Supplemental Table 1. Indications for Colonoscopy

Colonoscopy Indication	**Description**
Screening	Procedures performed for screening in those who are at average risk for CRC
High-risk screening	Procedures performed for screening in those who are above average risk for developing CRC, such as those with a family history of colon cancer
Surveillance	Procedures performed for in those with personal history of adenomas, sessile serrated lesions, or CRC
Diagnostic	Procedures performed for the presence of any signs (e.g. iron deficiency anemia), symptoms (e.g. change in bowel habits or hematochezia), or follow-up after abnormal FIT.

CRC – colorectal cancer; FIT – fecal immunochemical test

Supplemental Table 2: Importance of Accurately Determining the Indication for Colonoscopy

Category	**Examples**
Clinical Care	Procedural urgency and scheduling varies by colonoscopy indication Patient-reported benefits and adherence varies by colonoscopy indication
Payment	Insurance companies are required to provide screening (but not surveillance or diagnostic) colonoscopy exams without a co-payment;
Policy	Health systems may prioritize diagnostic and/or surveillance colonoscopy exams (over average-risk screening) given limited endoscopic capacity
Healthcare Quality Metrics	Adenoma detection rates are determined only in subset of colonoscopies performed for average-risk screening Appropriateness of interval for repeat colonoscopy is dependent on colonoscopy indication
Clinical Research	Research on the comparative effectiveness of different colon cancer screening tests and strategies are dependent on accurate determination of indication

Supplemental Table 3. Summary of prior algorithms classifying colonoscopy indications

Author, year	**Algorithm**	**Reference standard**	**Results**
Ko, 2012[34]	Algorithms were developed using CPT and ICD-9 codes from colonoscopy claim and Medicare claims in prior 12 months. Four-level hierarchical classification of indication (average-risk screening, high-risk screening, surveillance, diagnostic) was based on classification and regression trees and linear discriminant analysis.	Clinical Outcomes Research Initiative database and manual review of the colonoscopy report by three physicians	Algorithms were developed in a training set of 7515 patients and validated in an independent set of 7329 patients Sensitivity for classifying screening exams was 55-86%. Specificity for classifying screening exams was >95%
Haque, 2005[31]	Algorithms were developed using ICD-9 codes for conditions within one year prior to colonoscopy, signs and symptoms of GI bleeding within 45 days prior to colonoscopy, and FOBT test within 45 days prior to colonoscopy.	Manual chart review by two trained abstractors	Algorithm was developed in a set of 95 patients Sensitivity for classifying screening exam was 84% Specificity for determining screening exam was 76%
El-Serag, 2006[32]	Algorithms were developed using ICD-9 codes for conditions within one year prior	Manual chart review by two physicians	Algorithm was developed in a set of 303 patients

	to colonoscopy.		Sensitivity for classifying screening exam was 70% Specificity for determining screening exam was 72%
Fisher, 2010[33]	Algorithms were developed using ICD-9 codes for conditions within one year prior to colonoscopy. Modifications of El-Serag algorithm by removing ICD-9 codes for upper GI symptoms and abdominal pain as well as all ICD-9 codes from day of the colonoscopy. This modification also used data regarding prior FOBT, flexible sigmoidoscopy, and colonoscopy exams during the prior year.	Manual chart review by trained abstractor	Algorithm was developed in a set of 650 patients Sensitivity for classifying screening exam was 30-57% Specificity for determining screening exam was 81-93%
Sewitch, 2010[25]	Algorithm was based on pre-procedure patient self-report	Endoscopist impression of indication	Algorithm was developed in a set of 702 patients Concordance for classifying screening exam was 83% Kappa 0.67 (95%CI 0.61 – 0.72) Concordance for classifying surveillance exam was 85% Kappa 0.70 (95%CI 0.65 – 0.75) Concordance for classifying

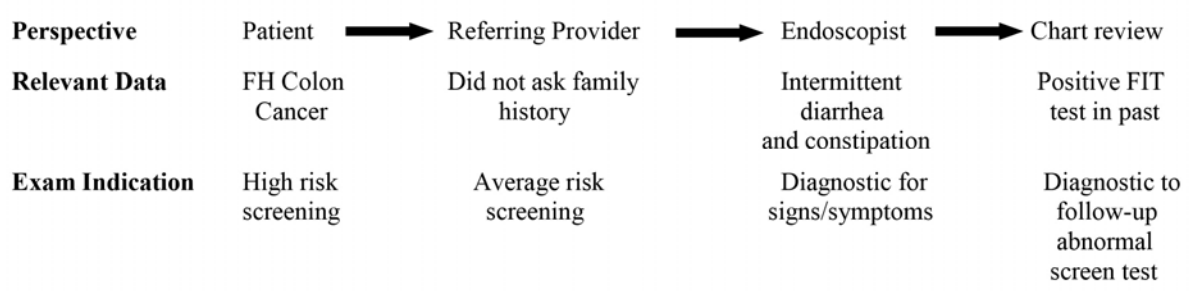
			diagnostic exam was 79% Kappa 0.58 (95%CI 0.52 – 0.64)
Sewitch, 2013[35]	Algorithm was based on logistic regression model using patient age, gender, procedure codes for prior colonoscopy, polypectomy, sigmoidsocpy, and double contrast barium enema in the past 4 years, ICD-9 codes for risk factors (e.g. inflammatory bowel disease, prior colorectal cancer) in the past 5 years, and ICD-9 codes for symptoms in the past year.	Two reference standards were used. Reference standard #1: Bayesian latent class model Reference standard #2: Endoscopist impression of indication	Algorithm was developed in a set of 702 patients Reference standard #1: Sensitivity for classifying screening exam was 85% Specificity for determining screening exam was 63% Reference standard #2: Sensitivity for classifying screening exam was 85% Specificity for determining screening exam was 62%
Harkema 2011[36]	Algorithm was based on natural language processing	Manual chart review	Algorithm was developed in a set of 453 patients Concordance for classifying screening exam was 82% Kappa 0.67

CPT – Current Procedural Terminology; ICD-9 – International Classification of Diseases – Ninth edition; FOBT – fecal occult blood test

SUPPLEMENTAL FIGURE

Figure Title: Different Perspectives on the Indication for Colonoscopy

Figure Legend: It is possible that the same procedure could be classified with different indications, depending on the perspective. A patient with a first-degree relative who had CRC should be regarded as “high-risk screening”; however, a provider may have referred the patient for “average-risk screening”. If the patient reports symptoms at the time of exam, these may be recorded and the exam considered diagnostic to evaluate these symptoms. Finally, if a researcher looks back and observes a prior positive FIT, the exam might be considered as a follow-up diagnostic exam.


Perspective
Patient
Referring Provider
Endoscopist
Chart review
Relevant Data
FH Colon Cancer
Did not ask family history
Intermittent diarrhea and constipation
Positive FIT test in past
Exam Indication
High risk screening
Average risk screening
Diagnostic for signs/symptoms
Diagnostic to follow-up abnormal screen test