

Predictors of Colorectal Cancer Screening From Patients Enrolled in a Managed Care Health Plan

Melissa M. Farmer, PhD^{1,2}
 Roshan Bastani, PhD^{2,3}
 Lorna Kwan, MPH³
 Michael Belman, MD, MPH⁴
 Patricia A. Ganz, MD^{2,3,5}

¹ Veterans Affairs, Greater Los Angeles Health Services Research and Development Center of Excellence for the Study of Healthcare Provider Behavior, Sepulveda, California.

² Department of Health Services, School of Public Health, University of California at Los Angeles, Los Angeles, California.

³ Division of Cancer Prevention and Control Research, Jonsson Comprehensive Cancer Center, University of California at Los Angeles, Los Angeles, California.

⁴ Clinical Quality, Blue Cross of California, Woodland Hills, California.

⁵ Department of Medicine, David Geffen School of Medicine, University of California at Los Angeles, Los Angeles, California.

Results from the first patient survey (2000) were presented at the annual meeting of the American Society of Preventive Oncology in 2001.

Supported by National Institutes of Health/National Cancer Institute Grant R01 CA75544 and an American Cancer Society Clinical Research Professorship (to P.A.G.).

Dr. Belman owns stock in Wellpoint, the parent company of Blue Cross.

The authors thank Irene da Costa and Christine Garcia for their work with the telephone interviews.

Dr. Farmer is currently funded by a Merit Review Entry Program career development award from the Veterans Affairs Health Services Research and Development program.

Address for reprints: Melissa M. Farmer, PhD, Veterans Affairs GLA Healthcare System, 16111 Plummer Street, Sepulveda, CA 91343-2036; Fax: (818) 895-5838; E-mail: Melissa.Farmer@va.gov

Received May 3, 2007; revision received October 1, 2007; accepted December 12, 2007.

BACKGROUND. Despite the growing recognition of the importance of colorectal cancer (CRC) screening in reducing cancer mortality, national screening rates are low, indicating a critical need to understand the barriers and remedies for underutilization of CRC screening tests.

METHODS. Using results from independent cross-sectional telephone surveys with patients aged ≥ 50 years performed before (2000; $n = 498$) and after (2003; $n = 482$) a quality improvement intervention for CRC screening within a large managed care health plan, the trends and predictors of CRC screening with fecal occult blood test (FOBT) and/or endoscopy (flexible sigmoidoscopy/colonoscopy) were examined from a patient perspective.

RESULTS. In 2000, patient reported screening rates within guidelines were 38% for any test, 23% for endoscopy, and 22% for FOBT. In 2003, screening rates increased to 50% for any test, 39% for endoscopy, and 24% for FOBT. Having discussed CRC with a doctor significantly increased the odds of being screened (FOBT: odds ratio [OR], 2.09 [95% confidence interval (95% CI), 1.47–2.96]; endoscopy: OR, 2.33 [95% CI, 1.67–3.26]; and any test: OR, 2.86 [95% CI, 2.06–3.96]), and reporting barriers to CRC in general decreased the odds of being screened (FOBT: OR, 0.76 [95% CI, 0.60–0.95]; endoscopy: OR, 0.74 [95% CI, 0.60–0.92]; and any test: OR, 0.66 [95% CI, 0.54–0.80]).

CONCLUSIONS. Although screening rates increased over the 3-year period, evidence was found of ongoing underutilization of CRC screening. The 2 strongest determinants of obtaining CRC screening were provider influence and patient barriers related to CRC screening in general, pointing to the need for multilevel interventions that target both the provider and patient. *Cancer* 2008;112:1230–8.

© 2008 American Cancer Society.

KEYWORDS: patient survey, colorectal cancer screening, provider influence, patient barriers, managed care.

Colorectal cancer (CRC) is the third leading cause of cancer death in the U.S., with an estimated 55,170 deaths in 2006. The majority of cases of CRC are detected at an advanced stage, and the overall 5-year survival rate for CRC is reported to be only 64%.¹ During the past decade, evidence-based guidelines have been disseminated regarding the value of CRC screening with fecal occult blood testing (FOBT) or endoscopy (flexible sigmoidoscopy or colonoscopy) as a means of decreasing the mortality rate from this common cancer.^{2–4} Despite the growing recognition of the efficacy and importance of CRC screening, national screening rates remain extremely low.⁵

There is an expanding literature on the potential barriers to and remedies for underutilization of CRC screening tests, focusing on both the patient and the provider.⁶ As with many other types of screening behavior, access to healthcare (eg, having insurance, a

usual source of care, a recent health examination)⁷⁻¹⁰ and provider recommendation for screening have been found to be important facilitators of CRC screening.^{11,12} Provider barriers to recommendation have been documented,¹³⁻¹⁵ yet providers often point to patient factors such as poor compliance and lack of knowledge regarding the risks and benefits of screening as barriers to screening and even recommending screening.

Given the important relationship between the patient and provider in determining the use of CRC screening, in 1998 we launched a multifaceted study to evaluate a quality improvement intervention for CRC screening within the setting of a managed care health plan.^{16,17} This provided an opportunity to examine CRC screening rates and patient and provider attitudes in a setting in which access to care was not a barrier, and in which screening in general was a priority. As part of the study, we conducted baseline patient and provider surveys (provider survey results reported elsewhere¹³) to inform the development of the intervention. A postintervention survey of a separate cross-sectional sample of patients was conducted to assess temporal trends in CRC screening behavior.

This article describes self-reported CRC screening behavior in patients from a well-characterized managed care health plan at 2 different time periods (2000 and 2003). The patient surveys permitted examination of predictors beyond administrative demographic information, including self-reported healthcare usage; health status; and knowledge, beliefs, barriers, and facilitators to CRC screening in patients with access to healthcare. Using the results from the 2 independent cross-sectional patient surveys, we describe trends in CRC screening rates and patient-reported barriers and facilitators to screening over the time, and predictors of CRC screening from the patient perspective.

MATERIALS AND METHODS

Study Setting, Design, and Sampling Procedures

This research was conducted in collaboration with a large California managed care health plan that contracted with provider organizations throughout the state. Thirty-six provider organizations were recruited for the randomized controlled effectiveness trial aimed at increasing CRC screening rates. Over a 2-year period, the provider groups assigned to the intervention received regular consultation, newsletters, and targeted materials from the research team to facilitate the implementation of an organizationally tailored quality improvement program to increase CRC screening among eligible individuals

cared for by their group. The intervention allowed each provider organization to choose from a variety of strategies, as appropriate, such as use of opinion leaders/CRC screening champions, tools to enhance provider self-efficacy and adherence to CRC screening guidelines, office system tools specific to CRC screening, and patient education materials. The details of the study design and the provider organization recruitment process,¹⁶ as well as the details of the intervention and results, have been reported elsewhere.¹⁷ The effectiveness of the intervention was assessed by chart review of a random sample of patients from each provider organization 2 years after randomization. No differences in CRC screening rates were found between the intervention or control organizations. Overall screening rates were low, with 29% of patients having received guideline concordant CRC screening; however, receiving a physical examination in the past 2 years, being older, and receiving care in an integrated medical group (IMG) (vs in an independent practice association [IPA]) were associated with a greater likelihood of receiving CRC screening.¹⁷

This work focuses on the companion telephone surveys administered before the intervention trial in 2000 (baseline) and after the completion of the trial in 2003 (postintervention) with patients served by these provider organizations. A repeated cross-sectional survey design was utilized, with a stratified random sample of patients (equal number of men and women) from each provider organization; patient population listings were generated by the health plan. A subscriber was eligible for the survey if s/he was aged ≥ 50 years in 2000, had contact information on file with the health plan, was the insurance plan primary subscriber (to avoid sampling multiple individuals from the same household), and had been a member of the provider organization for at least 2 years from the time the listing was pulled. Two years was considered a reasonable amount of time for a patient to have been seen at that provider organization and offered CRC screening. Because our goal was to examine attitudes and behaviors in an average risk, age-eligible population, we excluded respondents with a history of CRC, polyps, or inflammatory bowel disease from the analyses.

The postintervention evaluation of intervention effectiveness (2003) was based on chart review with an equal number of chart reviews attempted at each provider organization. Because the contact information from the health plan proved to be inaccurate for a significant portion of the subscribers at the baseline interview, we used the chart review (only completed in 2003) to obtain more accurate contact

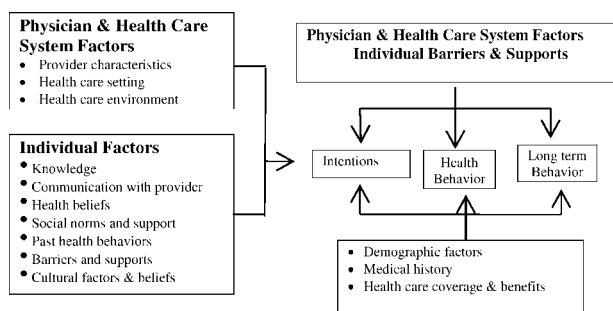


FIGURE 1. Health behavior framework. Adapted from Bastani 1999.¹⁹

information. Eligibility for the chart review was similar to the baseline survey selection strategy (chart review explained elsewhere¹⁶). An attempt was made to interview everyone whose chart had been reviewed.

Survey Design and Administration

The theoretical perspective of the Health Behavior Framework, previously Adherence Model,^{18–20} guided the choice of constructs that were assessed. This framework (Fig. 1) includes several individual, community, and societal level variables that have been found to influence cancer screening, and the current study focused mainly on the patient-level variables.

The telephone survey instrument was adapted from other Health Behavior Framework-based surveys conducted by our group examining predictors of cancer screening tests.^{21–23} Several items from this survey were adapted from the core set of self-report measures of CRC screening behaviors.²⁴ Items focused on FOBT and endoscopy in 2000 and separate items for FOBT, flexible sigmoidoscopy, and colonoscopy in 2003. Otherwise, items were consistent across both surveys.

Using addresses from the health plan in 2000, we mailed each potential respondent a cover letter signed by the study principal investigator (P.A.G.) and the provider organization medical director, a response form and stamped return envelope, and a 20-minute prepaid phone card to be activated at the phone interview. We attempted to contact by telephone all who were sent a letter, except those who had declined participation on the response form. Trained telephone interviewers administered the survey in English in 2000, with the additional availability of Spanish interviewers in 2003. The interviews lasted a mean of 23 minutes. Using updated patient contact information from the chart review, similar recruitment and incentive procedures were used for the 2003 telephone survey. The University of California at Los Angeles (UCLA) Office for the Protection of

Research Subjects approved this study and all respondents provided verbal informed consent at the time of the phone interview.

Measurement

The primary outcomes were receipt of CRC screening within specified guidelines (FOBT = 1 year; flexible sigmoidoscopy = 5 years; and colonoscopy = 10 years); specifically, we examined FOBT, endoscopy (flexible sigmoidoscopy and/or colonoscopy), and having received ‘any test’ (FOBT and/or endoscopy). These outcomes were derived from a series of questions asking whether the respondent had 1) ever done the test, 2) when the most recent test was done, and 3) why was the test done (health problem vs routine screening checkup). Respondents who reported a test was performed within guidelines and was for a health problem were excluded from the analyses because having already undergone the test made them inappropriate candidates for screening. Those who reported multiple tests within guidelines were coded as ‘screened within guidelines’ if the respondent reported that any of the tests were performed for screening.

Measures for respondent characteristics and socioeconomic status are shown in Table 1. Health status was measured using “In general, would you say your health is excellent, very good, good, fair or poor.” Cancer items included having knowledge of family history of cancer and specifically CRC. For insurance, respondents were asked whether they had health insurance in addition to the managed care health plan, whether their insurance covers the cost of colonoscopy, whether they had a copayment at last office visit, and can s/he easily get an appointment with a medical specialist when needed.

To assess provider influence, respondents were asked whether s/he had ever discussed CRC with her/his doctor. Specific measures for CRC knowledge, perceived efficacy of detection, perceived control, and specific barrier and facilitator items are shown in Table 2. Summed score measures were created for 3 barrier domains: barriers to CRC screening in general (range, 0–4), barriers specific to FOBT (range, 0–3), and barriers specific to endoscopy (range, 0–3)—a higher number indicates more barriers reported.

Analytic Strategy

Chi-square and Student *t* test analyses were used to describe the patient samples and CRC screening rates as well as compare patient-reported provider influence, knowledge, barriers, and facilitators at the

TABLE 1
Respondent Characteristics, Health Status, Health Insurance, Primary Care, and Other Screening*

	2000 Survey (n = 495)	2003 Survey (n = 482)	
	Percentage/Mean (SD)	Percentage/Mean (SD)	P
Respondent characteristics			
Age, y	59.97 (7.79)	61.30 (6.15)	.003 [†]
50–54	39.2%	12.4%	<.001
55–59	24.2%	37.2%	
60–64	16.0%	26.6%	
≥65	20.6%	23.7%	
Female	58.6%	56.0%	.417
Race/ethnicity: white	78.2%	64.9%	<.001
Hispanic	9.7%	18.3%	
Other	12.1%	16.8%	
Born in the U.S.	87.3%	77.6%	<.001
Married/living as married	64.4%	75.1%	<.001
Education (y completed): <12	5.9%	11.3%	.013
12	18.1%	17.6%	
13–16	50.3%	49.8%	
>17	25.7%	21.3%	
Yearly household income: <\$39,000	26.9%	23.7%	.132
\$40–84,000	44.0%	44.4%	
>\$85,000	29.1%	31.8%	
Employed	71.3%	64.9%	.032
Health status			
Self-rated health (1 = poor; 5 = excellent)	3.77 (0.95)	3.61 (0.95)	.007
Knowledge of family history of cancer	58.4%	62.2%	.228
Knowledge of family history of CRC	10.1%	12.0%	.336
Health insurance/provider organization			
Additional insurance	15.8%	19.9%	.093
Insurance covers FS/colonoscopy			
Yes	50.9%	58.0%	.028
Does not know	46.9%	39.2%	.021
Had copay at last office visit	82.6%	91.6%	<.001
Can easily get an appointment with specialist	70.7%	80.4%	<.001
% in IPA (vs IMG)	60.8%	56.4%	.165
Y at provider organization	7.13 (6.50)	10.28 (7.31)	<.001
Primary care			
Regular primary care provider	92.9%	97.7%	.001
Complete physical examination within past 2 y	79.0%	85.5%	.007

SD indicates standard deviation; FS, flexible sigmoidoscopy; IPA, independent practice association; IMG, integrated medical group.

* Sample size varied due to missing data.

[†] P value derived from the Student *t* test.

2 time periods. We discovered a severe lack of variation for several variables. Greater than 90% of those respondents screened within guidelines responded 'yes' to these items: had a regular health provider, had a health maintenance examination/physical in the past 2 years, and perceived efficacy of early detection. Given the lack of variation and the resulting reduced sample cells (often <2% in a cell), the confidence intervals of these variables were unusually large, which made them less than optimal covariates and they were excluded from further analyses.

Multiple logistic regression was used to predict self-reported screening by FOBT, endoscopy, and any test within guidelines (FOBT and/or endoscopy). Initially, separate models were tested for each outcome for the 2000 and 2003 survey samples, followed by models that included both samples with time as an indicator variable. Because the results were similar when using 2 models versus one, we focused the analyses on the combined models. To examine the effect of time in the models, a series of logistic regression models were estimated. First, logistic models for each outcome were estimated with time

TABLE 2
CRC-Specific Items Including Provider Influence, Knowledge, Barriers, and Facilitators

	2000 Survey (n = 495)	2003 Survey (n = 482)	
	Percentage/Mean (SD)	Percentage/Mean (SD)	P
Provider influence			
Have discussed CRC with your doctor	31.7%	41.4%	.002*
CRC knowledge			
Knowledge of risk factors scale (1–8)	4.6 (1.59)	4.7 (1.47)	.391
Think you can have CRC without symptoms	81.2%	85.6%	.068
Perceived efficacy of detection: Can CRC be cured if found early?	95.2%	93.7%	.331
Perceived control: Think there is anything you can do to prevent getting CRC	81.6%	80.4%	.622
Barriers: general			
Would be difficult to pay for the test	31.7%	37.7%	.049
Worried that screening will show you have cancer	17.8%	20.1%	.359
Think you only need to have a colon screening test when you have symptoms	15.8%	14.5%	.574
Getting tested for CRC is not important to you	13.3%	10.9%	.236
Barriers: FOBT			
Think you only need to get your stool tested for blood if your doctor recommends it	44.9%	39.4%	.081
Very/somewhat unpleasant to collect the stool samples and return the cards	44.0%	38.8%	.096
Very/somewhat inconvenient to not eat certain foods or not consume vitamin C/aspirin/alcohol	36.8%	29.7%	.019
Barriers: endoscopy			
Think you only need to get a FS/C if your doctor recommends it	52.5%	40.3%	<.001
Very/somewhat embarrassed when getting FS/C	43.4%	41.5%	.540
Very/somewhat concerned that the FS/C exam may be painful or uncomfortable	69.1%	69.1%	.999
Facilitators to CRC screening			
A stool blood test can detect colon cancer in its early stages	72.5%	55.6%	<.001
The benefits of doing a stool blood test are greater than any inconvenience	91.9%	86.7%	.008
A FS/C can detect colon cancer in its early stages	89.9%	90.2%	.863
The benefits of doing a FS/C are greater than any inconvenience	91.7%	95.2%	.026

CRC indicates colorectal cancer; SD, standard deviation; FOBT, fecal occult blood test; FS/C, flexible sigmoidoscopy or colonoscopy.

* P value derived from the Student *t* test.

only (time significant for endoscopy and any test: results shown in Table 3), time and the patient demographics (time significant for endoscopy and any test: results not shown), and models for each outcome including time, demographics, and CRC-specific variables (time not significant for any outcome; Models 1, 2, and 3 in Table 4). The effect of the intervention was also tested but was not significant in any models and thus was excluded. To maintain a family α of 0.05 for the analyses of the 3 outcomes, we employed a Bonferroni adjustment using $\alpha = 0.05/3 = 0.0167$. All analyses were performed using SAS software (version 8; SAS Institute Inc, Cary, NC).

RESULTS

Response Rate

In 2000, of the 1908 health plan subscribers who were sent letters, 136 refused by mail, 75 letters could not be delivered, and 43 were determined

ineligible. Telephone contact was attempted for 1654 people, and 1210 were contacted (318 were ineligible, 394 refused by telephone, and 498 were interviewed [41% of those contacted by telephone]). In 2003, letters were sent to 1974 individuals (113 refused and 72 letters could not be delivered), telephone contact was attempted for 1789 people, 1277 were contacted by telephone, and 606 were interviewed (47% of those contacted). To match the interview procedures used in 2000, respondents in 2003 with a history of polyps and/or inflammatory bowel disease ($n = 124$) were excluded from these analyses, leaving a final analytic sample of 482 in 2003. In additional analyses (data not shown), we used data from the chart review conducted in 2003 to examine whether there were any significant differences among the telephone survey respondents ($N = 471$) and nonresponders ($N = 1379$). Telephone survey respondents had significantly higher rates of any CRC test within guidelines (37% vs 27%; $P < .001$), and were more likely to be female and have had a

TABLE 3
CRC Screening Rates in 2000 and 2003

	FOBT			Endoscopy*			Any test [†]		
2000 Survey (n = 495)									
No. screened		105			103			169	
No. eligible for screening [‡]		483			447			447	
Percent screened		22%			23%			38%	
2003 Survey (n = 482)									
No. screened		111			182			230	
No. eligible for screening [‡]		470			469			464	
Percent screened		24%			39%			50%	
Logistic regression surveys combined	OR	(95% CI)	P	OR	(95% CI)	P	OR	(95% CI)	P
Time 2003 (vs 2000)	1.11	(0.82–1.51)	.49	2.12	(1.59–2.80)	<.001	1.62	(1.24–2.11)	<.001

CRC indicates colorectal cancer; FOBT, fecal occult blood test; OR, odds ratio; 95% CI, 95% confidence interval.

* Flexible sigmoidoscopy and colonoscopy.

[†] Includes FOBT, endoscopy, or both so the number screened does not sum across tests (ie, people may have had >1 test).

[‡] Number varies due to those excluded for tests performed for diagnostic/health problems only (not eligible for screening).

TABLE 4
Full Logistic Regression Models for Receipt of FOBT, Endoscopy (Flexible Sigmoidoscopy and/or Colonoscopy), and Any Test

	Model 1: FOBT			Model 2: Endoscopy			Model 3: Any test		
	OR	(95% CI)	P	OR	(95% CI)	P	OR	(95% CI)	P
Employed	0.88	(0.60–1.30)	.530	0.58	(0.40–0.83)	.003	0.61	(0.43–0.86)	.006
Self-rated health	1.19	(0.99–1.43)	.069	1.30	(1.09–1.56)	.004	1.21	(1.02–1.42)	.026
Friends and family screened for CRC	1.22	(0.96–1.56)	.112	1.24	(0.98–1.58)	.071	1.43	(1.14–1.79)	.002
Discussed CRC with your doctor	2.09	(1.47–2.96)	<.001	2.33	(1.67–3.26)	<.001	2.86	(2.06–3.96)	<.001
Can get appointment with medical specialist	1.70	(1.12–2.58)	.013	0.93	(0.64–1.35)	.689	1.12	(0.79–1.59)	.539
Barriers to FOBT	0.94	(0.78–1.13)	.532				1.01	(0.84–1.20)	.956
Barriers to endoscopy				0.81	(0.68–0.97)	.020	0.88	(0.74–1.06)	.171
Barriers to CRC screening in general	0.76	(0.60–0.95)	.014	0.74	(0.60–0.92)	.007	0.66	(0.54–0.80)	<.001
Belongs to IPA (vs IMG)	0.53	(0.38–0.74)	.000	0.70	(0.51–0.97)	.032	0.59	(0.43–0.79)	<.001
Time 2003 (vs 2000)	0.96	(0.63–1.44)	.830	0.87	(0.48–1.60)	.658	1.33	(0.91–1.94)	.141
–2 log likelihood		900.87			938.84			1032.47	

FOBT indicates fecal occult blood test; OR, odds ratio; 95% CI, 95% confidence interval; CRC, colorectal cancer; IPA, independent practice association; IMG, integrated medical group.

The following variables were included in each model (1, 2, and 3) but were not found to be statistically significant: gender, age, race, married, education, years with provider organization, patient has additional insurance, family history of CRC, belief that you cannot have CRC without symptoms, knowledge scale of CRC risk factors, belief that there is anything you can do to prevent CRC, belief that tests can detect CRC in its early stages, and belief that the benefits of screening tests outweigh the inconvenience.

physical examination documented in the chart in the past 2 years.

Respondent Characteristics

Respondent characteristics, health status, health insurance, and utilization are shown in Table 1. The samples had a mean age of approximately 60 years, greater than half were women, and the majority of respondents were white (with a larger Hispanic population in 2003 due to Spanish interviews). In general, the majority of respondents were married, highly educated, had incomes >\$40,000/year, were

employed, reported their health to be very good or excellent, and belonged to an IPA (vs an IMG).

The rates for having a primary care provider and having undergone a physical examination were very high. In 2000, 93% reported they had a primary care provider, which increased to 98% in 2003 ($P = .001$). Consistent with that, 79% had undergone a complete physical examination within the last 2 years in 2000 and 86% ($P = .007$) in 2003.

Screening Rates and CRC-specific Items

The screening rates within guidelines are presented in Table 3. In 2000, 38% of respondents reported

having 'any test', 23% reported endoscopy, and 22% reported FOBT for screening within guidelines. In 2003, these screening rates (within guidelines) increased to 50% for 'any test', 39% for endoscopy, and 24% for FOBT.

CRC-specific provider influence, knowledge, barriers, and facilitators items are shown in Table 2. In 2000, less than a third of respondents reported having discussed CRC with their doctor, but this figure was significantly higher in 2003. Patient knowledge of CRC risk factors was moderate (average of fewer than 5 of 8 items correct) and did not improve in 2003. Yet >80% of the sample reported they believed they can have CRC without symptoms. Perceived efficacy of detection and perceived control were high both years (95% and 82%, respectively, in 2000 and 94% and 80%, respectively, in 2003).

Overall, there was a wide range in respondent reporting of barriers, with only 10% to 13% reporting that getting tested is not important, to greater than two-thirds reporting they are concerned that the endoscopy may be painful or uncomfortable. Over the 3 years only 2 barrier items demonstrated a significant decrease: "test restrictions for FOBT would be inconvenient" dropped from 37% to 30% ($P = .019$) and "only need to get a flexible sigmoidoscopy or colonoscopy if doctor recommended it" dropped from 53% to 40% ($P < .001$).

We also examined barrier items stratified by whether a person had been screened by that method (data not shown). There were no significant differences in FOBT barriers. However, in 2000 respondents who had an endoscopy were less likely to report concerns that it may be painful (58% tested vs 74% not; $P = .003$) and less likely to report they only need to get one if a doctor recommends it (43% vs 57%; $P = .013$) than those who had not had an endoscopy. In 2003, respondents who had an endoscopy were less likely to report embarrassment than those who had not (37% vs 50%; $P = .008$).

The results for the facilitators were mixed, with the facilitators for endoscopy increasing slightly and the facilitators for FOBT significantly decreasing over time. The percent of patients reporting that a stool blood test can detect colon cancer in its early stages decreased by 17% over the 3-year period (73% vs 56%; $P < .001$).

The results from the full logistic regression models for FOBT (Model 1), Endoscopy (Model 2), and 'any test' (Model 3) (all within guidelines) are shown in Table 4. Only 2 variables were found to be significant in all 3 models at the adjusted α of 0.0167. Having discussed CRC with your doctor significantly increased the odds of being screened (FOBT: odds

ratio [OR], 2.09 [95% confidence interval (95% CI), 1.47–2.96]; endoscopy: OR, 2.33 [95% CI, 1.67–3.26]; and any test: OR, 2.86 [95% CI, 2.06–3.96]), regardless of the test. Reporting barriers to CRC in general decreased the odds of being screened (FOBT: OR, 0.76 [95% CI, 0.60–0.95]; endoscopy: OR, 0.74 [95% CI, 0.60–0.92]; and any test: OR, 0.66 [95% CI, 0.54–0.80]). It is interesting to note that the barriers specific to FOBT or endoscopy were not found to be significant in predicting use of any test.

For FOBT, reporting that s/he can get an appointment with a medical specialist increased the odds of being screened, whereas belonging to an IPA decreased the odds of being screened. Respondents who were not employed and who reported better health had significantly increased odds of screening with endoscopy. Belonging to an IPA and being employed significantly reduced the odds of having 'any test', whereas having friends and family that had been screened for CRC increased the odds of having 'any test' for screening.

DISCUSSION

We found evidence of ongoing under utilization of CRC screening. In 2000, only 38% of this managed care population was screened by FOBT, flexible sigmoidoscopy, and/or colonoscopy within guidelines. Screening rates did increase over the 3-year period, yet by 2003 still only 50% of respondents had been screened by 'any test' within guidelines. The majority of this increase was explained by a 16% increase in screening endoscopy, with rates increasing for flexible sigmoidoscopy (16–29%) and doubling for colonoscopy (7–14%), yet there was only a 2% increase in FOBT rates. One limitation is that some changes in endoscopy rates could be an artifact of question wording changes. In 2000, all questions were asked for endoscopy, whereas in 2003 the items were asked separately for flexible sigmoidoscopy and colonoscopy and then collapsed in the analyses. However, the increase we found is consistent with national trends demonstrating an increase in the use of endoscopy.⁵

Our sample represents a highly select group of patients, with few respondents reporting many of the barriers to CRC screening discussed in the literature.⁶ Overall, the respondents had high incomes, were highly educated, and were in good general health. By nature of the study design, all respondents had managed care insurance and therefore had access to care. The majority of respondents reported having a regular healthcare provider for primary care, and 80% to 85% had undergone a recent health examination. Utilization rates for other preventive services

(mammogram, Papanicolaou [Pap] smear, and prostate-specific antigen [PSA]: data not shown) were extremely high, with 99% to 100% of women reporting ever having a Pap smear and 96% to 98% ever having mammogram, and 64% to 67% of men reporting ever having a PSA. Greater than 90% of the sample reported that CRC can be cured if found early. Despite all these positive predictors for CRC screening in our sample, the CRC screening rate remained low.

What then impacted screening in what could be considered a highly motivated population? The most striking result was the strong influence of providers on screening rates. Those patients who reported that they had discussed CRC with their doctor were significantly more likely to be screened and this was consistent across all models. Barriers to CRC screening in general also significantly decreased the odds of being screened by FOBT, endoscopy, and any test. At the bivariate level, stratifying individual barrier items by whether a test had been performed revealed that respondents who had undergone an endoscopy were less likely to report concerns about pain and embarrassment than those who had not. However, in the logistic models it was general concerns about paying for the tests, worries concerning the diagnosis of cancer, and beliefs in the importance and reasons for getting testing that influenced screening, and not the specifics of individual tests (ie, unpleasant to collect stool, inconvenient to maintain limited diet, embarrassment, or concerns about pain/discomfort).

Beliefs regarding the efficacy of the various tests mirrored the trend of endoscopy rates increasing, whereas FOBT rates remained relatively stable from 2000 through 2003. These facilitators to CRC screening demonstrated that confidence in endoscopy increased, whereas patients became less confident in FOBT over the 3 years: there was a 17% drop in the percent of patients reporting FOBT can detect CRC at an early stage. This could be a result of the many media campaigns (ie, Katie Couric's television reports) promoting colonoscopy for CRC screening that occurred during this time. With all the information regarding the effectiveness of colonoscopy, patients may have become less convinced in the value of yearly FOBT.

Other predictors varied by test. For FOBT, patients who believed they could get an appointment with a medical specialist when needed and those who belonged to an IMG (vs IPA) were more likely to be screened. Perhaps this is a reflection of capacity in that places that have medical specialists (ie, endoscopists) available may be more aggressive in recommending CRC screening. Also, higher screening

rates are consistent with the typically more centrally structured organization of the IMG versus an IPA. For endoscopy, employed respondents were less likely to be screened. This could reflect the need to take time off work for the test—especially colonoscopy. In addition, patients in better health were more likely to be screened using endoscopy. This could be a result of those in poorer health being unwilling or unable to complete the preparation for the endoscopies. Further research is needed to explore these findings.

The current analyses do have some limitations. First, our telephone survey was based on self-report and therefore subject to recall bias. However, research concerning the validity of self-reported CRC screening has shown that self-reports of CRC screening can be reliable²⁵ and that it is unclear whether variations in self-reports versus medical record abstraction is due to over-reporting or challenges in obtaining a record.²⁶ Any bias in our sample would likely be with recall of time since last test and, therefore, our rates could be overestimates of the actual rates (unpublished data from this sample suggests errors in the recency of FOBT). A second limitation was the low response rate. We had to rely on the health insurance plan for contact information, whose accuracy was poor. We tried to overcome this with response forms as well as accessing the contact information from the charts in 2003. However, there was still a significant portion of patients we were never able to reach and a high refusal rate. With the proliferation of telephone marketing and the availability of caller identification, people are hesitant to complete surveys and even answer the phone. Results from our additional responder/nonresponder analyses utilizing data from our intervention chart review in 2003 only suggest that our responders had significantly different screening behavior and had more frequent routine check-ups. Therefore, the rates in the general managed care population are likely to be even *lower* than those reported by our responders. Despite these limitations, to our knowledge the current study is one of the few reports published to date to have such detailed data on CRC screening from managed care patients.

Overall, we found that there has been a secular trend of increasing CRC screening rates over a 3-year period in this managed care population. However, CRC screening rates are still suboptimal, even in our select sample of responders with high utilization rates for other preventive services. Provider influence was a powerful determinant of receipt of CRC screening—discussing CRC with the doctor was the strongest predictor of screening, regardless of the

CRC screening test. In addition, patient barriers to CRC screening in general, as opposed to those specific to the test, were important in predicting screening. These findings as well as those from the provider survey¹³ point to the need for multilevel interventions that target both the provider and patient. These results suggest that interventions focused solely on educating patients are not likely to increase rates significantly. The provider and the healthcare system in which the provider practices must be able to include discussions and recommendations for CRC screening in practice to effectively increase CRC screening rates.

REFERENCES

1. American Cancer Society. Cancer Facts and Figures 2006. Atlanta, GA: American Cancer Society; 2006.
2. U.S. Preventive Services Task Force. Guide to Clinical Preventive Services. 2nd ed. Baltimore: Williams and Wilkins; 1996.
3. Winawer SJ, Fletcher RH, Miller L, et al. Colorectal cancer screening: clinical guidelines and rationale. *Gastroenterology*. 1997;112:594–642.
4. Rex DK, Johnson DA, Lieberman DA, Burt RW, Sonnenberg A. Colorectal cancer prevention 2000: screening recommendations of the American College of Gastroenterology. *Am Coll Gastroenterol*. 2000;95:868–877.
5. Smith RA, Cokkinides V, Eyre HJ. Cancer screening in the United States, 2007: a review of current guidelines, practices and prospects. *CA Cancer J Clin*. 2007;57:90–104.
6. Subramanian S, Klosterman M, Amonkar MM, Hunt TL. Adherence with colorectal cancer screening guidelines. *Prev Med*. 2004;38:536–550.
7. Breen N, Wagener DK, Brown ML, Davis WW, Ballard-Barbash R. Progress in cancer screening over a decade: results of cancer screening from the 1987, 1992, and 1998 National Health Interview Surveys. *J Natl Cancer Inst*. 2001;93:1704–1713.
8. Cokkinides BE, Chao A, Smith RA, Vernon SW, Thun MJ. Correlates of underutilization of colorectal cancer screening among U.S. adults, age 50 and older. *Prev Med*. 2003;36:85–91.
9. Swan J, Breen N, Coates RJ, Rimer BK, Lee NC. Progress in cancer screening practices in the United States: results from the 2000 National Health Interview Survey. *Cancer*. 2003;97:1528–1540.
10. Seeff LC, Nadel MR, Klabunde CN, et al. Patterns and predictors of colorectal cancer test use in the adult U.S. population. *Cancer*. 2004;100:2093–2103.
11. Mandelson MT, Curry SJ, Anderson LA, et al. Colorectal cancer screening participation by older women. *Am J Prev Med*. 2000;19:149–154.
12. Wee CC, McCarthy EP, Phillips RS. Factors associated with colon cancer screening: the role of patient factors and physician counseling. *Prev Med*. 2004;41:23–29.
13. Dulai GS, Farmer MM, Ganz PA, et al. Primary care provider perceptions of barriers to and facilitators of colorectal cancer screening in a managed care setting. *Cancer*. 2004;100:1843–1852.
14. Klabunde CN, Frame PS, Meadow A, Jones E, Nadel M, Vernon SW. A national survey of primary care physicians' colorectal cancer screening recommendations and practices. *Prev Med*. 2003;36:352–362.
15. Klabunde CN, Vernon SW, Nadel MR, Breen N, Seeff LC, Brown ML. Barriers to colorectal cancer screening: a comparison of reports from primary care physicians and average risk adults. *Med Care*. 2005;43:939–944.
16. Ganz PA, Farmer MM, Belman M, et al. Improving colorectal cancer screening rates in a managed care health plan: recruitment of provider organizations for a randomized effectiveness trial. *Cancer Epidemiol Biomarkers Prev*. 2003;12:824–829.
17. Ganz PA, Farmer MM, Belman M, et al. Results of a randomized controlled trial to increase colorectal cancer screening in a managed care health plan. *Cancer*. 2005;104:2072–2083.
18. Bastani R, Marcus A, Hollatz-Brown A. Screening mammography rates and barriers to use: a Los Angeles county survey. *Prev Med*. 1991;20:3350–3363.
19. Bastani R, Maxwell AE, Bradford C, Prabhu Das I, Yan KX. Tailored risk notification for women with a family history of breast cancer. *Prev Med*. 1999;29:355–364.
20. Gritz E, Bastani R. Cancer prevention behavior changes: the short and the long of it. *Prev Med*. 1993;22:676–688.
21. Bastani R, Marcus A, Maxwell A, Prabhu Das I, Yan K. Prospective evaluation of an intervention to increase mammography screening in Los Angeles. *Prev Med*. 1994;23:83–90.
22. Maxwell AE, Bastani R, Vida P, Warda US. Results of a randomized trial to increase breast and cervical cancer screening among low-income Filipino-American women. *Prev Med*. 2003;37:102–109.
23. Glenn B, Bastani R, Reuben D. How important are psychosocial predictors of mammography receipt among older women when immediate access is provided via on-site service? *Am J Health Promotion*. 2005;20:237–246.
24. Vernon SW, Meissner H, Klabunde C, et al. Measures for ascertaining use of colorectal cancer screening in behavior, health services, and epidemiologic research. *Cancer Epidemiol Biomarkers Prev*. 2004;13:898–905.
25. Baier M, Calonge N, Cutter G, et al. Validity of self-reported colorectal cancer screening behavior. *Cancer Epidemiol Biomarkers Prev*. 2000;9:229–232.
26. Madlensky L, McLaughlin J, Goel V. A comparison of self-reported colorectal cancer screening with medical records. *Cancer Epidemiol Biomarkers Prev*. 2003;12:656–659.