs per Episode	Percent of Total	Mean Costs per Episode	Percent of Total
Procedures	$538	50.1%	$513	33.7%
Outpatient facility	$361	33.6%	$347	22.8%
General anesthesia[a]	$2	0.2%	$485	31.9%
Tests	$96	8.9%	$100	6.5%
Imaging	$25	2.3%	$25	1.7%
Inpatient facility	$20	1.9%	$18	1.2%
Drug costs	$16	1.5%	$17	1.1%
Evaluation and management	$15	1.4%	$13	0.9%
Other services	$2	0.2%	$3	0.2%
Durable medical equipment	$0	0.0%	$1	0.0%
Unclassified	$0	0.0%	$0	0.0%
Conscious sedation	$0	0.0%	$0	0.0%
Total costs	$1075	100.0%	$1523	100.0%

[a] "General Anesthesia" group identified based on the presence of general anesthesia services on the date of the colonoscopy defining the episode's measurement window. Other general anesthesia services rendered on other dates within the measurement window (ie, for repeat colonoscopies or other related procedures) may still be captured as related to the episode; hence, the $2 of general anesthesia services captured for the "No Anesthesia" group's episodes, on average.

average costs are not materially different between the 2 groups across the other types of service provided.

DISCUSSION

We have developed an initial measure specification to examine resource use associated with a colonoscopy episode. The measure was developed through a consensus process that included the representation of key clinical stakeholders who are actively involved in colorectal cancer screening and treatment. The measure includes resource use related to the procedure itself, as well as the pertinent resource use both related to preparations in advance of the procedure and related to any complications that may result. When testing the measure in a commercially insured population, we found that the average cost of a colonoscopy episode was just under $1200 and that the predominating contributing elements were the procedure costs ($658 or 55.2%) and outpatient facility costs ($359 or 30.1%).

The work group suspected that the use of general anesthesia might be a major factor in differentiating overall resource use in the colonoscopy episode cost of care measure. We found that approximately one-fourth of colonoscopies done were performed with the use of general anesthesia. The cost of these episodes was $448 (42%) higher than those where anesthesia services were not provided as part of the procedure. Although the use of anesthesia may make patients undergoing colonoscopy more comfortable, currently there are no evidence-based guidelines that indicate colonoscopy should be performed under general anesthesia for most of the population. Additionally, there are no data that suggest the use of general anesthesia

is associated with better outcomes. From the perspective of the health care system, the use of general anesthesia for colonoscopy may represent an inefficient use of resources if the costs of the episode are higher with no difference in the rates of complications. One question for future study may be whether or not patients would be willing to pay out of pocket for the additional cost of general anesthesia if they believed that it would increase the comfort of having the procedure done.

As noted earlier, the variability in costs observed in the colonoscopy episode is generally less than the variability we have observed in many of the C3 project's other episodes. One factor contributing to this lack of variation is the relatively short duration of the colonoscopy episode—the episode lasts only 22 days. Another is the relative infrequency of complications. However, there is clearly a meaningful difference in the costs between those episodes that use general anesthesia and those episodes that do not. Additionally, because episode costs are 22% higher than the mean ($1455 vs $1192) at the 75th percentile and 70% higher at the 90th percentile, there may be factors other than use of general anesthesia that are associated with higher episode costs. Therefore, this measure may provide additional actionable information if the costs of colonoscopies rendered by a particular provider or group of providers are significantly higher than those of their peer group. Also, despite the relatively low overall level of variability in this episode, it is important to note that because the volume of these procedures nationwide is so significant, even smaller levels of variability are associated with significant potentially unwarranted health care spending.

Two key strengths of this measure, and the development of such episode-based measures in general through the C3 project, are the transparency of the process through which the measures are developed and the use of input from key stakeholders throughout. By contrast, when considering many of the current episode grouping software available commercially, it is not clear what defines an episode or what resource use is assigned to that episode. One objective of this project was to make it clear to the measures' end users exactly what resources were being counted when calculating each episode's costs. This transparency can ultimately help improve the acceptability of the measure by all stakeholder groups.

As stated earlier, a real strength of the project that affects the ultimate acceptability of the measure is the involvement of key stakeholders. The colonoscopy work group was composed of clinicians nominated by professional societies, health plan representatives, and measurement experts. The fact that the measure was developed through a consensus process involving each of these key stakeholders provides for a measure that is meaningful and balanced from both the provider and health plan perspectives. This may ultimately affect the acceptability of the measures in both the physician and payer communities given that they will have a clear understanding of the measure's development process and that their interests were represented throughout the process.

There are a few limitations with our measure that should be noted. First, we require only a 1-year period in which a patient had not received a colonoscopy for the patient to be included in the measure. The HEDIS measure for colorectal cancer screening uses a 10-year look-back period in accordance with screening recommendations. We are unable to look back that far because of data constraints, noting that most users of these measures would likewise be unable to look back for colon cancer screening over a 10-year period. Therefore, patients included in this measure may be those having a colonoscopy for a reason other than a colorectal cancer screening, as they may have had a screening in the past 10 years. However, this measure is aimed at the resource use associated with the colonoscopy and therefore whether

or not a previous colon cancer screening was performed may be of less importance than it is with a colorectal cancer screening quality measure.

As with all episode-based measures that use administrative data, we rely on ICD-9, CPT, and other similar codes to identify related services during the episode's measurement window. Therefore, differences in coding practices or coding errors can affect the resources that are included as part of this measure. Our measure is based on inclusion of resource use from a list of related codes and does not exclude any resource use based on the presence of ICD-9 or CPT codes. Therefore, it is possible that a claim will be included in the resource use for an episode if an eligible diagnosis code shows up in any position on the claim regardless of what the procedure or event is associated with the claim. This situation could result in some unrelated resource use being grouped as related. Similarly, it is possible that some resource use (for example a specific procedure) will not group to the episode in some claims and will group with others because of the diagnosis codes on the claim. We would anticipate that this is generally random variability added to the measure and would not result in any systematic differences in resource use.

The findings presented here are based on resource use and practice patterns in 2007; recent decisions by payers relative to the use of anesthesia may result in different findings if the analysis were repeated on a more recent dataset. The results are also not risk adjusted and describe initial findings used in development of the measure specification. Finally, because the goal of this article was to describe the process used for the development of a colonoscopy resource use measure, provide a description of the measure, and present initial findings from the development phase of the project, findings from this article may change as the measure undergoes further refinement and testing.

SUMMARY

Working with a group of key stakeholders, we have developed an episode-based resource use measure focused on the use of colonoscopy. This measure is intended to identify differences in health care resource use in a short time frame surrounding the colonoscopy. It was a goal of this effort to develop a resource use measure that would provide actionable information for the health care community. Although this measure focuses strictly on resource use, it was the ultimate intent in the development of this measure to pair it with a measure of quality so that both the cost and quality of care can be evaluated together. In our initial testing of the episode, we found the use of general anesthesia with colonoscopy to be associated with higher episode costs. It will be important to continue to evaluate the performance of the episode measure in a variety of datasets and populations. Eventually, when paired with quality measures, it is hoped this measure will provide actionable information for health care payers and providers to more efficiently provide colonoscopy services without compromising quality.

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