

Longitudinal Adherence to Colorectal Cancer Screening Guidelines

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Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of all cancer-related deaths in the United States.^{1,2} Compared with other cancer types, CRC has the third-highest global economic impact after lung and breast cancers.³ In the United States, the annual cost for CRC was estimated at \$14 billion in 2010, and this is expected to increase as the population ages.^{4,5}

CRC places a substantial burden on healthcare systems, primarily due to detection in later stages. Forty percent of US patients diagnosed with CRC between 2004 and 2010 had localized disease, for which the 5-year relative survival rate was 89.8%, while 20% of patients had metastatic CRC, which has a 5-year relative survival rate of only 12.9%.⁶ The burden of CRC is largely preventable through early detection and removal of abnormal growths before symptoms develop.⁷ Furthermore, CRC treatment costs are lower when patients are diagnosed in earlier stages of disease.⁸

Evidence-based CRC screening guidelines developed by the United States Preventive Services Task Force (USPSTF) in 2008 recommend that adults at average risk for CRC begin screening at age 50 and continue until age 75 with either high-sensitivity fecal occult blood test (FOBT) or fecal immunochemical test (FIT) annually, flexible sigmoidoscopy (FS) every 5 years with a high-sensitivity FOBT every 3 years, or colonoscopy every 10 years.⁹ USPSTF guidelines do not recommend any of the above strategies over the others, but direct patients to use a routine CRC-screening strategy. These guidelines are aligned with recommendations by other US professional organizations, such as the Institute for Clinical Systems Improvement¹⁰ and the American College of Radiology.¹¹

Although it is widely accepted that early detection through CRC screening provides the best potential to reduce the clinical and economic burdens of CRC,¹²⁻¹⁴ the effectiveness of CRC screening is limited by low uptake and adherence. In fact, 1 in 3 eligible individuals are not appropriately

ABSTRACT

Objectives: To describe adherence with United States Preventive Services Task Force (USPSTF) colorectal cancer (CRC) screening recommendations over a 10-year period in a large, continuously insured screening population at average risk for CRC.

Study Design: Retrospective claims database analysis.

Methods: Insured members (N = 151,638) who turned 50 years old between January 1, 2000, and December 31, 2004, and were at average risk for CRC were included in the analysis. Subjects were categorized as adherent, inadequately screened, or screening-naïve based on their level of adherence with USPSTF CRC screening guidelines. Outcomes considered were age at initial CRC screening and CRC screening tests received over the 10-year period.

Results: Of the 151,638 subjects in the cohort, only 97,518 (64%) were adherent with current CRC screening recommendations. An additional 18,050 (12%) were considered inadequately screened and 36,070 (24%) were screening-naïve. In those subjects who received some form of CRC screening, the average age at screening initiation was 53 years—3 years past the age recommended by current guidelines. Of those subjects who were inadequately screened, nearly half (46%) received only 1 fecal occult blood or fecal immunochemical test over the 10-year period.

Conclusions: In a sample of continuously insured average-risk individuals aged 50 to 54 years, CRC screening was initiated later and performed less frequently than recommended in USPSTF guidelines.

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Take-Away Points

- Longitudinal adherence to current United States Preventive Services Task Force colorectal cancer (CRC) screening recommendations was evaluated in a large population of continuously insured individuals at average risk for CRC.
- Only 64% of subjects were adherent to current CRC screening recommendations.
- Average age at screening initiation with any test was 3 years past that recommended by guidelines.

screened for CRC.¹⁵ Despite the fact that CRC screening rates have slowly and steadily increased over the last few decades in the United States, only 65.1% of adults had up-to-date screening—well below the national target of 80% by 2018,¹⁶ and lower than for other screening-eligible cancers, such as breast (72.4%) and cervical (83%).¹⁷

While several studies have assessed CRC screening behavior,¹⁸⁻²¹ very few US population-based studies have evaluated longitudinal adherence to CRC screening guidelines.²²⁻²⁴ Data from these longitudinal studies are less recent and may not reflect current adherence to CRC screening guidelines. In addition, some studies have used shorter time frames, which could lead to an underestimation of CRC screening adherence, especially for individuals choosing colonoscopy every 10 years as their periodic screening strategy.²⁴

The objective of this analysis was to describe the longitudinal adherence with USPSTF-recommended CRC screening over a 10-year period in an average-risk CRC screening population continuously enrolled in commercial health plans. We suspected that a longer study time frame would not reveal improved longitudinal adherence to CRC screening guidelines.

METHODS**Data Source**

This was a retrospective analysis of patient-level data from a large, national US administrative health claims database (Clinformatics DataMart, affiliated with Optum) containing records for medical, pharmacy, and laboratory services. The database contains more than 111 million unique commercial and Medicare members, with 12.1 million members having 5 or more years of continuous enrollment in 2008-2012, and it is geographically diverse across the United States, with greatest representation in the south and midwest US Census regions. Medical (professional, facility) claims include *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)* diagnosis codes and procedure codes; Current Procedural Terminology, version 4, procedure codes; Healthcare Common Procedure Coding System procedure codes; site of service codes;

provider specialty codes; and health plan and patient costs. All data were de-identified and accessed in compliance with the Health Insurance Portability and Accountability Act (HIPAA). No identifiable protected health information was extracted or accessed during the course of the study and the database used in this study has been certified as de-identified. Pursuant to HIPAA, the use of de-identified data does not require institutional review board approval or waiver of authorization.²⁵

Subject Identification

All individuals who turned 50 years old between January 1, 2000, and December 31, 2004, and had continuous medical eligibility for at least 10 years, beginning with the year that they turned 50, were included and tracked over this 10-year period. Individuals who had claims for CRC screening prior to the year they turned 50 were excluded, including those with any claims for colonoscopy (screening or diagnostic), FS, FIT or FOBT, double-contrast barium enema (DCBE), or computed tomographic colonography (CTC) tests. Additionally, individuals with evidence of high-risk history were excluded, including those with any of the following: a diagnosis of cancer prior to the index CRC screening test (ICD-9-CM diagnosis codes: 153.x, 154.0, 230.3, 230.4, 230.7, 211.3, 211.4, 211.9, 235.2, 239.0), a personal history of colorectal polyps (V12.72), a personal history of cancer (V10.9), a family history of gastrointestinal cancer (V16.0), Crohn's disease (555.1, 555.9), or ulcerative colitis (556).

Subject Classification

Included subjects were classified as adherent, inadequately screened, or screening-naïve, based on alignment with current USPSTF screening guidelines.⁹ Subjects categorized as adherent had at least 1 colonoscopy claim, or at least 2 FS claims, or 1 FS and 5 annual FIT/FOBT test claims (FS and FIT/FOBT could occur in the same year), or 1 FIT/FOBT test claim per year over the 10-year observation period. Subjects categorized as inadequately screened had only 1 FS claim or fewer than 10 annual FIT/FOBT test claims over the 10-year observation period. Screening-naïve subjects had no claims for a CRC screening test over the 10-year observation period. Receipt of DCBE or CTC was not considered in this study, as these tests are not recommended by current USPSTF guidelines.⁹

Outcomes

The number and proportion of subjects 50 years or older who were adherent with CRC screening guidelines

were assessed. Additionally, the average age at initiation of CRC screening and the types of CRC screening tests received were assessed. Within the adherent subgroup, the most common screening strategy received and the age at first colonoscopy were assessed. In inadequately screened subjects, the average number of FIT/FOBT tests received, and the utilization of FIT/FOBT and FS over the 10-year period were determined.

Analysis

Subject characteristics were analyzed descriptively using *t* tests for continuous variables and χ^2 tests for dichotomous variables. Descriptive statistics (mean, median) were computed for all outcomes. The data analysis for this paper was generated using SAS version 9.2 (SAS Institute, Cary, North Carolina).

RESULTS

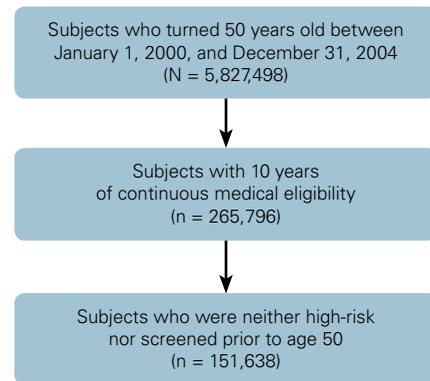
Study Population

As depicted in the **Figure**, of the roughly 5.8 million enrollees who turned 50 years old between January 1, 2000, and December 31, 2004, 265,796 had continuous medical eligibility for at least 10 years, beginning with the year that they turned 50. Of these, 151,638 were eligible for inclusion in the cohort (ie, they were neither high-risk nor screened prior to age 50).

Outcomes

Subject characteristics for the entire cohort and by adherence category are presented in **Table 1**. In the overall cohort, most subjects were commercially insured (98.9%) and only a small number of patients (1.1%) aged less than 61 years were insured through Medicare for disability reasons. Just under half of all subjects were male (47.4%) and the majority of subjects lived in southern (38.8%) or midwestern states (30.5%). For 45% of subjects, race was unknown; for the remainder, 45% were Caucasian, 4.9% African American, 3.7% Hispanic, and 1.4% Asian. Over the 10-year observation period, 97,518 (64.3%) subjects were adherent to USPSTF CRC screening recommendations; 18,050 (11.9%) were screened, but not adherent to screening recommendations (inadequately screened); and 36,070 (23.8%) were screening-naïve. There was no significant difference between the proportion of males and females who were adherent (64.5% vs 64.2%; $P = .22$); however, a significantly greater proportion of females than males were inadequately screened (14.3% vs 9.2%; $P < .001$) and a significantly greater proportion of males than females were screening-naïve (26.3% vs 21.5%; $P < .001$).

■ Figure. Subject Selection



Subjects could be considered adherent based on more than 1 screening strategy. Of the 97,518 adherent individuals, 97,081 (99.6%) were adherent because they received at least 1 colonoscopy; 1946 (2%) were because they received at least 2 FS tests; 614 (0.6%) were because they received at least 1 FS test and at least 5 years of FIT/FOBT tests; and 268 (0.3%) were because they received at least 1 FIT/FOBT test per year over the 10-year observation period.

Of the 18,050 inadequately screened individuals, 773 (4.3%) were inadequately screened because they received only 1 FS test and no annual FIT/FOBT tests, 371 (2.0%) because they received 1 FS test and between 1 and 4 annual FIT/FOBT tests, and 16,906 (93.7%) because they received no FS test and fewer than 10 annual FIT/FOBT tests over the 10-year study period. Nearly half (8330 of 18,050; 46%) of inadequately screened subjects received just 1 annual FIT/FOBT test (with or without a FS test) over the 10-year period. Inadequately screened subjects received a mean of 2.6 annual FIT/FOBT tests over the 10-year study period.

Table 2 shows the distribution of ages when subjects in the cohort received their first CRC screening test. The mean and median age at the time of first CRC screening test were 53 and 52 years, respectively, for both the adherent and inadequately screened subgroups. Almost half (47,085 of 97,081; 49%) of subjects who were adherent because they received at least 1 colonoscopy had their first colonoscopy after age 53 (**Table 3**).

DISCUSSION

In this retrospective analysis of patient-level data from a large, national US administrative health claims database, we found that just under two-thirds of subjects (64.3%) were adherent to USPSTF CRC screening recommendations, primarily due to a single screening colonoscopy.

Table 1. Subject Characteristics Overall and by Subgroup

	Total (N = 151,638)^a	Adherent (n = 97,518)^b	Inadequately Screened (n = 18,050)^b	Screening Naïve (n = 36,070)^b
Gender				
Male	71,832 (47.4%)	46,308 (64.5%)	6617 (9.2%)	18,907 (26.3%)
Female	79,806 (52.6%)	51,210 (64.2%)	11,433 (14.3%)	17,163 (21.5%)
Geographic region				
South	58,858 (38.8%)	38,904 (66.1%)	7675 (13.0%)	12,279 (20.9%)
Midwest	46,199 (30.5%)	28,536 (61.8%)	4593 (9.9%)	13,070 (28.3%)
Northeast	24,267 (16.0%)	16,312 (67.2%)	2868 (11.8%)	5087 (21.0%)
West	22,234 (14.7%)	13,733 (61.8%)	2905 (13.1%)	5596 (25.2%)
Other	80 (0.05%)	33 (41.3%)	9 (11.3%)	38 (47.5%)
Race				
Caucasian	68,364 (45.1%)	45,579 (66.7%)	8191 (12.0%)	14,594 (21.3%)
African American	7359 (4.9%)	4762 (64.7%)	816 (11.1%)	1781 (24.2%)
Hispanic	5568 (3.7%)	3439 (61.8%)	743 (13.3%)	1386 (24.9%)
Asian	2121 (1.4%)	1345 (63.4%)	285 (13.4%)	491 (23.1%)
Unknown	68,226 (45.0%)	42,393 (62.1%)	8015 (11.7%)	17,818 (26.1%)
Insurance				
Commercial	149,946 (98.9%)	96,528 (64.4%)	17,860 (11.9%)	35,558 (23.7%)
Medicare	1692 (1.1%)	990 (58.5%)	190 (11.2%)	512 (30.2%)

^aPercentage is calculated out of total number of subjects.

^bPercentage is calculated out of the row total.

Our results are in line with current national survey data.^{15,17} Of those aged 50 to 75 years who responded to the 2012 Behavioral Risk Factor Surveillance System telephone survey, 65.1% reported being up-to-date with 1 of the CRC screening tests recommended by USPSTF.¹⁵ Up-to-date was defined as FOBT within the past year, FS within the previous 5 years, and FOBT within the previous 3 years, or colonoscopy within the previous 10 years. However, these self-reported data are likely to overestimate true adherence to CRC screening guidelines, and it may not be possible to generalize these results to the entire US population. Other national data show similar levels of adherence. National Health Information Survey data show that 58.6% of adults are up-to-date with 1 of the USPSTF-recommended CRC screening methods.¹⁷ Our database analysis aligns with results from national surveys and provides further evidence that CRC screening levels remain below the national target of 80%.¹⁶ A strength of this study is that it examined claims data from a large, insured population over a 10-year observation period rather than on less reliable self-reported data. The result that adherent subjects were primarily adherent because of screening colonoscopy is unsurprising as individuals are more likely to adhere to screening options that require fewer screenings over time.²⁴

Nearly half of inadequately screened subjects in our sample (46%) received only 1 FIT/FOBT test over the 10-year period. This result is consistent with previous studies.^{23,24} Fenton et al examined adherence with biennial (every other year) FOBT screening recommendations in over 11,000 Washington state health plan members aged 52 to 78 years who were previously screened with FOBT.²³ During the subsequent 2-year observation period (2002-2003), only 44.4% adhered to repeat biennial FOBT screening.²³ Gellad et al followed patient records forward 5 years to evaluate adherence to repeat annual FOBT testing through a large retrospective cohort study of 1 million patients aged 50 to 75 years who were seen at Veterans Affairs medical centers across the United States.²⁴ Similar to our study results, very few subjects were adherent with annual FOBT testing. Only 14.1% of men and 13.7% of women completed at least 4 FOBTs over the 5-year study period. This demonstrates that good programmatic adherence to annual screening with FIT/FOBT may be difficult, based on retrospective analysis. However, a prospective population-based CRC screening study conducted by van Roon et al²⁶ found participation rates that ranged between 63.2% and 64% for 7501 Dutch individuals sent FIT screening tests at 1-, 2-, or 3-year intervals.

One reason for the higher adherence rates may be the interaction that took place with individuals through study invitations and follow-up mailings.^{27,28}

Even more concerning than the low adherence rates demonstrated in this study is that about a quarter of insured subjects (24%) received no screening at all. Survey studies have demonstrated that having health insurance or higher income is correlated with a greater likelihood of adhering to CRC screening guidelines.^{19,20} Claims data cannot provide insight into the reasons that these subjects did not complete a single CRC screening test over the 10-year period. Therefore, future studies should attempt to answer this question.

Studies have suggested that acceptance and completion of certain CRC screening test options may vary by race or ethnicity.^{21,29} Unfortunately, race was not known for 45% of subjects in our analysis, making it difficult to understand finer differences in adherence by race. However, similar to national survey data, we also found adherence to CRC screening was significantly lower for Hispanic subjects compared with all other ethnic groups combined ($P < .001$). Bazargan et al triangulated data from a prospective survey, medical charts, and clinic logbooks for 306 underserved minority (primarily Hispanic) patients 50 years or older seen at a large outpatient primary care clinic in Los Angeles to examine correlates of physician recommendation, scheduling, and actual completion of CRC screening. Only 13.7% and 11.4% of participants had sigmoidoscopy and colonoscopy, respectively,³⁰ per National Comprehensive Cancer Network guidelines. Further, in the population assessed by Bazargan and colleagues, only 44% and 59% of scheduled sigmoidoscopy and colonoscopy procedures were completed, respectively.³⁰ This study, as well as others, suggests that invasive screening tests may be a barrier to screening for certain population subgroups.

Another important finding from our study is that about three-fourths (74.7%) of subjects who received a CRC screening test did not receive their first test at age 50. The average age at initial CRC screening was 53 years of age—3 years past that recommended by current guidelines.⁹ This is consistent with a study by Sinicropo et al that analyzed medical record data for approximately 21,000 average-risk individuals 50 years or older residing in Olmsted County, Minnesota, to explore longitudinal trends in CRC screening between 1997 and 2008.²² Individuals were categorized as current-, ever-, and never-screeners according to their level of adherence to American Cancer Society CRC screening guidelines.³¹ They found that although CRC screening tripled over the study period, individuals were delaying initiating CRC screening by up to 5 years.

Table 2. Age at First Colorectal Cancer Screening Test for Adherent and Inadequately Screened Subjects

Subject Age at First CRC Screening Test, years	Adherent Patients (n = 97,518) ^a	Inadequately Screened Patients (n = 18,050) ^a
50	24,654 (25.3%)	4577 (25.4%)
51	19,627 (20.1%)	3178 (17.6%)
52	13,219 (13.6%)	2260 (12.5%)
53	9872 (10.1%)	1717 (9.5%)
54	7613 (7.8%)	1336 (7.4%)
55	6410 (6.6%)	1121 (6.2%)
56	5027 (5.2%)	936 (5.2%)
57	4000 (4.1%)	893 (4.9%)
58	3124 (3.2%)	827 (4.6%)
59	2603 (2.7%)	785 (4.3%)
60	1369 (1.4%)	420 (2.3%)

CRC indicates colorectal cancer.
^aPercentages may not sum to 100% due to rounding.

CRC screening is known to be lower in certain population subgroups, such as people with low income or low educational attainment, recent immigrants (under 10 years), and those without health insurance, a usual source of care, or recent physician contact.^{1,18,20,29,32,33} Our long-term study found that even in a continuously commercially insured screening population, longitudinal adherence to CRC screening guidelines was less than ideal. Longitudinal adherence to CRC screening may be improved with the availability of a test that is noninvasive,²¹ requires less frequent testing, is widely accessible,³⁴⁻³⁶ and is accompanied by provider and patient support.³⁷ Alternatively, the success of CRC screening may depend more on patient education, outreach, and monitoring than the type of test used. A recent review of population-based CRC screening programs³⁸ found 4 factors that played a role in the success of screening programs, independent of the type of screening test used: 1) having a dedicated funding source for the program, 2) having a structured policy in place for responding to positive screening results, 3) having an outreach program to educate and increase screening rates, and 4) having a plan in place for rescreening. These 4 factors may be challenging for most community clinics to implement because of the costs involved, but may not be challenging for the larger managed care organizations.

Limitations

The results of this study must be interpreted with appropriate consideration of the limitations inherent in all retrospective database analyses. Since claims data are

Table 3. Age at First Colonoscopy for Adherent Subjects Receiving at Least 1 Colonoscopy

Subject Age at First Colonoscopy, years	Adherent (n = 97,081)
50	10,021 (10.3%)
51	14,781 (15.2%)
52	13,424 (13.8%)
53	11,770 (12.1%)
54	10,512 (10.8%)
55	9534 (9.8%)
56	8025 (8.3%)
57	6526 (6.7%)
58	5299 (5.5%)
59	4581 (4.7%)
60	2608 (2.7%)

collected primarily for payment purposes, coding errors may occur. Additionally, the presence of a screening test code on a claim is not positive confirmation that the test was actually performed. This is especially true for FOBT/FIT tests performed at home. Claims also do not provide the results of screening tests, so adherence to follow-up testing—for instance, measuring adherence to diagnostic colonoscopy in subjects with positive FOBT or FS tests—is not possible. Additionally, claims data do not provide information about whether or not programmatic/educational interventions may have been used to increase patient participation and compliance, such as a mailed invitation or reminder about completing a test.^{27,28} Furthermore, the study design does not allow for causal inferences of results to know what recommendations subjects were given by their physicians or to ascertain the reasons that subjects did not adhere to their CRC screening regimen. Lastly, the sample includes only continuously commercially insured individuals aged 50 to 54 years at average risk of CRC, and so the results may not be representative of the general population.

CONCLUSIONS

In a sample of continuously insured individuals aged 50 to 54 years at average risk for CRC, screening was initiated later and performed less frequently than recommended in guidelines. Only 64.3% of patients were adherent to USPSTF CRC screening recommendations and the average age at screening was 3 years later than recommended. These results suggest a significant gap in care that should be addressed to improve early detection rates and, ultimately, reduce the clinical and economic burden of CRC.

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