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Cancer Epidemiology, Biomarkers & Prevention

*Research Article*

# A Population-Based Study of Prevalence and Adherence Trends in Average Risk Colorectal Cancer Screening, 1997 to 2008

Pamela S. Sinicrope[4,6], Ellen L. Goode[2], Paul J. Limburg[3], Sally W. Vernon[9], Joseph B. Wick[1], Christi A. Patten[4,6], Paul A. Decker[5], Andrew C. Hanson[5], Christina M. Smith[6], Timothy J. Beebe[7], Frank A. Sinicrope[3,8], Noralane M. Lindor[1], Tabetha A. Brockman[6], L. Joseph Melton III[2], and Gloria M. Petersen[2]

## Abstract

**Background:** Increasing colorectal cancer screening (CRCS) is important for attaining the Healthy People 2020 goal of reducing CRC-related morbidity and mortality. Evaluating CRCS trends can help identify shifts in CRCS, and specific groups that might be targeted for CRCS.

**Methods:** We utilized medical records to describe population-based adherence to average-risk CRCS guidelines from 1997 to 2008 in Olmsted County, MN. CRCS trends were analyzed overall and by gender, age, and adherence to screening mammography (women only). We also carried out an analysis to examine whether CRCS is being initiated at the recommended age of 50.

**Results:** From 1997 to 2008, the size of the total eligible sample ranged from 20,585 to 21,468 people. CRCS increased from 22% to 65% for women and from 17% to 59% for men ($P < 0.001$ for both) between 1997 and 2008. CRCS among women current with mammography screening increased from 26% to 74%, and this group was more likely to be adherent to CRCS than all other subgroups analyzed ($P < 0.001$).The mean ages of screening initiation were stable throughout the study period, with a mean age of 55 years among both men and women in 2008.

**Conclusion:** Although overall CRCS tripled during the study period, there is still room for improvement.

**Impact:** Working to decrease the age at first screening, exploration of gender differences in screening behavior, and targeting women adherent to mammography but not to CRCS seem warranted. *Cancer Epidemiol Biomarkers Prev; 21(2); 347–50. ©2011 AACR.*

## Introduction

Colorectal cancer screening (CRCS) has steadily increased over time (1, 2), with current adherence rates of approximately 65% (range, 50%–70%; ref. 1) including 60% to 70% of Minnesotans (3). Despite increases in screening rates, adherence to CRCS remains lower than for breast and cervical cancer screening and must be improved to reach the Healthy People 2020 goal of reducing CRC deaths from 17.0 to 14.5 per 100,000 (1).

We used medical records from a defined population with access to medical care services (4) to explore longitudinal trends in CRCS prevalence and covariates of screening, including gender and adherence to mammography (women only). We also evaluated whether average-risk individuals begin CRCS as recommended at age 50 (5). These analyses of screening trends and patterns can help detect shifts in CRCS, while also aiding in the identification of specific groups with low levels of adherence that might benefit from targeted interventions.

## Material and Methods

### Study setting and population

This study utilized data collected on residents of Olmsted County, MN (2,000 population, 124,277; 89% non-Hispanic whites). Olmsted County residents are socioeconomically similar to the U.S. white population although 25% are employed in healthcare services (vs. 8% nationwide) and the education level is correspondingly higher (30% have completed college vs. 21% nationwide;

**Authors' Affiliations:** [1]Department of Medical Genetics; [2]Division of Epidemiology, Department of Health Sciences Research; [3]Division of Gastroenterology and Hepatology; [4]Departments of Psychology and Psychiatry, [5]Biomedical Statistics and Informatics; [6]Behavioral Health Research, Mayo Clinic College of Medicine; [7]Division of Health Care Policy and Research, Department of Health Sciences Research; [8]Division of Oncology, Mayo Clinic, Rochester, Minnesota; and [9]Division of Health Promotion and Behavioral Sciences, University of Texas School of Public Health, Houston, Texas

**Corresponding Author:** Pamela S. Sinicrope, Mayo Clinic, 200 First Street SW, Charlton 6, Rochester, MN 55905. Phone: 507-266-1238; Fax: 507-266-2478; E-mail: sinicrope.pamela@mayo.edu

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ref. 4). Healthcare utilization data on Olmsted County residents are available through the Rochester Epidemiology Project (REP), which captures data from medical records of patients using Mayo Clinic, Olmsted Medical Center, their affiliated hospitals, and a local private practice provider. Given the fact that all Olmsted County providers collaborate and share their medical record data with the REP and the Olmsted County population is fairly stable, this is one of the few places in the country where it is possible to conduct population-based research on disease incidence, mortality, and use of health services (4). More than 96% of patients of REP-affiliated medical care providers have permitted the REP to access their records (6).

### Classification of average risk CRC and breast cancer screening

Following approval from the Mayo Clinic and Olmsted Medical Center Institutional Review Boards, we identified all individuals age 50 years or greater residing in Olmsted County for at least 1 year in 1997 to 2008 (starting in 1997 allowed a 10-year window from 1987, the first year from which records were examined, to assess colonoscopy adherence). We attempted to include only average-risk individuals by excluding those who underwent CRCS prior to age 50 because current guidelines recommend CRCS begin at age 50; we assumed that screening before age 50 would occur for other reasons such as a CRC family history or symptoms). We also excluded those with a prior diagnosis of CRC or large polyps, inflammatory bowel disease, or genetic conditions such as familial adenomatous polyposis or Lynch Syndrome.

The 177 ICD codes used to identify these diagnoses were verified by medical billing personnel and 2 physicians to account for any coding changes over the study period. A similar process was used to analyze CRCS adherence among women who were current with screening mammography (i.e., we excluded women undergoing mammography for diagnosis, those who reported mammography prior to age 40, and those with a *BRCA1* or *BRCA2* mutation).

Individuals were categorized according to adherence to American Cancer Society (ACS) CRCS guidelines [fecal occult blood test (FOBT) every year or flexible sigmoidoscopy (FS) every 5 years or FOBT and FS every 5 years or double-contrast barium enema every 5 years or colonoscopy every 10 years (7)]. Categories included "current screeners," who met adherence criteria for CRCS, "ever screeners," who had prior CRCS but were not current with guidelines, and "never screeners," who had no CRCS tests. Mammography screeners were similarly categorized for annual mammography starting at age 40. Similar to other studies, we allowed a 3-month window before and after the recommended screening interval when classifying screeners as "current" (8). Individuals were excluded from future prevalence estimates if they entered the cohort as average risk but subsequently had a diagnosis or procedure code indicating high risk.

### Age at CRCS initiation

We examined age at initiation to determine whether average-risk men and women were beginning CRCS as recommended at age 50 (5). We used medical record data from 1987 to 2008 to determine the age at which participants' first CRCS procedure occurred and reported the average age of screening initiation for men and women from 1997 to 2008. We restricted our analysis by age to ensure that we identified the first CRCS starting at age 50 or older. Because this analysis examined data starting from 1987, we restricted ages of those in the cohort in 1997 to between 50 and 61 (i.e., all included in 1997 were age 50 or less in 1987, allowing us to capture their first CRCS). The upper age limit was increased by 1 year for each year thereafter (i.e., participants aged 50 to 71 were included in 2008, as those ages 71 or less in 2008 were age 50 or less in 1987).

### Statistical analysis

Poisson regression was used to assess screening trends over time and differences between males and females. Values of $P < 0.05$ were considered statistically significant.

## Results

The study population of men was 9,030 in 1997 and 8,752 in 2008. The study population of women was 11,555 in 1997 and 11,999 in 2008. The average age of females in the population was $66 \pm 12$ years in 1997 and was $65 \pm 12$ years in 2008; the average age of males was $63 \pm 10$ years in 1997 and was $63 \pm 11$ years in 2008. The prevalence of current CRCS among Olmsted County residents age 50 years and older increased from 20% in 1997 to 62% in 2008 (Fig. 1). Adherence increased from 17% to 59% among men and from 22% to 65% among women, and was consistently higher among women than men throughout the study period ($P < 0.001$). The prevalence of people who

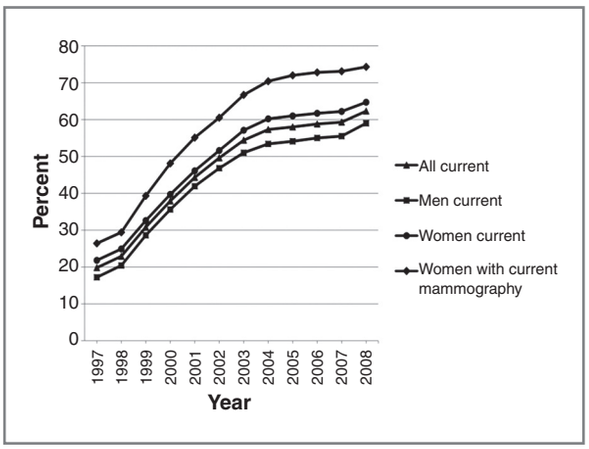


Figure 1. Adherence to American Cancer Society colorectal cancer screening guidelines among average risk men, women, and women adherent to screening mammography $\geq$ 50 years of age residing in Olmsted County, MN, from 1997 to 2008.

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had ever received CRCS but were not current with adherence remained low and relatively stable throughout the entire study period, ranging from 1% in 1997 to 3% in 2008.

### CRCS among mammography adherent women

The population of mammography adherent average-risk women age 50 or greater was 5,280 in 1997 and 6,380 in 2008. CRCS among this population increased from 26% in 1997 to 74% in 2008 (Fig. 1). Women current with mammography were significantly more likely to be current with CRCS than the general population of women, men, and the entire population ($P < 0.001$ in all comparisons).

### Age of screening initiation analysis

The number of eligible men ranged from 657 in 1997 to 4,249 in 2008; the number of eligible women ranged from 914 in 1997 to 6,007 in 2008. The mean ages of CRCS initiation remained relatively stable at 54 years in 1997 and 55 years in 2008 for men and women.

## Discussion

### CRCS overall

CRCS rates more than tripled among Olmsted County residents between 1997 and 2008. The greatest increase occurred in 2001 to 2004, after which rates began to plateau. The larger increase from 2001 to 2004 may be attributable in part to 2 events: former Today Show anchorwoman Katie Couric's televised colonoscopy in 2000 (9) and the 2001 expansion of Medicare to cover average-risk screening colonoscopy (10).

In 2008, 65% of women age 50 years or greater were adherent to ACS screening recommendations (5), as were 59% of men in the same age group. These screening rates are lower than those from studies using self-report data (3, 7, 11, 12). For example, the 2010 Behavioral Risk Factor Surveillance Survey (BRFSS) estimated that 72.2% of Minnesotans age 50 or greater underwent a sigmoidoscopy or colonoscopy and 12.3% had a FOBT (categories not mutually exclusive; ref. 12). Our lower reported screening rates were expected for several reasons. First, our study used medical record data whereas national surveys utilized self-reports, which are subject to over-reporting (13–15). Indeed, a 2009 metaanalysis of self-reports found that endoscopic CRCS procedures were overreported by an average ratio of 2.2:1 when compared with medical records (16). Second, we excluded individuals who were screened for diagnosis rather than prevention purposes, whereas most versions of the NHIS and BRFSS do not make this distinction (17, 18). Finally, although medical records are more likely to correctly identify the time and specific type of screening that was done, it is possible that some tests were missed because individuals were screened outside of Olmsted County; however, this is fairly unlikely given Olmsted County's relatively stable population and local patterns of medical care (4).

### CRCS by gender

CRCS rates for men were significantly lower than for women. This gender disparity could be related to the degree of healthcare utilization prior to age 50 by women compared with men (19); women utilize healthcare more than men and thus have the opportunity to have more discussions with providers about preventive health screenings, including CRCS (20). Our findings are inconsistent with previous studies reporting that women are less adherent to CRCS than men (2, 3, 7, 10, 17). This may be due to differences in study methodology as men are more likely than women to overreport CRCS (21), potentially causing studies that utilize self-reports to overestimate male CRCS rates. This difference may also have been due to dissimilarities in study populations, as we examined a fairly homogenous population with good access to medical care (4). These inconsistent findings warrant further exploration to determine whether different approaches are needed to promote CRCS among men and women.

### CRCS among women adherent to screening mammography

We included this analysis because several studies have shown that whereas CRCS rates are higher among mammography-adherent women, a significant number of mammography-adherent women do not undergo CRCS and therefore present a significant group to target for CRCS (22–24). Our mammography and CRCS adherence data were consistent with previous studies that showed an association between CRCS and other cancer screenings (23, 24). Contrary to the results of Molina and colleagues, which examined medical record data from women who underwent screening mammography in 1998, we found the percentage of women adherent to both mammography and CRCS to be much higher (29% vs. 12% in 1998; ref. 24). This discrepancy may be due to the fact that we examined screening among an entire population rather than at a single institution, as women may not have undergone CRCS procedures at the same institution at which they underwent mammography screening. Despite this, 26% of mammography-adherent women were not current with CRCS in 2008, and this group therefore presents an important avenue for future CRCS intervention efforts in health care settings. Moreover, the correlation between mammography and CRCS indicates that other types of screenings and preventive health visits may also present opportunities for physicians to educate patients about CRCS.

### Age at CRCS initiation

Our analysis of age at screening initiation suggests that individuals are delaying CRCS by as much as 5 years. This finding was fairly consistent over the study period; however, fewer people were excluded each year as the age range increased; therefore the most accurate assessment of screening initiation likely occurred in the final years of the analysis. Also, given the age restrictions used to ensure

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that no participants were over age 50 before entering the cohort, it is possible that our results are biased downward and that the actual mean age at screening initiation is higher than 55 among the entire population of screeners. Regardless, our findings suggest a need for screening messages that are targeted to individuals at or prior to age 50.

### Strengths and limitations

Our study includes several strengths and a few limitations. One limitation is the lack of racial/ethnic and socioeconomic diversity in Olmsted County, which precludes our ability to generalize our findings to other communities. Furthermore, we do not have information on the insurance status of our participants, which is a factor that has been linked to CRCS adherence (1). Strengths of the study include that the REP database allowed us to describe CRCS patterns for a defined population and that CRCS uptake was assessed through medical records rather than self-report, thus providing a more accurate estimate of CRCS adherence patterns (13–15). Our study is also one of the first reports to assess age at CRCS initiation. In conclusion, our findings document historical and current trends in CRCS and highlight potential targets for further study to reduce CRC-related morbidity and mortality.

## Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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