Short Communication

Colorectal Cancer Screening Adherence in a General Population

Mark W. Yeazel,[1] Timothy R. Church,[2] Resa M. Jones,[2,3] Laura K. Kochevar,[2,4] Gavin D. Watt,[2] Jill E. Cordes,[2] Deborah Engelhard,[2] and Steven J. Mongin[2]

[1]Department of Family Practice and Community Health, School of Medicine and Divisions of [2]Environmental and Occupational Health and [3]Epidemiology, School of Public Health, University of Minnesota, Minneapolis, MN and [4]Center for Chronic Disease Outcomes Research, Veteran's Administration Medical Center, Minneapolis, MN

Abstract

Background: This article describes the self-reported colorectal cancer (CRC) screening adherence rates of adults, aged 50 years and older, living in five nonurban Minnesota counties. Methods: During the year 2000, 1693 eligible respondents, aged 50 years and older, from a randomly selected sample completed a survey assessing CRC screening adherence (~86.3% response). The survey allowed differentiation between the four CRC screening modalities but did not differentiate between screening and diagnostic testing. Adjustment for nonresponse was performed using a version of Horvitz-Thompson weighting accounting for unknown eligibility. Results: 24.5% of respondents had a fecal occult blood test within 1 year of the survey, 33.8% had flexible sigmoidoscopy within 5 years, 29.3% had a colonoscopy within 10 years, and 13.7% had a barium enema within the last 5 years. Overall, 55.3% of respondents reported testing by any modality; thus, 44.7% were not adherent to screening guidelines. Conclusions: This study improves on previous attempts to characterize CRC screening adherence by assessing all four modalities of screening as recommended by current screening guidelines, by focusing on nonadherence, and by rigorously accounting for nonresponse. This study confirms that nearly half of the population remains unscreened by any method. (Cancer Epidemiol Biomarkers Prev 2004;13(4):654–657)

Introduction

In the United States, an estimated 147,500 incident cases of colorectal cancer (CRC) and 57,100 deaths from CRC will occur in 2003 (1). Only 37% of cases are detected early (2). Despite evidence that screening can reduce CRC incidence and mortality (3–11), these tests remain underutilized (12, 13).

To determine the extent of nonadherence to screening in the U.S. population, the timing of all use of all screening modalities must be identified. In this regard, the National Health Interview Survey (NHIS) and the Behavioral Risk Factor Surveillance System (BRFSS), the two most important sources for estimating screening nonadherence in the general U.S. population, have shortcomings (12, 13). Until recently, the NHIS reported only CRC testing done for screening. The BRFSS and NHIS questions do not differentiate between flexible sigmoidoscopy and colonoscopy. Nonadherence to current screening guidelines, which describe different screening intervals for these procedures, becomes impossible to accurately assess. Neither BRFSS nor NHIS addresses double-contrast barium enema, now an option for CRC screening. Lastly, reports from the BRFSS and NHIS use different and inconsistent screening periods to report outcomes (12–15). Thus, we cannot compare current reports on CRC screening nonadherence from different sources, make historical comparisons, or easily assess progress in improving CRC screening coverage.

The consistent use of current screening guidelines and capturing both diagnostic and screening use of tests can overcome these shortcomings. The U.S. Multisociety Task Force on Colorectal Cancer recommended screening for average-risk adults aged 50 and older by any of four modalities: annual fecal occult blood test (FOBT), flexible sigmoidoscopy every 5 years, colonoscopy every 10 years, or a barium enema every 5 years (16). These guidelines essentially agree with American Cancer Society recommendations and the U.S. Preventive Services Task Force guidelines (17, 18).

Prior to a trial of community-based interventions promoting CRC screening, we surveyed adults in five Minnesota counties to determine the proportion whose utilization of colorectal screening was not in accordance with current recommendations (16, 19). We assessed utilization rates for each of the four testing

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Requests for reprints: Mark W. Yeazel, Department of Family Practice and Community Health, School of Medicine, University of Minnesota, MMC 381, 420 Delaware Street Southeast, Minneapolis, MN 55455. Phone: (612) 624-2335; Fax: (612) 624-5930. E-mail: yeazel@umn.edu

modalities within time frames specified by the 2003 U.S. Multisociety Task Force on Colorectal Cancer recommendations (16).

Materials and Methods

The University of Minnesota Institutional Review Board approved this study. Eligible participants were at least 50 years old and residents of Isanti, Kandiyohi, Rice, Steele, or Wright counties. Wright County—the intervention site for the trial—is semirural, with a large farming population and several small communities within commuting distance of a major metropolitan area. Its 1999 population was 87,864, with 21.6% (18,979) ≥50 years old (20). The other counties, selected as controls, approximated these characteristics.

We targeted a random sample of 2000 eligible participants (1500 from Wright and 500 from control counties) from the 1999 Minnesota State Driver's License and Identification Card database. Because some individuals in the database may have been ineligible (*e.g.*, by death), we oversampled 2590 individuals. In 1997, 79% of Minnesota's residents had driver's licenses (21); 13% of Minnesota residents in the database have ID cards only, so the percentage represented by the database is probably larger than 90%.

A 55-item mailed questionnaire completed between February and October 2000 with telephone follow-up assessed participants' CRC screening practices and beliefs. The questions on CRC screening practices were developed to assess each of the four screening modalities. Because we focused on nonadherence, our survey could be simplified by not asking the purpose of testing. Each question was prefaced with a two-to-four-sentence description of the test (available upon request) to help respondents differentiate between the tests. The main distinguishing characteristics of the tests cited were as follows: (*1*) FOBT is performed at home, and the cards are then returned to the clinic; (*2*) flexible sigmoidoscopy (as opposed to colonoscopy) is performed with a shorter flexible tube, takes less time, is performed in the physician's office, and does not require medication; and (*3*) barium enema requires an X-ray after drinking a large amount of white fluid.

The first mailing was followed by up to three mailed reminders, including resending surveys. To maximize participation of persons for whom a mailed survey could be a barrier (*e.g.*, the elderly and persons with reading problems or low literacy), we attempted to call all nonrespondents and ask the four screening test questions.

The primary outcome was overall nonadherence to the U.S. Multisociety Taskforce on Colorectal Cancer screening guidelines (16). Subjects were considered adherent if they reported having a FOBT within the previous year, a flexible sigmoidoscopy or barium enema within 5 years, or a colonoscopy within 10 years. All others were nonadherent.

To better represent the target sample estimates, screening probabilities were adjusted using a modified form of Horvitz-Thompson weighting (22) that simultaneously adjusts for nonresponse and unknown eligibility (23). Rather than assume that all nonrespondents are eligible, this modified method employs a flexible model based on both continuous and discrete covariates in the driver's license database (age, gender, license, and address status) to estimate the probability of eligibility for nonrespondents and differentially down-weight their contribution to the nonresponse adjustment. To incorporate variability both from sampling and from estimating the weights, confidence intervals (CIs) were constructed using bootstrap methods that include computing the estimated weights. CIs for adherence rates are based on 2000 bootstrap samples (24). Data analysis was performed on the data set current as of May 1, 2001.

Results

Eligible respondents numbered 1689, 89.6% of confirmed eligible individuals. However, correcting for unknown eligibility lowered the percentage to 86.3%. Of the remaining 901 in the sample, 383 (42.5%) were dead before their survey mailing date and therefore ineligible, 150 (16.6%) were ineligible due to incorrect addresses in the driver's license database or relocation before their survey mailing date, 196 (21.8%) were eligible but did not respond to the survey adequately for determination of overall screening compliance status, and 172 (19.1%) from whom surveys were not obtained and there was not enough other contact information to verify study eligibility. Respondents' mean age was 63.7 years, 53% were female, 79% were married, 17% had a college degree or higher (Minnesota = 24.7%, United States = 22.8% for those 45 years and older), and 15% had annual household incomes less than $15,000 (Minnesota = 14.5%, United States = 23.2% for those 45 and older; Ref. 25).

Response-adjusted, self-reported CRC test utilization rates are in Table 1. Overall, 44.7% of respondents reported having no CRC examinations within screening guidelines and thus were nonadherent. Twenty-six percent were adherent to only one test and 29% were adherent to multiple tests: 19% reported two, 8% reported three, and 2% reported all four methods.

Participants 65 years or older were significantly less likely than those 50–64 years old to be nonadherent overall and for each testing method (Table 1). Women were significantly less likely than men to be nonadherent overall and for each testing method except FOBT.

Discussion

CRC screening is underutilized in this population; 44.7% of those surveyed self-reported not meeting recommendations for screening. Because all tests were reported regardless of why they were done, the reported level of nonadherence is independent of any intention to screen.

Our findings approximate those from a population-based Massachusetts study where, overall, 49.1% had not been tested by any method (26). There were notable differences in our results and the Massachusetts data by testing type. Our sample reported lower rates of FOBT (24.5% Minnesota *versus* 32.8% Massachusetts) and higher rates of flexible sigmoidoscopy (33.8% Minnesota *versus* 24.2% Massachusetts), colonoscopy (29.3%

Table 1. Self-reported CRC screening test adherence by age and sex, Minnesota, 2000

	Test	Estimate	95% CI
Total	FOBT	0.245	0.234–0.271
	Flexible sigmoidoscopy	0.338	0.330–0.358
	Colonoscopy	0.293	0.283–0.314
	Barium enema	0.137	0.127–0.163
	Overall	0.553	0.545–0.571
Age, <65 yr	FOBT	0.218	0.200–0.264
	Flexible sigmoidoscopy	0.293	0.278–0.328
	Colonoscopy	0.227	0.212–0.266
	Barium enema	0.096	0.079–0.143
	Overall	0.487	0.473–0.519
Age, 65+ yr	FOBT	0.284	0.277–0.289
	Flexible sigmoidoscopy	0.402	0.398–0.406
	Colonoscopy	0.386	0.381–0.391
	Barium enema	0.195	0.190–0.197
	Overall	0.648	0.644–0.652
Men	FOBT	0.230	0.219–0.241
	Flexible sigmoidoscopy	0.319	0.304–0.334
	Colonoscopy	0.272	0.267–0.277
	Barium enema	0.117	0.114–0.121
	Overall	0.526	0.519–0.533
Women	FOBT	0.258	0.239–0.306
	Flexible sigmoidoscopy	0.354	0.339–0.389
	Colonoscopy	0.310	0.295–0.348
	Barium enema	0.154	0.136–0.201
	Overall	0.577	0.564–0.607

Minnesota *versus* 9.0% Massachusetts), and barium enema (13.7% for a 5-year interval in Minnesota *versus* 4.8% for a 10-year interval in Massachusetts). This disparity may be due to different sociodemographics, question wording, or true differences in screening practices.

Collectively, these data highlight a need for efforts aimed at overcoming barriers to CRC screening and reaching the large proportion of nonadherent individuals. Our finding of gender- and age-specific differences in CRC examination rates demonstrate the importance of reaching adults aged 50–64 years and males with future interventions.

Our study is limited in its reliance on self-reported screening data, which could have resulted in overestimates of screening rates (27–29). In a recent study, improved accuracy in responses was demonstrated when questions were designed specifically to differentiate between CRC screening modalities—sensitivities ranged from 89% to 96% for individual tests and specificities ranged from 86% to 97% (30). Our survey questions, although developed before the publication of this study, were worded consistently with these validated questions.

For simplicity, we did not distinguish between tests done for screening and for diagnosis, which is appropriate for the focus on nonadherence. However, the rate of testing done strictly for screening cannot be determined, a shortcoming of this approach. Although not relevant to the questions addressed here, motivation for test use may be important in determining the specific mechanisms or effects of screening promotion efforts.

The generalizability of these results may be limited. These semirural Minnesota counties might differ from urban areas or other regions of the United States in factors such as access to care or health beliefs. Our population was somewhat more affluent than the United States overall and had lower levels of educational attainment. Nonetheless, our FOBT screening rate was only slightly higher than national rates (24.5% Minnesota *versus* 20.6% national 1999 BRFSS data), and our flexible sigmoidoscopy rate was essentially the same as national rates (33.8% Minnesota *versus* 33.6% nationally; Ref. 12).

Our study's strengths include its relatively large population-based sample and high participation rate. Previous studies have reported response rates of 65% or less (12, 13, 26) compared with our 86.3%. Horvitz-Thompson methods that adjust for nonresponse were modified to account for eligibility rates among nonrespondents. Moreover, the survey assessed all four screening options according to current guideline intervals, with questions that allowed differentiation between flexible sigmoidoscopy and colonoscopy. We recommend that future studies examining completeness of CRC screening in populations assess all use of all four screening modalities according to current guideline intervals and report summary nonadherence rates to promote greater consistency among research findings and to provide the most accurate assessment of the number of people who need screening.

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References

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Correction

Colorectal Cancer Screening

In the article on colorectal cancer screening adherence in a general population in the April 2004 issue of *Cancer Epidemiology, Biomarkers & Prevention* (1), it was discovered that programming errors were made during the reweighting processes. Although this led to minor errors in the point estimates of screening rates, it did lead to substantially incorrect estimates of the 95% confidence intervals, which were inappropriately small in span and mislocated. Table 1 shows the original and corrected estimates.

Table 1. Self-reported colorectal cancer screening test adherence by age and sex, Minnesota, 2000

	Test	Originally reported		Corrected	
		Estimate	95% Confidence interval	Estimate	95% Confidence interval
Total	Fecal occult blood test	0.245	0.234–0.271	0.218	0.189–0.248
	Flexible sigmoidoscopy	0.338	0.330–0.358	0.332	0.298–0.366
	Colonoscopy	0.293	0.283–0.314	0.277	0.245–0.308
	Barium enema	0.137	0.127–0.163	0.144	0.119–0.169
	Overall	0.553	0.545–0.571	0.548	0.507–0.586
Age <65 y	Fecal occult blood test	0.218	0.200–0.264	0.177	0.144–0.212
	Flexible sigmoidoscopy	0.293	0.278–0.328	0.296	0.257–0.337
	Colonoscopy	0.227	0.212–0.266	0.218	0.182–0.256
	Barium enema	0.096	0.079–0.143	0.097	0.070–0.127
	Overall	0.487	0.473–0.519	0.498	0.454–0.541
Age 65+ y	Fecal occult blood test	0.284	0.277–0.289	0.271	0.222–0.322
	Flexible sigmoidoscopy	0.402	0.398–0.406	0.379	0.320–0.435
	Colonoscopy	0.386	0.381–0.391	0.352	0.297–0.406
	Barium enema	0.195	0.190–0.197	0.204	0.157–0.251
	Overall	0.648	0.644–0.652	0.614	0.539–0.676
Men	Fecal occult blood test	0.230	0.219–0.241	0.209	0.168–0.250
	Flexible sigmoidoscopy	0.319	0.304–0.334	0.342	0.292–0.392
	Colonoscopy	0.272	0.267–0.277	0.264	0.218–0.307
	Barium enema	0.117	0.114–0.121	0.142	0.108–0.179
	Overall	0.526	0.519–0.533	0.537	0.472–0.592
Women	Fecal occult blood test	0.258	0.239–0.306	0.227	0.186–0.271
	Flexible sigmoidoscopy	0.354	0.339–0.389	0.323	0.280–0.369
	Colonoscopy	0.310	0.295–0.348	0.290	0.246–0.335
	Barium enema	0.154	0.136–0.201	0.146	0.110–0.184
	Overall	0.577	0.564–0.607	0.559	0.511–0.606

NOTE: Corrected analysis uses the data set current as of April 8, 2004.

Reference

1. Yeazel MW, Church TR, Jones RM, et al. Colorectal cancer screening adherence in a general population. Cancer Epidemiol Biomarkers Prev 2004;13:654–7.

Colorectal Cancer Screening Adherence in a General Population

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