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Effect of Comorbid Conditions on Adherence to Colorectal Cancer Screening

Dana J. Lukin,
Department of Medicine, Mount Sinai School of Medicine, 1425 Madison Ave, New York, NY 10029, USA

Lina H. Jandorf,
Department of Oncological Sciences, Mount Sinai School of Medicine, 1425 Madison Avenue, Box 1130, New York, NY 10029, USA

Rayhana J. Dhulkifl,
Department of Oncological Sciences, Mount Sinai School of Medicine, 1425 Madison Avenue, Box 1130, New York, NY 10029, USA

Linda D. Thélémaque,
Department of Oncological Sciences, Mount Sinai School of Medicine, 1425 Madison Avenue, Box 1130, New York, NY 10029, USA

Jennifer A. Christie,
Emory University School of Medicine, 1365 Clifton Rd, Rm 1264, Atlanta, GA 30322, USA

Steven H. Itzkowitz, and
Department of Medicine, Mount Sinai School of Medicine, 1425 Madison Ave, New York, NY 10029, USA

Katherine N. DuHamel
Department of Psychiatry and Behavioral Sciences, Memorial Sloan Kettering Cancer Center, 641 Lexington Avenue, 7th Floor, New York, NY 10022, USA

Lina H. Jandorf: lina.jandorf@mssm.edu; Linda D. Thélémaque: linda.thelemaque@mssm.edu

Abstract

Potential barriers to colorectal cancer (CRC) screening include preexisting medical conditions (comorbidities), physician recommendation, psychosocial factors, and screening preparedness. This study's purpose was to investigate the impact of comorbid conditions on CRC screening among African Americans. A stage-matched randomized clinical trial was performed. Asymptomatic African Americans over age 50, with a primary care physician, and eligible for CRC screening were recruited at The Mount Sinai Hospital from 2005 to 2008. One hundred sixty-one patients were assessed for referral for, and completion of, CRC screening, comorbid conditions, "readiness to change," and number of physician visits within the observation period. Data was compared to a pretrial index to predict the likely effect of comorbid conditions on CRC screening. One hundred fifty-nine patients completed the study; 108 (68.9%) were referred for and 34 (21.2%) completed CRC screening. No demographic characteristics were associated with CRC screening completion. CRC screening referrals were similar for all patients, regardless of comorbidities or clinical visits. Comorbidities rated as having extreme influence on CRC screening showed a trend toward lower screening rates. There was a significant increase in

Correspondence to: Lina H. Jandorf, lina.jandorf@mssm.edu.

screening rates among participants in advanced stages of readiness at enrollment. These data suggest that while comorbidities did not predict colonoscopy completion, they may play a role in concert with other factors. This is the only study to assess the effect of screening colonoscopy in an African American primary care setting. We must continue to explore interventions to narrow the disparate gap in screening and mortality rates.

Keywords

Colorectal cancer; Screening colonoscopy; Comorbidities; African Americans; Screening barriers

Introduction

Colorectal cancer (CRC) has come to the foreground in preventable cancers, where effective screening is available. Yet, although clinical research has demonstrated that CRC incidence and mortality can be reduced through appropriate screening (i.e., colonoscopy with polypectomy) [1], less than 60% of men and women in the USA participate in CRC screening [2]. This problem is particularly acute for African Americans, in whom CRC is the second most common cancer [3]; screening rates are lower than whites [4]; the mortality rate is higher [5]; and often, the cancer presents at a younger age, resulting in lower survival rates [6–8]. While recent efforts using a patient navigator to increase CRC screening have been found to be moderately effective [9], other interventions, such as standard print materials have not been proven effective [10, 11]. However, the low impact of standard print materials may be due to the lack of cultural sensitivity of differences in values of those targeted in the intervention.

The most recent CRC guidelines from the 2008 US Multi-Society Task Force [12] recommend seven screening procedures for average-risk individuals aged 50 years and older: three stool tests that detect cancer—fecal occult blood test (FOBT), fecal immunochemical test (FIT), and stool DNA test; and four tests to detect polyps and cancer —flexible sigmoidoscopy (FS), double-contrast barium enema, computed tomography colonography, and colonoscopy. Colonoscopy, with immediate surgical removal of polyps, is associated with a 76–90% reduction in CRC incidence [13, 14] and is considered by the American College of Gastroenterology and a number of other professional associations to be the preferred screening method because it is the most sensitive procedure for detecting polyps and preventing CRC [12, 15, 16]. This position is further supported by independent research by Lieberman and Weiss [17], Imperiale [18], and Schoenfeld [19] who found that FS missed 30% of the advanced stage neoplasias identified through colonoscopy. Additionally, adherence to other screening methods is sub-optimal, as 25–40% of patients have been shown to fail to complete repeat annual FOBT screening over a period of several years in clinical trials and they have significant miss rates for many advanced adenomas [20]. Although CT colonography has shown promise as a CRC screening modality, it has a lower sensitivity and specificity than colonoscopy for polyps less than 6 mm [21] and also leads to a high incidence of extra-colonic findings which must be evaluated further.

Adherence to CRC screening guidelines, including colonoscopy, is poor for all ethnic groups [22]. Barriers rooted within the health care system often stand in the way of participation in cancer prevention and early detection services. For example, not having a routine source of medical care, not receiving a recommendation for screening and/or not having insurance coverage have all been viewed as barriers [2, 23, 24]. In addition, there are also intrapersonal barriers to completing CRC screening, particularly colonoscopy, such as difficulties in navigating the medical system. There are several intrapersonal factors associated with CRC screening including perceived risk, benefits (pros), and barriers (cons),

and knowledge of CRC screening. For example, according to the Health Belief Model (HBM), patients will undertake CRC screening if they perceive themselves to be susceptible to CRC, and/or perceive the consequences of CRC to be severe. Based on the HBM and the Transtheoretical Model (TTM), pros, and cons may also be associated with CRC screening [25]. Based on the TTM, the stage of adoption is used in understanding CRC screening behavior intentions. Knowledge of CRC screening can be influential as prior research with the targeted population found that those with greater intention to undergo CRC screening were more likely to have heard of colonoscopy and had a physician recommended CRC screening [26].

It is reasonable to expect that with an invasive procedure such a colonoscopy, preexisting medical conditions (comorbidities) might serve as a barrier to routine screening, both to physicians who need to decide about making a referral for colonoscopy, and for patients who need to complete the procedure. To date, little data exists on this subject. One study performed on African American males over age 55 failed to demonstrate an effect of comorbidities on cancer screening practices [27]. In the present investigation, we were interested in studying the impact of comorbid conditions in African American men and women who participated in a randomized clinical trial, examining different print educational interventions [26], all aimed at increasing adherence to physician referral for CRC screening.

Methods

This IRB-approved prospective randomized clinical trial was designed to investigate the effectiveness of five different culturally sensitive or staged-matched print educational interventions in reducing African Americans' barriers and increasing their adherence with CRC screening recommendations. Recruitment began July 1, 2005 and was completed February 29, 2008. Eligible patients included African American men and women over the age of 50, who were asymptomatic for gastrointestinal symptoms, were in need of screening, and had a Primary Care Physician (PCP) (see [26] for greater details). The Internal Medicine Associates clinic at the Mount Sinai Hospital was chosen as the primary study site. This clinic is the main catchment site at Mount Sinai for the surrounding East Harlem community and serves a large number of ethnically and economically diverse patients. Additionally, direct physician referrals for colonoscopy and tertiary care are readily made from the clinic and a well-established patient navigator system is available for ease of scheduling.

Two hundred thirty-seven individuals were informed about the study. Sixty-eight percent of eligible patients agreed to participate. Overall, 56 individuals did not want to participate. Thirty-two people were "not interested" for reasons such as they had other medical problems that they were dealing with, and not believing it was beneficial. Nineteen people "did not want to participate" and gave reasons including having too many other tests, and not wanting to answer any questions. Five people gave "other" reasons, including being a full-time caretaker, having a colonoscopy already scheduled, and not being comfortable with access to their personal medical history not expiring.

Assessments

The 45-min baseline interview was conducted immediately before a patient's PCP visit. Follow-up interviews then occurred at 2 weeks (to review the educational materials) and at approximately 3, 6, and 12 months. Stages of change were assessed with the measures developed by Manne and colleagues [25]. As described by Christie and colleagues [26], there are five stages of change in the parent study used to describe the process of deciding to undergo CRC screening with pre-contemplation divided into three subgroups. Stage 1 of "Pre-contemplation" is when the person is unaware of CRC risk or has never heard of a

colonoscopy. During stage 2 of "Pre-contemplation," the person is aware of the CRC risk or has heard of a colonoscopy, but has never considered having a colonoscopy. Stage 3 of "Pre-contemplation" includes when the person is aware of the CRC risk and has considered having a colonoscopy but decided against it. In stage 4 of "contemplation," the person is considering undergoing colonoscopy screening in the next year. At stage 5 of "preparation," the person has an appointment scheduled for colonoscopy screening. The participants received $20.00 (in either cash or a gift card to a local store) after each interview as compensation for their time.

Medical Chart Review

Throughout the study period, participants were asked about their completion of colonoscopy. In addition, medical chart reviews were completed, using the Medical Chart Abstraction Form (MCAF), approximately 18 months after the baseline interview (to allow for completion of colonoscopy in the months following the last interview). Medical records were examined and included additional sociodemographic variables and clinic-specific variables (e.g., date of birth, date first registered at the clinic site). Existing comorbid conditions were identified from a checklist on the MCAF or otherwise noted if not included on the form. Additionally, any history of malignancy, regardless of time of occurrence, and any surgeries occurring within 12 months of consent were noted. Comorbidities were grouped into categories for analysis. Patient charts were also reviewed for [1] recommendation, [2] referral form, [3] referral written in doctors notes, [4] reason for recommendation, and [5] completed results for any type of CRC screening, including FOBT, FIT, flexible sigmoidoscopy, or colonoscopy. If completed, the date of the procedure and physician's chart note were noted.

Data Analysis

Data obtained on the MCAF was entered for analysis using SPSS (version 16.0) software. Comorbidities were grouped into categories for analysis. First, all of the recorded comorbid conditions (N=160) were classified by body systems. Then, in order to examine the potential influence of different comorbid conditions (so-called CRC Medical Barriers) which may affect ability to have a screening colonoscopy, two independent physicians coded each condition as to their likelihood to affect CRC screening: 1=extremely unlikely to affect colorectal cancer screening adherence (e.g., diabetes, GERD, and hypercholesterolemia) to 5=extremely likely to affect colorectal cancer screening adherence (e.g., endocarditis, pancreatitis, and pulmonary embolism). A third physician reviewed any disagreements. Two summary scores for each participant were created: total number of comorbid conditions and a summary of the CRC Medical Barriers. Both patient-reported and chart-confirmed CRC screening data was compiled 18 months after the baseline visit.

Results

One hundred fifty-nine patients completed the study and follow-up periods. The patient demographics are presented in Table 1. Overall, 108 (67.9%) of patients were recommended for CRC screening by their physician. The population was largely female (76.3%), not married (76.9%), unemployed (85.9%), and had an annual income of less than $15,000 (64.7%). The patient population was in regular contact with the medical system with 75% of patients seeing their primary physician 4 or more times in the 12-month study period. Conditions that were pre-determined to have either minimal, mild, or extreme influence on affecting screening rates were unaffected by the stage of change (precontemplation, contemplation, preparation, action) prior to the study. While those having more comorbidities were more likely to have conditions that were rated as having an extreme

influence on potential screening (Table 2), there were no other associations with influence and stage at either baseline or 12 months of completion of colonoscopy.

None of the patient demographics was associated with a statistically significant impact on CRC screening (Table 3). Overall, the largest group of patients who completed screening comprised females, although a higher proportion of all referred males completed screening, and a married status tended to positively influence screening rates. A higher proportion of screening colonoscopies were performed in patients who had three or more physician visits per year than in those with less than three visits, but there was no difference in rates of screening between patients with fewer MD visits and those with more visits.

Patients who were in a contemplation or preparation stage at baseline were more likely to have a screening colonoscopy as compared to those patients in a precontemplation stage (Table 4). Stage was related to non-screeners, with almost all patients who remained in a precontemplation or contemplation stage at 12 months failing to be screened. There was a non-statistically significant trend for comorbid conditions, in the expected direction (p=0.133). When examining the number of comorbid conditions (0 or 1, 2–4, or 5–12), a number of statistically significant findings are noted (Table 5). Patients with more comorbid conditions were less likely to be employed or retired (<0.001). They also were more likely to not have insurance coverage and less likely to have public insurance (p=0.046), and as expected, had more physician visits in the past year (p=0.027).

Discussion

Although CRC screening has been proven effective and has the potential to reduce mortality, screening rates still remain low, across all ethnic groups. African Americans have the highest incidence and mortality related to CRC. In order to reduce this disparity, efforts to increase their screening rates are important and timely. This study sought to understand the potential role that preexisting, comorbid conditions, might serve as a barrier to screening. Currently in the literature, there is data to indicate that age is the strongest determinant of screening while comorbidity has little impact [28]. In this sample of low-income primary care African Americans, we too found no statistical association between number of as well as weighted significant comorbid conditions and CRC screening. Our patients were slightly different from groups previously studied in that the average age of our study population was 57 years compared to greater than age 65. Furthermore, the majority of our patients had two to four comorbidities that were considered minimal to mild influence on screening completion. Therefore, we did not have a large number of very sick patients. Others have investigated the relationship between comorbidities in an elderly population (patients age >65) and cancer screening behaviors [29]. This group evaluated breast, cervical, and colon cancer screening rates. Interestingly, patients with increased comorbidities (three or more) were more likely to undergo breast and cervical cancer screening. Yet, this association was not seen with FOBT. Specifically, the diagnosis of hypertension revealed a trend toward higher rates of mammography (OR=1.56), pap smear (OR=1.41), and FOBT (OR=1.37). Colonoscopy, which is more invasive, was not investigated in this study. However, in a study by Walter and colleagues [28] involving mostly male veterans over the age of 70, the impact of age and comorbidity on CRC screening by all modalities (including colonoscopy) was evaluated. The Charlson–Deyo score was used to classify the patient burden of the comorbidity as none, average, and severe. This is a modified version of the original Charlson score which is a validated assessment tool that weights comorbidity factors including cardiovascular disease, dementia, COPD, rheumatologic disease, liver disease, etc., to determine illness status [30]. Nonetheless, as with previous studies, advancing age was a predictor of decreased CRC screening in general, but comorbidity was not. However, the association between specific

CRC screening modality and the affect of comorbidity was not evaluated in this study. Subsequently, because colonoscopy is more invasive and associated with greater procedural risks, we expected to find a greater association between comorbidities and stage of readiness as well as completion of screening colonoscopy. Since demographic characteristics nor preexisting medical conditions were related to increase in screening, perhaps other factors, including CRC knowledge and personal beliefs about cancer screening should be analyzed in future studies. Physicians are recommended to factor in comorbid conditions when assessing the potential risks and benefits of cancer screening in their patients, particularly in older patient groups. However, comorbid conditions did not predict physician recommendation for screening in our study. Perhaps, this is because we did not have a very sick patient population.

While most participants did report their physician having recommended screening (67.9%), this rate is relatively low given the importance of CRC screening. Importantly, only 21.4% of the participants, all of whom received print materials about the importance of CRC screening, completed the exams, although there was some improvement in their stage of readiness at the final, 12-month, and assessment point. Therefore, there was a low completion rate of screening colonoscopy which was not related to the influence of comorbid conditions. Although we did not find a significant measurable difference, patients may not follow-up with screening recommendations by their primary care physicians because of the impact comorbid conditions may have on functional and cognitive status which we did not independently assess in this study.

Interestingly, the navigated patients had a significantly lower screening completion rate than previously seen in the same clinic using a patient navigator [9]. The number of navigated patients and non-navigated is likely too small to appreciate a difference. Also, the process and procedures of navigation were different in the current study. Importantly, navigators have different personality and communication qualities that can influence the effectiveness of the navigation. It is also possible that completion rates were affected by changes in the referral system during the study period or that the strategy of patient navigation was less intensive for this study population.

This is the only study to assess the effect of screening colonoscopy in an African American primary care setting. While we did not find that comorbidities were related to colonoscopy completion rates, we did detect a trend toward increases stage of readiness and milder comorbidities. Therefore, while comorbidities did not predict colonoscopy completion, they may in concert with other interpersonal and cultural factors play a role. The decision to complete screening colonoscopy can be complex, particularly for low-income minority groups. However, as we continue to peel back the onion, we must continue to explore interventions such as navigation to narrow the disparate gap in screening and mortality rates in the group.

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References

1. Ransohoff DF, Sandler RS. Screening for colorectal cancer. N Engl J Med. 2002; 346:40–44. [PubMed: 11778002]
2. Beydoun HA, Beydoun MA. Predictors of colorectal cancer screening behaviors among average-risk older adults in the United States. Cancer Causes Control. 2008; 19(4):339–359. [PubMed: 18085415]

3. American Cancer Society [Internet]. Atlanta: Breast Cancer Facts & Figs 2005–2006. 2005. Available from: http://www.cancer.org/downloads/STT/CAFF2005BrF.pdf
4. U.S. Centers for Disease Control. Trends in screening for colorectal cancer - United States, 1997 and 1998. MMWR. 2001; 50(9):167–168.
5. Polite BN, Dignam JJ, Olopade OI. Colorectal cancer model of health disparities: understanding mortality differences in minority populations. J Clin Oncol. 2006; 24(14):2179–2187. [PubMed: 16682737]
6. Subramanian S, Amonkar MM, Hunt TL. Use of colonoscopy for colorectal cancer screening: evidence from the 2000 National Health Interview Survey. Cancer Epidemiol Biomarkers Prev. 2005; 14 (2):409–416. [PubMed: 15734966]
7. Brenner H, Chang-Claude J, Seiler CM, Sturmer T, Hoffmeister M. Potential for colorectal cancer prevention of sigmoidoscopy versus colonoscopy: population-based case control study. Cancer Epidemiol Biomarkers Prev. 2007; 16(3):494–499. [PubMed: 17337649]
8. Lieberman D. Screening for colorectal cancer in average-risk populations. Am J Med. 2006; 119(9): 728–735. [PubMed: 16945604]
9. Chen LA, Santos S, Jandorf L, Christie J, Castillo A, Winkel G, et al. A program to enhance completion of screening colonoscopy among urban minorities. Clin Gastroenterol Hepatol. 2008; 6(4):443–450. [PubMed: 18304882]
10. Vernon SW. Participation in colorectal cancer screening: a review. J Natl Cancer Inst. 1997; 89(19):1406–1422. [PubMed: 9326910]
11. Basch CE, Wolf RL, Brouse CH, Shmukler C, Neugut A, DeCarlo LI, et al. Telephone outreach to increase colorectal cancer screening in an urban minority population. Am J Public Health. 2006; 96 (12):2246–2253. [PubMed: 17077394]
12. Levin B, Lieberman DA, Mcfarland B, Andrews KS, Brooks D, Bond J, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. Gastroenterology. 2008; 134(5):1570–1595. [PubMed: 18384785]
13. Winawer SJ, Zauber AG, O'Brien MJ, Ho MN, Gottlieb L, Sternberg SS, et al. Randomized comparison of surveillance intervals after colonoscopic removal of newly diagnosed adenomatous polyps. The National Polyp Study Workgroup. N Engl J Med. 1993; 328(13):901–906. [PubMed: 8446136]
14. Winawer SJ, Zauber AG, Stewart ET, O'Brien MJ. The natural history of colorectal cancer: opportunities for intervention. Cancer. 1991; 67:1143–1149. [PubMed: 1991272]
15. Bertakis KD, Roter D, Putnam SM. The relationship of physician medical interview style to patient satisfaction. J Fam Pract. 1991; 32(2):175–181. [PubMed: 1990046]
16. Rex, DK.; Johnson, DA.; Liberman, DA.; Burt, RW.; Sonnenberg, A. ACG Recommendations on colorectal cancer screening for average and higher risk patients in clinical practice. American College of Gastroenterology. Apr. 2000 Available from: http://www.gi.org/patients/ccrk/CRC2000.pdf
17. Lieberman DA, Weiss DG. One-time screening for colorectal cancer with combined fecal occult-blood testing and examination of the distal colon. N Engl J Med. 2001; 345(8):555–560. [PubMed: 11529208]
18. Imperiale TF, Wagner DR, Lin CY, Larkin GN, Rogge JD, Ransohoff DF. Risk of advanced proximal neoplasms in asymptomatic adults according to the distal colorectal findings. N Engl J Med. 2000; 343(3):169–174. [PubMed: 10900275]
19. Schoenfeld P, Cash B, Flood A, Dobhan R, Eastone J, Coyle W, Kikendall JW, Kim HM, Weiss DG, Emory T, Schatzkin A, Lieberman D. Colonoscopic screening of average-risk women for colorectal neoplasia. N Engl J Med. 2005; 352(20):2061–2068. [PubMed: 15901859]
20. Lieberman DA. Screening for colorectal cancer. N Engl J Med. 2009; 361(12):1179–1187. [PubMed: 19759380]
21. Johnson CD, Chen MH, Toledano AY, Heiken JP, Dachman A, Kuo MD, et al. Accuracy of CT colonography for detection of large adenomas and cancers. N Engl J Med. 2008; 359(12):1207–1217. [PubMed: 18799557]

22. CDC [Internet]. Atlanta: Behavioral Risk Factor Surveillance System (BRFSS); 2004. Available from: http://www.cdc.gov/brfss/technical_infodata/surveydata/2004.htm

23. Jerant AF, Fenton JJ, Franks P. Determinants of racial/ethnic colorectal cancer screening disparities. Arch Intern Med. 2008; 168(12):1317–1324. [PubMed: 18574089]

24. Christie J, Nassisi D, Wilets I, DuHamel KN, Winkel G, Hilliard R, et al. Assessing endoscopic colorectal screening adherence in an emergency department population. J Natl Med Assoc. 2006; 98 (7):1095–1101. [PubMed: 16895278]

25. Manne S, Markowitz A, Winawer S, Meropol NJ, Haller D, Rakowski W, et al. Correlates of colorectal cancer screening compliance and stage of adoption among siblings of individuals with early onset colorectal cancer. Health Psychol. 2002; 21(1):3–15. [PubMed: 11846342]

26. Christie J, Jandorf L, Itzkowitz S, Halm E, Freeman K, King S, et al. Sociodemographic correlates of stage of adoption for colorectal cancer screening in African Americans. Ethnic Dis Summer. 2009; 19(3):323–329.

27. Ford ME, Havstad SL, Fields ME, Manigo B, McClary B, Lamerato L. Effects of baseline comorbidities on cancer screening trial adherence among older African American men. Cancer Epidemiol Biomarkers Prev. 2008; 17(5):1234–1239. [PubMed: 18463399]

28. Walter LC, Lindquist K, Covinsky KE. Relationship between health status and use of screening mammography and Papanicolaou smears among women older than 70 years of age. Ann Intern Med. 2004; 140(9):681–688. [PubMed: 15126251]

29. Heflin MT, Oddone EZ, Pieper CF, Burchett BM, Cohen HJ. The effect of comorbid illness on receipt of cancer screening by older people. J Am Geriatr Soc. 2002; 50(10):1651–1658. [PubMed: 12366618]

30. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987; 40:373–383. [PubMed: 3558716]

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Table 1

Demographics by degree of influence

Variable	Minimal influence (% of *n*=71)	Mild influence (% of *n*=54)	Extreme influence (% of *n*=32)	Total (% of *n*=157)	*p* value
Mean age (SD)	56.41 (6.4)	58.22 (8.9)	56.06 (4.5)	56.97 (7.1)	0.266
Gender					0.108
Male	18.6	22.2	37.5	23.7	
Female	81.4	77.8	62.5	376.3	
Marital status					0.710
Married	22.9	20.4	28.1	23.1	
Not married	77.1	79.6	71.9	76.9	
Education					0.938
<11th Grade	30.0	33.3	28.1	30.8	
HS Grad or GED	25.7	29.6	28.1	27.6	
Some college or more	44.3	37.0	43.8	41.7	
Income ($)					0.248
<10,000	38.6	50.0	61.3	47.1	
10,000–14,999	22.9	15.4	9.7	17.6	
>15,000	38.6	34.6	29.0	35.3	
Employed					0.056
No	78.6	90.7	93.8	85.9	
Yes	21.4	9.3	6.2	14.1	
Retired					0.081
No	50.0	48.1	68.8	53.2	
Yes	30.0	42.6	25.0	33.3	
N/A	20.0	9.3	6.2	13.5	
Insurance					0.071
Public	77.6	93.9	90.3	86.2	
Private	15.5	6.1	9.7	10.9	
None	6.9	0.0	0.0	2.9	
MD recommend CRC					0.360
Yes	74.3	63.0	59.4	67.3	
No	21.4	35.2	37.5	29.5	

Variable	Minimal influence (% of *n*=71)	Mild influence (% of *n*=54)	Extreme influence (% of *n*=32)	Total (% of *n*=157)	*p* value
Not sure	4.3	1.9	3.1	3.2	
MD visits in the last 12 months					0.663
1–4 visits	40.0	38.9	34.4	38.5	
5–9 visits	31.4	22.2	25.0	26.9	
10 or more visits	25.7	37.0	40.6	32.7	
None	2.9	1.9	0.0	1.9	

Table 2

Comorbidities by degree of influence

Variable	Minimal influence (% of *n*=71)	Mild influence (% of *n*=54)	Extreme influence (% of *n*=32)	Total (% of *n*=157)	*p* value
Stage at baseline					0.723
Precon	40.0	46.3	40.6	42.3	
Contemplation	50.0	46.3	56.2	50.0	
Preparation	10.0	7.4	3.1	7.7	
Stage at 12 months					0.459
Precon/contemplation	76.9	76.5	90.0	79.5	
Preparation	1.5	3.9	0.0	2.1	
Action/completion	21.5	19.6	10.0	18.5	
Mean # of comorbidities (SD)	2.85 (1.5)	4.15 (1.9)	4.41 (1.7)	3.61 (1.8)	0.000
Colonoscopy					0.133
Yes	26.8	20.4	9.4	21.0	
No	73.2	79.6	90.6	79.0	

Table 3

Demographics by colonoscopy adherence

Variable	No colonoscopy (% of *n*=125)	Had colonoscopy (% of *n*=34)	Total (% of *n*=159)	*p* value
Mean age (SD)	57.35 (7.6)	55.55 (4.5)	56.97 (7.1)	0.193
Gender				0.017
Male	19.5	39.4	23.7	
Female	80.5	60.6	76.3	
Marital status				0.041
Married	19.5	36.4	23.1	
Not married	80.5	63.6	76.9	
Education				0.655
<11th Grade	30.1	33.3	30.8	
HS Grad or GED	29.3	21.2	27.6	
Some college or more	40.7	45.5	41.7	
Income ($)				0.138
<10,000	50.4	34.4	47.1	
10,000–14,999	14.9	28.1	17.6	
>15,000	34.7	37.5	35.3	
Employed				0.186
Yes	12.2	21.2	14.1	
No	87.8	78.8	85.9	
Retired				0.235
Yes	32.5	36.4	33.3	
No	56.1	42.4	53.2	
N/A	11.4	21.2	13.5	
Insurance				0.210
Public	88.8	77.4	86.2	
Private	9.3	16.1	10.9	
None	1.9	6.5	2.9	
MD recommend CRC				0.932
Yes	67.2	70.6	67.9	
No	29.6	26.5	28.9	
Not sure	3.2	2.9	3.1	
MD visits in the last 12 months				0.646
1–4 visits	36.8	44.1	38.4	
5–9 visits	27.2	29.4	27.7	
10 or more visits	33.6	26.5	32.1	
None	2.4	0.0	1.9	

Table 4

Comorbidities by colonoscopy history

Variable	No colonoscopy (% of *n*=125)	Had colonoscopy (% of *n*=34)	Total (% of *n*=159)	*p* value
Stage at baseline				0.015
Precon	46.3	27.3	42.3	
Contemplation	48.8	54.5	50.0	
Preparation	4.9	18.2	7.7	
Stage at 12 months				0.000
Precon/contemplation	99.1	6.5	79.5	
Preparation	0.9	6.5	2.1	
Action/completion	0.0	87.1	18.5	
Highest influence				0.133
Minimal influence	41.9	57.6	45.2	
Mild influence	34.7	33.3	34.4	
Extreme influence	23.4	9.1	20.4	
Mean # of comorbidities (SD)	3.53 (1.7)	3.91 (2.2)	3.61 (1.8)	0.287
Range of comorbidities				0.131
0–1	11.9	2.9	10.0	
2–4	68.3	64.7	67.5	
5–12	19.8	32.4	22.5	

Table 5

Demographics by range of comorbidities

Variable	0–1 (% of *n*=16)	2–4 (% of *n*=107)	5–12 (% of *n*=36)	Total (% of *n*=159)	*p* value
Mean age (SD)	57.25 (5.7)	56.9 (7.0)	57.31 (7.9)	57.00 (7.0)	0.938
Gender					0.529
Male	12.5	25.2	25.0	23.9	
Female	87.5	74.8	75.0	76.1	
Marital status					0.917
Married	18.8	23.4	22.2	22.6	
Not married	81.2	76.6	77.8	77.4	
Education					0.456
<11th Grade	25.0	28.0	38.9	30.2	
HS Grad or GED	43.8	28.0	22.2	28.3	
Some college or more	31.2	43.9	38.9	41.5	
Income ($)					0.358
<10,000	25.0	49.1	50.0	46.8	
10,000–14,999	18.8	18.9	14.7	17.9	
>15,000	56.2	32.1	35.3	35.3	
Employed					0.000
No	56.2	85.0	100.0	85.5	
Yes	43.8	15.0	0.0	14.5	
Retired					0.007
No	43.8	50.5	66.7	53.5	
Yes	18.8	34.6	33.3	32.7	
N/A	37.5	15.0	0.0	13.8	
Insurance					0.046
Public	58.3	86.3	0.0	85.8	
Private	33.3	10.5	94.1	11.3	
None	8.3	3.2	5.9	2.8	
MD recommend CRC					0.545
Yes	62.5	68.2	69.4	67.9	
No	37.5	27.1	30.6	28.9	

Variable	**0–1 (% of *n*=16)**	**2–4 (% of *n*=107)**	**5–12 (% of *n*=36)**	**Total (% of *n*=159)**	***p* value**
Not sure	0.0	4.7	0.0	3.1	
MD visits in the last 12 months					0.027
1–4 visits	37.5	42.1	27.8	38.4	
5–9 visits	37.5	29.9	16.7	27.7	
10 or more visits	18.8	26.2	55.6	32.1	
None	6.2	1.9	0	1.9	