An Assessment of the AGA and CCFA Quality Indicators in a Sample of Patients Diagnosed with Inflammatory Bowel Disease

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ABSTRACT

BACKGROUND: Inflammatory bowel disease (IBD) is a chronic relapsing disease characterized by activation of the mucosal immune system and inflammation of the gastrointestinal tract. Management of IBD places a significant burden on the health care system because of the complexity of treatment, variability in patient outcomes, and chronic nature of the disease.

OBJECTIVE: To investigate the American Gastroenterological Association (AGA) and Crohn's and Colitis Foundation of America's (CCFA) quality measurement sets in a sample of IBD patients.

METHODS: Fourteen quality measures were restated for application to a claims database and calculated using Optum Clinformatics DataMart database. Selected measures were calculated over calendar year 2011.

RESULTS: Performance measures ranged from 0.4% for AGA measure 9, prophylaxis for venous thromboembolism, to 66.9% for AGA measure 8, testing for *Clostridium difficile*. CCFA outcome measures ranged from 0.6% qualifying for CCFA 010, report of fecal incontinence, to 32.9% for CCFA 01, prednisone usage. In addition to *Clostridium difficile* testing, the use of appropriate corticosteroid-sparing therapy (51.1%) and testing for latent tuberculosis before initiating anti-tumor necrosis factor therapy (45.0%) were the highest achieved measures.

CONCLUSIONS: This is the first examination of IBD quality measures using administrative claims. Rates of achievement across measures were variable and likely affected by the ability to calculate certain measures with claims data. Future studies should further examine measurement of IBD quality indicators in claims data to assess the validity of claims-based analyses and to ascertain whether measure attainment translates into better overall health or IBD-related outcomes.

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- Because of the lack of available quality metrics and ongoing measurement, the quality of IBD care remains unknown and/or variable; consequently, the American Gastroenterological Association (AGA) and Crohn's and Colitis Foundation of America (CCFA) have released quality measure sets designed to improve the quality of IBD care.

What this study adds

- This study investigated the rate of achievement for 2 sets of quality measures in a national sample of commercially insured patients diagnosed with IBD.
- This is the first known examination of the AGA and CCFA quality measures assessed through administrative claims data.
- Rates of measure achievement were highly variable and ranged from 0.4% to 66.9%, with some measures achieving at lower than expected rates; these low rates are likely a reflection of the inherent difficulty and limitations using administrative claims data to calculate these measures.

Inflammatory bowel disease (IBD) is a complex group of autoimmune disorders characterized by chronic activation of the mucosal immune system and inflammation of the gastrointestinal tract.¹ Ulcerative colitis (UC), which affects the colon and rectum, and Crohn's disease (CD), which can affect any portion of the gastrointestinal tract, are the 2 primary diagnoses of IBD.² A disease previously found mostly in Westernized nations, IBD is becoming more prominent in developing nations and is increasing in incidence and prevalence worldwide.³ In the United States alone, there are approximately 1 million prevalent cases of IBD, with 30,000 incident cases annually.^{4,5} The chronic inflammatory cascade present in IBD leads to tissue damage, loss of barrier function in the gut epithelium, and disease progression.¹ The etiology of IBD remains unknown, but environmental, genetic, and epigenetic factors play a role in susceptibility and disease severity.⁶⁻⁹

IBD is a chronic relapsing and remitting disease; therefore, treatment efforts are aimed at achieving prolonged periods of remission.¹⁰⁻¹² Rates of remission differ between CD and UC and are impacted by medication regimens and patient-specific factors.¹³⁻¹⁵ Relapse from a state of remission is also more likely with extended periods of time off treatment.¹⁴ It is estimated that approximately 50% of IBD patients are in remission at any

What is already known about this subject

- Inflammatory bowel disease (IBD) is becoming more prominent in developing nations and is increasing in incidence and prevalence worldwide.
- IBD patients incur 3- to 5-fold higher annual medical costs than individuals not suffering from IBD; in 2008, this cost augmentation translated to over \$6 billion in medical costs for IBD patients in the United States.

time, but 1% of UC and 25% of CD patients exhibit continuously active disease.^{16,17} Because of the lifelong nature of this disease and the relatively young age of onset, treatment for IBD can place a significant burden on the health care system.¹⁸ IBD patients incur 3- to 5-fold higher annual medical costs than individuals not suffering from IBD.^{19,20} In 2008, this cost augmentation translated to over \$6 billion in medical costs for IBD patients in the United States.¹⁹ The indirect cost burden of IBD is substantial and mainly accounted for by the inability to maintain employment and by reduced psychological well being.^{18,21} Only one third of IBD patients with active symptoms in the preceding year report being part of the labor force; indirect costs due to lost time in the workforce are estimated to amount to over \$5.5 billion.^{22,23} Even by more conservative estimates, the indirect costs are still substantial and account for an additional loss of \$738 per capita for IBD patients, leading to total indirect costs of \$249 million.²⁴

Increased quality in health care, through initiation of proper treatment pathways and proper monitoring of patient health and well being, can result in better control of IBD symptoms and disease progression, leading to increased quality of life and reduced costs.^{18,25,26} In the case of IBD, the difficulty of diagnosis, range of symptoms, chronic nature, and potential for severe complications are factors that complicate treatment strategies and affect the rate of positive outcomes.^{27,28} Because chronic illnesses such as IBD are lifelong and require increased use of health care services, outcomes are likely to be affected by health care quality. Defined treatment and quality outcome measures resulting in standardized initial treatment pathways could improve the standard of care for IBD patients and subsequently reduce burden to both payer and patient by controlling the course of disease. Since control of IBD can be dependent on maintenance treatments, consideration of patient preference in the treatment pathway is warranted.²⁹ In IBD, as in other chronic diseases, increased rates of patient adherence have been shown to be related to better disease management and improved patient outcomes.²⁵ Increased physician-patient joint decision making, as well as proper patient treatment, could also improve the quality of patient care and reduce overall health care costs for IBD patients.³⁰⁻³³

Medical associations nationwide are responding to the need for more standardized treatment measures for chronic diseases. To date, 2 unique sets of metrics have been developed that focus on the assessment of IBD treatment quality. In 2011, the American Gastroenterology Association (AGA) published a set of 10 clinical performance measures using the Physician Consortium for Performance Improvement model.³⁴ Additionally, the Crohn's and Colitis Foundation of America (CCFA) outlined 20 performance- and outcome-quality indicators in a 2013 special Clinical Guidelines article appearing in the journal *Gastroenterology and Hepatology*.²⁷ The CCFA measures were developed from the RAND Appropriateness Panel

methodology and were designed to assess therapeutic optimization, patient safety, remission, and quality of life.

Although these measures have been established, their impact on the quality of care received by IBD patients remains unknown. The impact of these measures on patient treatment quality is inextricably tied to the use of these measures by prescribing physicians. Further, measurement of quality in health care requires continuous measurement and assessment, necessitating establishment of intensive quality programs. Because administrative claims are a continuously updated source of medical information, they could be an asset in quality assessment; indeed, some measures, such as the Healthcare Effectiveness Data and Information Set measures, are designed for administrative claims. Therefore, the goal of this study was to define and calculate several of the AGA and CCFA quality measures with an administrative claims database to determine the feasibility of quality assessment in IBD through claims signatures. The rates of measure qualification by IBD patients are presented, as well as an assessment of the ability to calculate measures using claims.

Methods

Data Source

Study data were derived from the Optum Clinformatics DataMart database (Optuminsight Clinformatics, Eden Prairie, MN). Medical, pharmacy, and laboratory claims for members with an *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis of IBD (555.x,556.x) during calendar years 2008 through 2012 were extracted. The AGA and CCFA quality measure sets were assessed for IBD patients during the calendar year 2011. All data were void of identifying information in compliance with the Health Insurance Portability and Accountability Act of 1996. Therefore, institutional review board approval was unnecessary for this study. Regardless, all work was carried out in accordance with The Code of Ethics of the World Medical Association.

AGA Quality Measures

The calculation of AGA measures using administrative claims required the computation of, at a minimum, the following 2 components³⁴:

1. *Denominator statement.* For each measure, the denominator consisted of the number of patients aged over 18 years with an ICD-9-CM diagnosis of IBD during the calendar year (measures #8 and #10 require an additional code for hospitalization) and a procedure code for an outpatient visit.
2. *Numerator statement.* The numerator for each measure contained a Category II Current Procedural Terminology (CPT) code designed to track a specific component of quality patient care.

A portion of the measures had additional numerator and denominator exclusions, which were dependent on the specific aspects of treatment being assessed. Each AGA measure is designed to be calculated over the course of a calendar year; therefore, continuous, annual eligibility was imposed on all members for inclusion in analyses of these measures. As previously stated, denominator statements required multiple specifications, typically a CPT code *and* an ICD-9-CM diagnosis code; patients only qualified for these measures if the relevant codes appeared on the same claim line. Table 1 presents the list of AGA quality measures. Detailed measure definitions and claims logic may be found in the performance measurement guidance document online via the AGA website.³⁴

CCFA Quality Measures

The CCFA indicators were designed for measurement via electronic medical records. Ten process and 10 outcome measures were developed. The list of CCFA quality measures also may be viewed in Table 1. For the detailed methodology underlying the development of these indicators, see Melmed and Siegel (2013).²⁷ To be consistent with the AGA measure logic, CCFA outcomes were assessed only in those members aged more than 18 years.

Quality Measure Application to Claims Data

Neither of the 2 performance measurement sets were optimized to be calculated with administrative claims data. The requirement for Category II CPT codes, officially defined as “optional” performance measurement codes, was the primary limitation of the AGA set, which otherwise did include some information for administrative claims-based calculation. The CCFA set lacked standardized definitions and rules for administrative claims calculation. Therefore, the 2 quality measure sets were restated for application to claims data. The first step in this process involved the identification of AGA and CCFA metrics that overlapped in content, in which cases the AGA measures were adopted, since these measures included some logic for claims-based administration. Six of the CCFA performance measures (P1-P3, P5, P9-P10) were deemed similar in scope to 7 of the AGA measures (2, 4-8, 10; Table 1). These 7 AGA measures were then reexamined for applicability to a claims dataset. The remaining nonmatching AGA and CCFA measures were also reexamined for claims feasibility. In total, 6 of the AGA measures (3-8) were redefined with commonly used CPT and ICD-9-CM diagnosis codes in place of the seldom-used CPT Category II codes, with 4 measures (1-2, 9-10) being deemed possible to calculate with administrative claims (Table 1). Regarding the CCFA measures, as previously stated, 6 of these measures were absorbed by the similar AGA measures, and 9 additional measures were successfully redefined (P6, O1b, O3-O6, O8-O10; Table 1). One other measure (P7) was deemed possible for use with administrative claims

data; the remaining 5 measures (P4, P8, O1a, O2, and O7) were dropped. Overall, 7 of the 10 AGA quality measures, 6 CCFA outcome measures, and a single CCFA performance measure were assessed in the current study. The final subset of the AGA and CCFA measures used in the current study are identified in Table 1. A completed list of updated CPT codes, ICD-9-CM codes, and other measurement adjustments applied to both measurement sets are shown in the Appendix (available in the online article).

Patient Characteristics

In addition to quality metrics, patient demographics were summarized from the membership table. Demographics reported included age, gender, geographic region of residence, insurance line of business, and type of benefit plan. Additionally, the Charlson Comorbidity Index, an overall measure of health,³⁵ was calculated during the measurement year, as were the rates for a variety of other comorbidities of interest. Given that each quality measure contains specific inclusion and exclusion criteria which resulted in the creation of a unique sample for each measure, analyses of demographics included all members meeting the age and IBD diagnosis inclusion criteria during the measurement year.

Analyses

Descriptive statistics were reported for all demographic measures, including means and standard deviations (SDs) for scale variables and frequencies and proportions for categorical variables. For each of the AGA and CCFA metrics, numerator and denominator frequencies were reported. All data management and analyses were conducted using SPSS version 20 (SPSS Inc., Chicago, IL).

Results

The IBD sample characteristics are presented in Table 2. Approximately 53% of the sample was female, with a mean age of 45.1 years (SD=13.8). The majority of members were residents of the southeastern (34.6%) and Mid-American (38.5%) regions of the United States, with the remaining members split between the Northeast (12.7%) and the West (14.2%). Almost all members were commercially insured (>99.9%). Of this sample, a minority of members (16.9%) were treated with a biologic (infliximab, adalimumab, or certolizumab). The most common comorbidities were disorders of lipid metabolism, hypertension, and osteoarthritis.

AGA and CCFA measure achievement are indicated in Table 3. Overall, there was a large degree of variability in measurement achievement, likely due to inconsistencies in how many of these services are billed. The performance measures ranged from 0.4% for AGA measure 9, prophylaxis for venous thromboembolism, to 66.9% for AGA measure 8, testing for *Clostridium difficile* (*C. difficile*). The CCFA outcome measures

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TABLE 1 Quality Measures

Measure Designation	Measure Concept	AGA Measure	CCFA Measure	Ability to Assess in Claims
AGA Measures				
Measure #1	IBD: type, anatomic location, and activity all assessed	X		Activity assessed is not available in claims
Measure #2	IBD preventive care: corticosteroid-sparing therapy	X		*
Measure #3	IBD preventive care: corticosteroid-related iatrogenic injury, bone loss assessment	X		*
Measure #4	IBD preventive care: influenza immunization	X	X	*
Measure #5	IBD preventive care: pneumococcal immunization	X	X	Dosing schedule is not consistent with data extraction period
Measure #6	Testing for latent TB before initiating anti-TNF therapy	X	X	*
Measure #7	Assessment of hepatitis B virus before initiating anti-TNF therapy	X	X	*
Measure #8	Testing for <i>Clostridium difficile</i> , inpatient measure	X	X	*
Measure #9	Prophylaxis for venous thromboembolism, inpatient measure	X		*
Measure #10	IBD preventive care: tobacco user, screening and cessation intervention	X	X	Tobacco cessation therapy is not usually coded in claims
CCFA Measures				
Measure P1	IF a patient with IBD is initiating anti-TNF therapy, THEN TB risk assessment should be documented, and tuberculin skin testing or interferon gamma release assay should be performed	X	X	Overlap with AGA measure
Measure P2	IF a patient with IBD is initiating therapy with anti-TNF, THEN risk assessment for hepatitis B virus should be documented	X	X	Overlap with AGA measure
Measure P3	IF a patient with IBD requires at least 10 mg prednisone (or equivalent) for 16 weeks or longer, THEN an appropriately dosed steroid-sparing agent or operation should be recommended	X	X	Overlap with AGA measure
Measure P4	IF a hospitalized patient with severe colitis is not improving on intravenous steroids within 3 days, THEN sigmoidoscopy with biopsy should be performed to exclude cytomegalovirus, AND surgical consultation should be obtained		X	Improvement cannot be assessed in claims other than by proxy
Measure P5	IF a patient in whom a flare of IBD is suspected with new or worsening diarrhea, THEN the patient should undergo <i>Clostridium difficile</i> testing at least once	X	X	Overlap with AGA measure
Measure P6	IF a patient with IBD is initiating 6 MP/AZA, THEN TPMT testing should be performed before starting therapy		X	*
Measure P7	IF a patient with ulcerative colitis is found to have confirmed low-grade dysplasia in flat mucosa, THEN proctocolectomy or repeat surveillance within 6 months should be offered		X	Offers are not coded in claims
Measure P8	IF a patient with extensive ulcerative colitis or Crohn's disease involving the colon has had disease for 8 to 10 years, THEN surveillance colonoscopy should be performed every 1 to 3 years		X	1- to 3-year follow-up duration too long for data extraction
Measure P9	IF a patient with IBD is on immunosuppressive therapy, THEN patients should be educated about appropriate vaccinations, including (1) annual inactivated influenza, (2) pneumococcal vaccination with a 5-year booster, and (3) general avoidance of live virus vaccines	X	X	Overlap with AGA measures
Measure P10	IF a patient with Crohn's disease is an active tobacco smoker, THEN smoking cessation should be recommended, and treatment should be offered or suitable referral provided at least annually	X	X	Tobacco cessation therapy is not usually coded in claims
Measure O1A	Steroid use: proportion of patients with steroid-free clinical remission for > 12 month period		X	Remission cannot be assessed in claims other than by proxy
Measure O1B	Steroid use: proportion of patients currently taking prednisone (excluding those diagnosed within the last 112 days)		X	*
Measure O2	Number of days per month/year lost from school/work attributable to IBD		X	Indirect data is not available in claims
Measure O3	Number of days per year in the hospital attributable to IBD		X	*
Measure O4	Number of emergency room visits per year for IBD		X	*
Measure O5	Proportion of patients with malnutrition		X	Malnutrition is not usually coded in claims
Measure O6	Proportion of patients with anemia		X	*
Measure O7	Proportion of patients with normal disease-targeted health-related quality of life		X	Quality of life is not available in claims
Measure O8	Proportion of patients currently taking narcotic analgesics		X	*
Measure O9	Proportion of patients with nighttime BMs or leakage		X	Nocturnal occurrence is not stated in claims
Measure O10	Proportion of patients with incontinence in the last month		X	*

Note: The * symbol indicates that the measure is included in this study.

AGA = American Gastroenterological Association; BM = bowel movement; CCFA = Crohn's and Colitis Foundation of America; IBD = irritable bowel disease; mg = milligram; TB = tuberculosis; TNF = tumor necrosis factor; TPMT = thiopurine methyltransferase; 6 MP/AZA = 6-mercaptopurine and azathioprine.

TABLE 2 Sample Characteristics During Measurement Year

	N=22,699	
	Mean/Frequency	SD or %
Demographics		
Female	11,963	52.7
Age	45.1	13.8 (SD)
Geographic region		
Mid-American	8,729	38.5
Northeast	2,883	12.7
Southeast	7,848	34.6
West	3,233	14.2
Benefit plan type		
Commercial	22,696	100.0
Medicare/Medicaid	3	0.0
Treatment		
Treated with a biologic	3,829	16.9
Infliximab	1,788	7.9
Adalimumab	1,648	7.3
Certolizumab	491	2.2
Health Status		
Charlson Comorbidity Index	0.55	1.16 (SD)
Specific comorbidities		
Disorders of lipid metabolism	6,195	27.3
Hypertension	5,621	24.8
Osteoarthritis	5,317	23.4
Chronic pulmonary disease	2,450	10.8
Depression	2,315	10.2
Hypothyroidism	2,054	9.0
Diabetes without complications	1,607	7.1
Mild liver disease	1,435	6.3
Chronic pain	1,124	5.0
Osteoporosis	1,064	4.7
Any malignancy	983	4.3

Note: Sample was composed of patients aged > 18 years, continuously eligible for benefits for entire measurement year, and met the AGA definition of IBD during the measurement year.

AGA = American Gastroenterological Association; IBD = irritable bowel disease; SD = standard deviation.

were also variable with 0.6% qualifying for CCFA O10, incontinence, and 32.9% meeting requirements for CCFA O1b, utilization of prednisone. Overall, within the AGA measurement set, *C. difficile* testing in an inpatient setting (66.9%), the use of appropriate corticosteroid-sparing therapy (51.1%), and testing for latent tuberculosis (TB) before initiating anti-tumor necrosis factor (TNF) therapy (45.0%) were the 3 highest achieved measures, while prednisone usage (32.9%) and narcotic usage (24.1%) were the 2 highest achieved CCFA outcome measures.

Discussion

IBD is a group of chronic inflammatory autoimmune diseases affecting the gastrointestinal tract. The progression of these diseases is difficult to predict and varies among individuals.

As a result, treatment pathways, although standardized, may require modification for each individual. The overall goal of treatment for IBD is to improve the patient's well being and achieve prolonged periods of disease remission, thereby preventing tissue damage and disease progression.³⁶ The purpose of this exploratory study was to determine the feasibility of assessing the AGA and CCFA quality measures through an analysis of administrative claims data. Measures fell into 4 broad categories, including therapy for IBD (corticosteroid and narcotic therapy); laboratory testing to inform treatment decisions (influenza vaccination, latent TB, hepatitis B [Hep B], thiopurine methyltransferase [TPMT], and *C. difficile* testing); hospitalization (inpatient and emergency room [ER] visits); and IBD-related conditions (incontinence, venous thromboembolism prophylaxis, and anemia).

The measures assessing corticosteroid (AGA 2, 3, and CCFA O1B) and narcotic therapy (CCFA O8) were met at expected rates based on published studies. CCFA measure O1B and AGA measures 2 and 3 focus on corticosteroid use in IBD treatment, assessing use of prednisone, corticosteroid-sparing therapy, and bone loss assessments, respectively. Corticosteroids are effective for the treatment of IBD but come with notable side effects, including osteoporosis, increased risk of infection, and mood disorders.^{30,37} For these reasons, steroid use is recommended only for the short term or in severe cases.^{10,30,37} Corticosteroid-sparing therapies—which can assist in achieving remission—such as anti-TNF biologics, thiopurines, and immunomodulators, are used to control disease and reduce steroid use where possible.^{10,30} In the sample of patients assessed, approximately 32.9% qualified for CCFA measure O1B, which assesses use of prednisone for treatment of IBD. When steroid use is found to be necessary, monitoring for potential complications, such as osteoporosis, is warranted to prevent future disease. AGA measures 2 and 3 focus on the population of patients who have a 60 days' supply of corticosteroids and receive a prescription for a sparing therapy or bone loss assessment, respectively. The use of corticosteroid-sparing therapy was relatively common in the patient sample, with approximately half (51.1%) of patients receiving some sort of sparing therapy. This rate is in line with another finding that approximately 60% of patients receiving corticosteroids for 90 days or more did not receive a sparing therapy.³⁸ Patients with autoimmune hepatitis or inflammatory arthritis were excluded from this analysis, since these patients are more likely to require chronic prednisone use, and their disease may not be as amenable to steroid-sparing therapy. Bone loss assessments were less common than sparing therapy and were completed by 15.7% of the patient sample. A recent publication assessing adherence to this guideline in a Veterans Administration cohort found only 23% adherence, similar to the findings reported here.³⁹ This is a measure that is easy to accomplish and must be improved to prevent increased

TABLE 3 AGA and CCFA Measure Attainment Rates

Measure	Numerator	Denominator	Attainment Rate (%)	Administrative Claims Limitation
AGA Measure 2				
Corticosteroid-sparing therapy	897	1,755	51.1	
AGA Measure 3				
Corticosteroid-related iatrogenic injury, bone loss assessment	208	1,322	15.7	
AGA Measure 4				
IBD preventive care, influenza immunization	3,528	16,940	20.8	
AGA Measure 6				
Testing for latent TB before initiating anti-TNF therapy	317	704	45.0	
AGA Measure 7				
Assessment of hepatitis B virus before initiating anti-TNF therapy	139	704	19.7	Hepatitis B testing cannot be done on sero-positive patients, thus excluding an unknown proportion of patients.
AGA Measure 8				
Testing for <i>Clostridium difficile</i> , inpatient measure	299	447	66.9	
AGA Measure 9				
Prophylaxis for venous thromboembolism, inpatient measure	25	6,810	0.4	VTE prophylaxis codes are not present in claims
CCFA Process Measure 6				
Appropriate TPMT testing	100	822	12.2	TPMT testing is only required once, and claims data were only available for a short period of time.
CCFA Outcome Measure O1B				
Proportion of patients taking prednisone	7,071	21,481	32.9	
CCFA Outcome Measure O3				
Proportion of patients hospitalized for IBD	2,107	22,699	9.3	
CCFA Outcome Measure O4				
Proportion of patients visiting the ER for IBD	1,879	22,699	8.3	
CCFA Outcome Measure O6				
Proportion of patients diagnosed with anemia	4,129	22,699	18.2	Anemia is not always coded, and over-the-counter remedies are available and thus do not appear in claims
CCFA Outcome Measure O8				
Proportion of patients receiving narcotics for IBD	5,471	22,699	24.1	
CCFA Outcome Measure O10				
Proportion of patients with fecal incontinence	138	22,699	0.6	Incontinence codes are not present in claims

AGA = American Gastroenterological Association; CCFA = Crohn's and Colitis Foundation of America; ER = emergency room; IBD = irritable bowel disease; TB = tuberculosis; TNF = tumor necrosis factor; TPMT = thiopurine methyltransferase; VTE = venous thromboembolism.

morbidity for IBD patients. Also, because it is relatively easy to capture presence of a bone loss assessment in an administrative claims database, the rate of 15.7% is likely to be representative of the rates of testing.³⁹ The last measure in the IBD therapy category met at the expected rate was CCFA O8, which assessed narcotic use for the treatment of IBD. Narcotic usage for IBD is not recommended because of adverse effects, yet the use of narcotics by IBD patients to manage severe pain is relatively common.⁴⁰ For this study, narcotic prescriptions associated with an IBD office visit or surgical procedure were included in the calculation of CCFA measure O8, with 24.1% of patients qualifying for this measure. This finding is consistent with other studies that report rates of narcotic use in IBD patients from 13.1% to 27.7%.^{41,42}

The measures falling into the broad category of testing and vaccination were met at varying rates (12.2%-66.9%). The measure met by the highest percentage of patients (66.9%) was AGA measure 8, which assesses testing for *C. difficile* at inpatient admissions. Due to their immunosuppressed status, IBD patients are at an increased risk of *C. difficile* infection compared with the general population; approximately 10% of IBD patients will develop a *C. difficile* infection during their lifetime.⁴³ Infection can result in a dramatically increased use of health care resources in addition to the increase in morbidity, mortality, and worsened long-term prognosis.^{43,44} Because of the similarity of symptoms between IBD flares and *C. difficile* infection, testing is recommended for new IBD patients, as well as individuals experiencing flares or slow

treatment progression, in order to allow for proper treatment of disease (e.g., IBD flare or *C. difficile* infection).⁴⁴ For these reasons, prompt testing for *C. difficile*, especially in the inpatient setting, is necessary to ensure quality treatment leading to proper treatment of patient illness and decreased cost of care. This finding of 66.9% measure attainment indicates that *C. difficile* testing is ordered for the majority of inpatient hospital admissions where the patient presents with symptoms of a potential infection. However, it should be noted that the timing of the testing during the hospital stay cannot be determined from claims analysis.

Thiopurines are immunosuppressants used as a steroid-sparing therapy to maintain remission of IBD symptoms.¹⁰ Genetic testing for TPMT, an enzyme involved in metabolism of mercaptopurine, can be used to determine if the patient is a good candidate for thiopurine therapy, since 3%-14% of the population have a genetic mutation in a TPMT allele.⁴⁵ Although effective, the dose of these medications must be optimized for each patient to reduce the risk of leucopenia, which is partially dependent upon individual metabolism.⁴⁶ In the current study, only 12.2% of eligible patients (patients started on a new prescription of thiopurine) were tested for TPMT within 6 months prior to initiation of therapy.⁴⁶ Although TPMT testing has been found to be cost-effective, the U.S. Food and Drug Administration does not require TPMT testing prior to thiopurine therapy; however, the practice of TPMT testing has been increasing since availability of testing in 1992.^{46,47} It is recommended that this inexpensive and accurate test be performed on all patients prior to thiopurine initiation.⁴⁸⁻⁵⁰ Since TPMT testing is a genetic test, and only needs to be performed once in a lifetime, the 1 year assessed in this study would not be expected to yield an accurate assessment of overall TPMT testing rates. Accordingly, the low rate of TPMT testing reported here is likely due to a combination of physician practices and the use of administrative claims data in calculation.

Anti-TNF biologics have proven effective in managing IBD but result in further immunosuppression, leaving patients vulnerable to viral and bacterial infection.^{51,52} Therefore, determination of the patient's Hep B or TB status before the initiation of treatment is recommended in order to reduce potential complications. AGA measures 6 and 7 assess the prevalence of TB or Hep B testing prior to initiation of anti-TNF therapy, respectively. AGA measure 6 was met by 45.0% of patients, while AGA measure 7 was met by only 19.7%. Both of these rates are below the recommended guidelines for testing. The low rates of measure achievement may again be partly attributed to administrative claims as the data source. Since the measures require patients who are newly initiating anti-TNF therapy, the sample size for these measures was low for the single measurement year assessed. Further, TB testing is a routine test and may therefore be subject to code bundling or may not be billed by physicians at all. The lack of complete

laboratory data may also be a hindrance in calculating these measures. Hep B testing was determined by use of CPT codes for Hep B vaccination, which was necessary because of the lack of laboratory data. Only those patients with negative Hep B serology are eligible for vaccination; therefore, the 19.7% measure rate observed does not account for testing of patients who may have been ineligible. Similar to AGA measures 6 and 7, the rate of achievement for AGA measure 4, influenza vaccination, was low (20.8%). Because of immunosuppression associated with IBD, patients are advised to obtain an influenza vaccination to prevent infection.^{28,51,52} In the 2011 flu season, 43% of the general population received an influenza vaccination, notably higher than the 20.8% seen in this high-risk IBD sample.⁵³ Once again, the low rates of measure achievement observed here may be because of the usage of out-of-network or workplace influenza vaccination programs, patient refusal, allergy (which is difficult to obtain from claims data), claim bundling, and/or failure to submit a claim.

Two measures were achieved by less than 1% of the patient sample—AGA 9 (inpatient prophylaxis for venous thromboembolism [VTE]) and CCFA O10 (rate of patient fecal incontinence). IBD patients are at a 3-fold increased risk for VTE; this relative risk is even higher during periods of disease flare.⁵⁴ As a result, IBD patients should be given blood thinners or compression garments as prophylaxis for inpatients.⁵⁴ Although it is known that VTE prophylaxis for IBD is not fully in compliance with guidelines, leading to calls for increased VTE prophylaxis in treating the IBD community, the measure rate of 0.4% is far too low to be accurate.⁵⁴ Other studies have reported rates of VTE prophylaxis of at least 50%, and surveys conducted on IBD-treating physicians estimate that at least one third of physicians would give VTE prophylaxis.⁵⁵⁻⁵⁸ One conclusion is that it is infeasible to measure this indicator using administrative claims. The lack of relevant billing codes is likely because of inpatient billing procedures, which may use code bundling or other practices, obscuring the actual rate of measure achievement. CCFA outcome measure O10, which assesses the rate of patient fecal incontinence and was achieved by 0.6% of patients, is also deemed immeasurable in administrative claims data. The prevalence of fecal incontinence in the IBD population is difficult to estimate in general, let alone in an administrative claims database, in part because of the personal and embarrassing subject matter. Although ICD-9-CM codes for fecal incontinence are available for use, they are rarely found in administrative claims. Survey studies conducted on the IBD population estimate rates of incontinence of approximately 67%; the general population has an estimated incontinence rate of 0.4%-18%, indicating that the finding of 0.5% in an IBD population is simply inaccurate.^{59,60} The extremely low rate calculated in this study is indicative of the sensitive nature of facets of IBD, as well as the lack of coding for certain symptoms in medical claims.

Two of the remaining measures—CCFA measures O3 and O4—assessed rates of hospitalization and ER visits for IBD, respectively. For both measures, qualification was based on the presence of a hospital or ER claim tied to an IBD-related diagnosis or procedure code (see the Appendix for complete definition, available in online article). In the sample evaluated, 9.3% of patients qualified for CCFA measure O3, and 8.3% qualified for CCFA measure O4 during the measurement year. Comparison of these rates with the total rates of hospitalization (17.6% of the sample) and ER visits (12.1% of the sample) reveals that the majority of hospital admissions (52.8%) and ER visits (68.6%) can be tied directly to patients having IBD.

Finally, CCFA measure O6 looked at the proportion of patients with an anemia diagnosis. Anemia is the most common complication of IBD, occurring in approximately one third of patients, and can have a notable effect on the patient's quality of life because of increased hospitalizations.⁶¹ Approximately 18% of the eligible sample presented with an ICD-9-CM diagnosis code for anemia during the measurement year. This rate is lower than the estimated one third of IBD patients affected in other studies.⁶¹ The low prevalence of anemia may be a result of the availability of over-the-counter iron supplements, which do not require a prescription and therefore do not generate a pharmacy claim.

Limitations

There were a number of limitations in the current study. Although administrative claims databases can provide access to large sample sizes and can also be adapted to answer a variety of health outcomes research questions, coding inconsistencies across providers, general coding mistakes, and the dearth of clinical outcomes are some of their well-known inadequacies.⁶²⁻⁶⁴ Inexpensive laboratory tests and minor medical procedures may be subject to code bundling or the failure to submit a claim at all, artificially decreasing some of the measure counts. The lack of complete laboratory data may also be a hindrance in calculating these measures, especially for the measures assessing Hep B and TB, requiring some measure redesign for feasibility. Regarding AGA measure 8 in particular (inpatient *C. difficile* testing), in addition to using the standard laboratory tests to determine the administration of *C. difficile* toxin testing (CPT codes 87230, 87234, and 87449), patients with inpatient diagnosis codes for either *C. difficile* intestinal infection (008.45) or infectious diarrhea (009.1, 009.2, or 009.3) were also assumed to have received the appropriate testing. This may overestimate the true rate of achievement of this measure, but a previous study demonstrated a high concordance rate between *C. difficile* assay results and the presence of the 008.45 diagnosis code.⁶⁵ A final limitation was the sample, which consisted solely of commercially insured health plan members. It is unknown how results may generalize to members of Medicare, Medicaid, or to the uninsured.

Conclusions

This is the first examination of the AGA and CCFA quality measures assessed through administrative claims data. Rates of measure achievement were highly variable and ranged from 0.4% to 66.9%. The measures achieved at lower rates are likely a reflection of the inherent difficulty and limitations using claims data. Future studies should examine additional ways to adapt such measures to claims data, which are becoming increasingly more commonplace in health outcomes studies.⁶⁶ Additionally, it is presently unclear if increased measure attainment translates into genuine health care quality improvement and/or decreased health care costs. Further studies are needed to validate current findings, in addition to understanding whether attainment of these measures translates into better overall health or IBD-related outcomes.

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Study concept and design were created by Meyer, Lofland, Ruetsch, and Coelho-Prabhu. Tkacz collected the data, with data interpretation performed by Tkacz and Brady, along with Coelho-Prabhu. The manuscript was written and revised primarily by Tkacz and Brady, with assistance from the other authors.

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APPENDIX Descriptions and Updates for AGA and CCFA Measures

Measure	Description	Denominator Requirements	Standard Billing Codes Applied	Additional Measure Updates
AGA #2	IBD Preventive Care: Corticosteroid-sparing therapy	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.		Patients with a diagnosis of autoimmune hepatitis and inflammatory arthritis within 6 months of initiating steroid therapy were excluded from the denominator, as were any patient receiving corticosteroid injections.
AGA #3	IBD Preventive Care: Bone loss assessment due to steroids	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, 99401, 99402, 99403, 99404, 99406, 99407, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.	Tests for bone loss include: <i>DEXA - CPT codes:</i> 77080 - 1+ site; axial skeleton 77081 - 1+ site; appendicular skeleton 77082 - 1+ site; vertebral fracture assessment <i>QCT (Quantitative Computed Tomography)</i> 77078 - CT bone mineral study 1+ site; axial skeleton 77089 - CT bone mineral study 1+ site, appendicular skeleton <i>Ultrasound Densitometry</i> 76977 - Ultrasound bone density measurement and interpretation; axial skeleton	The bone loss assessment should occur any time within 1 year following the termination of corticosteroid therapy or during therapy.
AGA #4	IBD Preventive Care: Influenza immunization	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, 99401, 99402, 99403, 99404, 99406, 99407, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.	<i>Influenza vaccination codes:</i> 90654, 90656, 90658, 90662, 90672, 90673, 90685, 90686, 90688	
AGA #6	TB testing	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99304, 99305, 99306, 99307, 99308, 99309 AND ICD-9-CM diagnosis codes: 555, 556.	<i>CPT codes:</i> 86480 - Quantiferon Gold TB Test 86481 - TB Spot test 86580 - PPD Skin Test <i>ICD-9-CM codes:</i> V74.1 - special screening for TB	Testing for latent TB prior to initiating anti-TNF therapy should be examined in 6 months before initiating therapy
AGA #7	Hep B	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99304, 99305, 99306, 99307, 99308, 99309 AND ICD-9-CM diagnosis codes: 555, 556.	<i>CPT codes:</i> 90740 - Hep B vaccine for immunosuppressed patient, 3 doses, IM 90743 - Hep B adolescent, 2 doses, IM 90744 - Hep B pediatric, 3 doses, IM 90746 - Hep B vaccine, adult, IM 90747 - Hep B vaccine, immunosuppressed patient, 4 doses, IM	
AGA #8	<i>C. difficile</i> testing	All patients aged 18 years and older who are continuously eligible for the measurement year with a diagnosis of inflammatory bowel disease hospitalized (for any reason) who have refractory diarrhea at the time of hospitalization or who develop diarrhea during hospitalization. CPT service codes-hospital: 99218, 99219, 99220, 99224, 99225, 99226, 99251, 99252, 99253, 99254, 99255, 99221, 99222, 99223, 99231, 99232, 99233, 99234, 99235, 99236, 99238, 99239, 99356, 99357 AND ICD-9-CM diagnosis codes: 555, 556 AND ICD-9-CM diagnosis codes: 008.45, 009.1, 009.2, 009.3.	<i>CPT codes:</i> 87230 - <i>C. difficile</i> toxin test 87234 - <i>C. difficile</i> toxin A&B II 87449 - <i>C. difficile</i> Quik Check <i>ICD-9-CM codes:</i> 008.45 - <i>C. difficile</i> pseudomembrane colon 009.1 - colitis, enteritis, gastroenteritis of infectious origin 009.2 - infectious diarrhea 009.3 - diarrhea of presumed infectious origin	

APPENDIX Descriptions and Updates for AGA and CCFA Measures (continued)

Measure	Description	Denominator Requirements	Standard Billing Codes Applied	Additional Measure Updates
AGA #9	Prophylaxis for venous thromboembolism	All patients aged 18 years and older who are continuously eligible for the measurement year with inflammatory bowel disease, hospitalized for any reason. CPT service codes—hospital: 99218, 99219, 99220, 99224, 99225, 99226, 99251, 99252, 99253, 99254, 99255, 99221, 99222, 99223, 99231, 99232, 99233, 99234, 99235, 99236, 99238, 99239, 99356, 99357 AND ICD-9-CM diagnosis codes: 555, 556.	<i>Heparin codes:</i> J1645 (drug) + 96372 (injection) J1650 (drug) + 96372 (injection) J1655 (drug) + 96372 (injection) J1652 (drug) + 96372 (injection) J1644 (drug) <i>Compression garments:</i> E0650, E0651, E0652, E0675, E0676	
CCFA P6	TPMT testing	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556. Also must initiate be initiating 6 MP/AZA therapy, defined as a 180-day 6MP/AZA-naïve period preceding earliest fill date.	82657 - TPMT (thiopurine S-methyltransferase) enzyme activity in peripheral red blood cells	TPMT testing should be assessed any time during the 6 months preceding the initiation of 6MP/AZA therapy.
CCFA O1b	Prednisone usage	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.		Patients receiving budesonide (ENTOCORT) were included in this calculation, as it is a prednisone derivative.
CCFA O3	Hospitalized for IBD	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.		Hospitalization was deemed IBD-related if an inpatient claim (1) carried any of the following diagnoses: IBD, kidney stones, abdominal pain or colon cancer; (2) a procedure code for bowel incision, other abdominal or bowel surgery, complete colectomy, fistula repair, ostomy creation, partial colectomy, colonoscopy, flexible sigmoidoscopy, pouchoscopy, ileoscopy, or upper endoscopy; or (3) carried any of the following diagnoses, accompanied by any medical encounter with an IBD diagnosis code within the 3 months preceding or following the visit: diarrhea, GI bleeding, bowel obstruction, ileus, nausea/vomiting, bloating, malnutrition, dehydration, acute renal failure, kidney injury, pancreatitis, or hepatitis.
CCFA O4	ER visit for IBD	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.		Same logic as measure CCFA O3 but applied to claims for an ER visit.

APPENDIX Descriptions and Updates for AGA and CCFA Measures (continued)

Measure	Description	Denominator Requirements	Standard Billing Codes Applied	Additional Measure Updates
CCFA O6	Patients with anemia	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.	ICD-9-CM diagnosis codes for 280.x and 285.x	
CCFA O8	Receiving narcotics for IBD	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.		Narcotic fill (American Hospital Formulary Service Classification code 280808, 28080800, 280812, or 28081200) within 1 week of a medical encounter (1) carrying a diagnosis for IBD, kidney stones, abdominal pain, or colon cancer; (2) carrying a procedure code for bowel incision, other abdominal or bowel surgery, complete colectomy, fistula repair, ostomy creation, partial colectomy, colonoscopy, flexible sigmoidoscopy, pouchoscopy, ileoscopy, or upper endoscopy; or (3) a visit to a colorectal surgeon (provider category codes 0422, 0423, 0424, 0425, 1141, 2632, 2987, 3832, or 3973).
CCFA O10	Incontinence	All patients 18 years and older who are continuously eligible for the entire measurement year with a diagnosis of inflammatory bowel disease. CPT service codes: 99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99251, 99252, 99253, 99254, 99255, 99354, 99355, 99356, 99357, G0406, G0407, G0408, G0425, G0426, G0427 AND ICD-9-CM diagnosis codes: 555, 556.	ICD-9-CM diagnosis codes for 787.6	

AGA=American Gastroenterological Association; CCFA=Crohn's and Colitis Foundation of America; CPT=Current Procedural Terminology; ER=emergency room; GI=gastrointestinal; Hep B=hepatitis B; IBD=irritable bowel disease; ICD-9-CM=International Classification of Diseases, Ninth Revision, Clinical Modification; IM=intramuscular; TB=tuberculosis; TNF=tumor necrosis factor; TPMT=thiopurine methyltransferase; 6 MP/AZA=6-mercaptopurine and azathioprine.