

Trends in Up-to-Date Status in Colorectal Cancer Screening, North Carolina, 1998-2002

Jane A. Kim, MD, MPH, Deborah Porterfield, MD, MPH, and Ziya Gizlice, PhD

Abstract

Background: Rates of colorectal cancer (CRC) screening are rising nationwide. Our purpose was to determine the proportion of North Carolina adults who were up-to-date with CRC screening in 1998-2002 and analyze trends by socio-demographic subgroups.

Methods: We examined data from the North Carolina Behavioral Risk Factor Surveillance System. For 1998, 1999, 2001, and 2002, we determined the proportion of respondents 50 years old and older who were up-to-date, defined as a home fecal occult blood test (FOBT) in the past 12 months and/or a sigmoidoscopy or colonoscopy in the past five years. We examined trends in up-to-date status in all respondents and in selected socio-demographic subgroups. We also examined the characteristics of respondents who were up-to-date in 2001-2002.

Results: From 1998-2002, the percentage of respondents 50 years old or older who were up-to-date with CRC screening increased from 46.1% to 54.0% (test for trend, $p < 0.0001$). The proportion who were up-to-date increased among those 50-74 years old, those with a high school or college education, and those with incomes less than \$25,000. Proportions that were up-to-date did not significantly increase among African Americans and respondents with less than a high school education. In 2001-2002, we found low percentages that were up-to-date among adults 50-54 years old, Hispanics, and the uninsured.

Conclusions: The proportion of North Carolina adults who are up-to-date with CRC screening is increasing, but not across all socio-demographic groups. These results indicate that there are subgroups that need to be reached with screening programs. Efforts to educate the public and providers about CRC screening should continue.

Introduction

Colorectal cancer (CRC) is a leading cause of cancer in the United States and ranks only behind lung cancer as a cause of cancer death.¹ The American Cancer Society (ACS) estimates that 4,100 new cases and 1,590 deaths from colorectal cancer will occur in North Carolina in 2005.¹ Colorectal cancer screening reduces mortality²⁻⁶ and is cost-effective.^{7,8} The United States Preventive Services Task Force, the American Gastroenterological Association, the ACS, and others recommend screening for adults 50 years old or older.⁹⁻¹¹ Multiple modalities can be used for screening: a yearly fecal occult blood test (FOBT), flexible sigmoidoscopy or barium enema every five years, a combination of FOBT and sigmoidoscopy, or

colonoscopy every ten years (see Table 1). Despite expert group recommendations and multiple screening modalities, national rates of CRC screening^{12,13} remain far below rates for mammography, prostate-specific antigen screening, and Pap smear testing.¹⁴⁻¹⁶

Although CRC screening rates were low throughout the 1990s, recent data from the national Behavioral Risk Factor Surveillance System (BRFSS) show modest increases in screening rates. From 1999-2001, the percentage of adults 50 years old or older who reported FOBT screening within the past 12 months increased from approximately 19% to 24%, and the percentage reporting a sigmoidoscopy or colonoscopy within the past five years improved from 34% to 39%.^{12,13} In 2001, approximately 53% of adults 50 years and older were up-to-date with screening, defined as an FOBT in the past 12 months or

Jane A. Kim, MD, MPH, is an Associate in Medicine in the Department of Medicine at Duke University Medical Center and the Durham VA Medical Center. She completed this work as a Preventive Medicine resident in the Department of Social Medicine at the University of North Carolina at Chapel Hill. She can be reached at kim00057@notes.duke.edu or at the Department of Veterans Affairs (152), 508 Fulton Street, Durham, NC 27705.

Deborah Porterfield, MD, MPH, is Program Director for the Preventive Medicine Residency Program and a medical epidemiologist at the Cancer Prevention and Control Branch, North Carolina Division of Public Health. She can be reached at porterfi@email.unc.edu or at CB# 7240 Wing D, UNC-Chapel Hill, Chapel Hill, NC 27599.

Ziya Gizlice, PhD, is Statistical Research Manager for the Center for Health Promotion and Disease Prevention, University of North Carolina-Chapel Hill. He can be reached at ziya_gizlice@email.unc.edu or at CB# 8140, UNC-Chapel Hill, Chapel Hill, NC 27599.

Table 1.
Colorectal Cancer Screening Guidelines for Average Risk[§] Individuals
50 Years Old or Older^{* 9-11}

Any one of the following:

1. Yearly fecal occult blood testing (FOBT)
2. Flexible sigmoidoscopy (FS) every five years
3. Combined yearly FOBT and FS every five years**
4. Colonoscopy every ten years
5. Double-contrast barium enema every five years

[§] Average risk: individuals without a family or personal history of colorectal cancer, personal history of adenomatous polyps, and the absence of an illness, such as inflammatory bowel disease that predisposes individuals to CRC

^{*} Recommendations of the American Gastroenterological Association Consortium Panel, United States Preventive Services Task Force, and American Cancer Society (ACS)

^{**} ACS recommends the combination of flexible sigmoidoscopy and FOBT over either test alone

a lower endoscopy (colonoscopy or sigmoidoscopy) in the last ten years.¹³

Recent trends in up-to-date status in North Carolina are of interest to the Cancer Prevention and Control Branch of the North Carolina Division of Public Health, which is responsible for surveillance and has implemented CRC screening programs for underserved populations in the past. These trends are also of interest to the Advisory Committee for Cancer Coordination and Control, which makes recommendations on cancer screening and control for North Carolina and is currently writing an updated state plan for cancer control. We were also interested in assessing recent trends in CRC screening to determine if various factors, such as insurance policy changes, state-based legislation, and public awareness campaigns might have resulted in an increased proportion of North Carolinians who were up-to-date with CRC screening. We examined the data from the North Carolina BRFSS for trends in CRC screening rates, including trends across selected socio-demographic subgroups from 1998-2002. We also evaluated the characteristics of those who were up-to-date in 2001-2002 in order to identify populations that might be in need of interventions to improve the performance of CRC screening.

Methods

The BRFSS is a multistage, random-digit-dialed, state-based telephone survey of noninstitutionalized adult United States residents ages 18 and older.¹⁷ The BRFSS consists of a core set of questions with additional optional modules for topics, such as colorectal cancer screening. States have the option to add these additional modules based on the data needs of their state. Colorectal cancer screening questions were mandatory core items in the 1999, 2001, and 2002 BRFSS. The North Carolina Cancer Prevention and Control Branch paid to add questions to the 1998 BRFSS for enhanced surveillance of colorectal cancer screening behavior and needs assessment for public health programs.

During the study period, the North Carolina BRFSS conducted 17,764 interviews. Colorectal cancer screening questions

were asked of the 7,642 respondents who were ages 50 years old or older at the time of the interview. Response rates of all eligible individuals with telephones in North Carolina ranged from 56% (2001) to 64% (1998) and were calculated via the CASRO method.¹⁸ The CASRO method calculates the response rate by taking the percentage of complete and partial interviews out of an estimate of all eligible households.

Interviewers asked four questions about whether respondents had ever been screened with sigmoidoscopy/colonoscopy or a home FOBT and, if so, when they received screening (see Box 1). To reflect updated evidence regarding colonoscopy and proctoscopy, endoscopy questions changed in

1999 to ask about screening with "sigmoidoscopy/colonoscopy" instead of "sigmoidoscopy/proctoscopy." For this analysis we refer to both sets of terms as "endoscopy." In 2001, BRFSS changed endoscopy response choices to include endoscopy within the past ten years, the time frame recommended for colonoscopy screening. We defined up-to-date status for the analysis of trends from 1998-2002 as a home FOBT in the past 12 months and/or a sigmoidoscopy or colonoscopy in the past five years. We chose this definition in order to compare trends across years because the ten-year answer choice was not available before 2001.

For each year with data on CRC screening from 1998-2002, we determined the proportion of respondents who were up-to-date with screening for the total number of respondents as well as for the socio-demographic subgroups of gender, age, race, education, and household income. Those who responded "do not know/not sure" or "refused" were excluded. We used a test for trend to determine if there were significant trends in the proportions who were up-to-date with CRC screening. Trends were not calculated for subgroups with less than 100 respondents in a given year.

For 2001 and 2002, we also calculated the percentages who were up-to-date using an alternate definition: FOBT within the past 12 months and/or a sigmoidoscopy/colonoscopy within the past ten years. Given that the national BRFSS now uses the ten-year time interval to determine the percentage of individuals who were screened with lower endoscopy during recommended time intervals,¹² we used this updated definition of up-to-date in order to be consistent with the national definition. This definition of up-to-date includes respondents who were appropriately screened with colonoscopy within the past ten years, but also those who had a sigmoidoscopy five to ten years earlier and were no longer up-to-date with guidelines. To evaluate whether screening according to guidelines increased significantly between 2001 and 2002, we compared the difference in the proportions of respondents who were up-to-date using a t-test.

We combined data from 2001 and 2002, the most recent years for which we had data, and examined the characteristics of respondents who were up-to-date with screening. Combining data from 2001 and 2002 allowed us to determine the proportions

Box 1

Questions on colorectal cancer screening, 2002 BRFSS (Behavioral Risk Factor Surveillance System)

A blood stool test is a test that may use a special kit at home to determine whether the stool contains blood. Have you ever had this test using a home kit?

- A Yes
- B No
- C Don't know/not sure
- D Refused

How long has it been since you had your last blood stool test using a home kit?

- A Within the past year
- B Within the past two years
- C Within the past five years
- D Five or more years ago
- E Don't know/not sure
- F Never
- G Refused

Sigmoidoscopy and colonoscopy are exams in which a tube is inserted in the rectum to view the bowel for signs of cancer or other health problems. Have you ever had either of these exams?

- A Yes
- B No
- C Don't know/not sure
- D Refused

How long has it been since you had your last sigmoidoscopy or colonoscopy?

- A Within the past year
- B Within the past two years
- C Within the past five years
- D Within the past ten years
- E Ten or more years ago
- F Don't know/not sure
- G Refused

who were up-to-date with screening in subgroups, such as the uninsured and Hispanics, groups with small numbers sampled in each individual year.

We used SUDAAN version 8 to calculate rates, averages, standard errors, and 95% confidence intervals.¹⁹ Data from the sample were weighted to adjust for unequal probabilities of selection due to the disproportionate sampling method and due to people living in households with different numbers of telephones and different numbers of adults. The final sample data were also weighted to account for unequal non-response rates among different demographic groups. Two-sided p-values < 0.05 were considered statistically significant. Analyses using BRFSS data are exempt from Institutional Review Board approval because the BRFSS does not have any personal identifiers and is a public health surveillance system. These data were analyzed as part of the surveillance work of the North Carolina Division of Public Health.

Results

Trends in Up-to-Date Status in Colorectal Cancer Screening, 1998-2002

The percentage of respondents 50 years old or older who reported a home FOBT in the past 12 months or endoscopy in the past five years increased from 46.1% [95% confidence interval (CI), 42.2, 50.1] in 1998 to 54% (95% CI, 51.2, 56.7) in 2002 (test for trend, $p < 0.0001$, see Table 2). Table 2 shows the trend in the percentage of all respondents that were up-to-date from 1998-1999 and 2001-2002, the years in which North Carolina asked questions about CRC screening, and Table 3 presents trends in up-to-date status by socio-demographic subgroups. There were statistically significant positive trends in up-to-date status among males and females, those 50-74 years old, whites, those with a high school or some college education, and those with incomes less than \$25,000 (see Table 3). There was a 24 percentage-point increase in up-to-date status among those with incomes less than \$15,000 (33% to 57%) and a 13 percentage-point increase from 31% to 44% in the 50-54-year-old age group. In contrast, there were no significant trends in the percentages who were up-to-date among respondents with less than a high school education or a college degree or greater and those with incomes greater than \$25,000. Respondents with higher levels of education and income already had high baseline percentages of individuals who were up-to-date in 1998; these groups experienced only small increases over the five-year period.

Proportions and Characteristics of Up-to-Date Respondents, 2001-2002

For 2001-2002, using the updated definition of up-to-date, which was an FOBT in the past 12 months or sigmoidoscopy/colonoscopy in the past ten years, the percentage of respondents who were up-to-date

Table 2.
Number and Percentage of North Carolina Respondents 50 Years Old or Older Who Were Up-to-Date with Colorectal Cancer Screening,* 1998-2002

	Total Number of Respondents	Percent	95% Confidence Interval
1998	931	46.1	(42.2, 50.1)
1999	1,031	45.2	(41.8, 48.7)
2001	2,473	55.4	(52.5, 58.2)
2002	2,942	54.0	(51.2, 56.7)

Test for trend, 1998-2002: t-value = 4.47, $p < 0.0001$

* FOBT within past 12 months and/or sigmoidoscopy/colonoscopy within the past five years

Table 3.
Trends in Up-to-Date Status in Colorectal Cancer Screening* by Socio-demographic Groups in North Carolina, 1998-1999, 2001-2002

Demographics	1998 Percent (Total)	1999	2001	2002	Trend Test P Value
Gender					
Male	44.8 (354)	43.3 (385)	54.6 (896)	51.9 (1,082)	0.01
Female	47.1 (577)	46.7 (646)	56.0 (1,577)	55.7 (1,860)	0.001
Age					
50-54	30.9 (162)	39.8 (216)	42.5 (536)	43.9 (624)	0.01
55-64	49.0 (301)	40.0 (306)	57.9 (803)	56.7 (955)	0.003
65-74	51.1 (279)	50.6 (299)	61.9 (643)	60.9 (782)	0.003
75+	49.7 (189)	53.0 (210)	56.8 (491)	52.4 (581)	0.47
Race					
White	45.0 (765)	45.2 (831)	56.4 (2,043)	54.8 (2,046)	0.0001
African-American	51.9 (151)	43.7 (180)	52.5 (350)	53.6 (370)	0.46
Education					
Less than high school	44.8 (269)	37.5 (268)	50.2 (526)	44.7 (655)	0.41
Some high school	44.4 (290)	43.4 (331)	54.4 (753)	57.2 (878)	0.001
Some college	42.6 (196)	49.0 (195)	57.9 (576)	54.3 (609)	0.01
College+	55.5 (169)	54.0 (235)	60.7 (609)	59.9 (788)	0.23
Household Income					
Less than \$15,000	33.0 (180)	37.5 (151)	47.3 (311)	57.2 (390)	0.001
\$15,000-\$24,999	45.3 (190)	46.4 (191)	54.6 (427)	48.1 (473)	0.001
\$25,000-\$34,999	51.9 (129)	47.3 (133)	59.5 (321)	51.3 (307)	0.62
\$35,000-\$49,999	57.8 (100)	42.0 (126)	56.9 (292)	57.1 (342)	0.55
\$50,000+	43.9 (122)	46.9 (183)	58.5 (521)	60.3 (573)	0.23

* FOBT within past 12 months and/or sigmoidoscopy/colonoscopy within past five years

with CRC screening was 57.4% in 2001 and 56.4% in 2002; this difference was not significant.

In the combined data from 2001 and 2002, approximately 58% of whites were up-to-date compared to 54% of African-Americans and 41% of other minorities, a category that included Asians, American Indians, and native Hawaiian or other Pacific Islanders (see Table 4). Fewer respondents of Hispanic origin were up-to-date with screening (49.9%) compared to those who were not Hispanic (57.0%). Only 45% of respondents 50-54 years old were up-to-date, compared to 59% of those 55-64 years old and 61% of those 65 years old or older. Forty-nine percent of respondents with less than a high school education were up-to-date versus 63% of those who had a college education or beyond. Approximately 59% of those with health insurance were up-to-date with screening, compared to only 34.8% of respondents without health insurance.

Discussion

From 1998-2002, the percentage of North Carolina adults 50 years old or older who were up-to-date with CRC screening increased, but remained low, and positive trends in up-to-date status were present in some, but not all socio-demographic subgroups. In 2001-2002, screening rates continued to improve, but more than 40% of respondents still had not been screened according to guidelines. There were notable disparities in the

percentages that were up-to-date in 2001-2002 by race, age, and insurance status.

The proportions of those who were up-to-date in North Carolina are similar to those obtained from the national BRFSS. In the 1999 national BRFSS, 44% of adults 50 years old or older were up-to-date with screening, defined as an FOBT in the past year or a sigmoidoscopy in the past five years,¹³ compared to 45.2% of North Carolina respondents. In the 2001 national BRFSS, 53.1% were up-to-date using the updated definition, an FOBT within the past 12 months or lower endoscopy within the past ten years.²⁰ In North Carolina, approximately 57% of respondents reported screening within these time intervals.

The increase in the percentages of North Carolina respondents who were up-to-date may be due to national and state efforts to promote CRC screening. The Centers for Disease Control and Prevention (CDC) launched multi-media campaigns in 1999 to educate the public and healthcare providers about CRC screening.²¹⁻²³ The American Cancer Society also implemented a colorectal cancer screening media campaign in March 1999 and 2000. Activities organized through North Carolina's Cancer Prevention and Control Branch of the North Carolina Division of Public Health included a media campaign to promote screening and regional training sessions for physicians. In addition, the North Carolina Advisory Committee on Cancer Coordination and Control funded a pilot project in 2000 to

Table 4.
Characteristics of North Carolina Respondents 50
Years Old or Older Who Reported FOBT within Past
12 months and/or Sigmoidoscopy/Colonoscopy
within the Past Ten Years, 2001-2002

Demographics	Percent (Total)	95% CI
Total	56.9 (5,418)	54.9, 58.9
Sex		
Male	55.2 (1,978)	52.0, 58.4
Female	58.2 (3,440)	55.8, 60.7
Race		
White	58.1 (4,452)	55.9, 60.2
African American	54.2 (720)	48.9, 59.3
Other minorities	41.1 (202)	30.7, 52.4
Hispanic	49.9 (83)	35.0, 64.7
Non-Hispanic	57.0 (5,325)	55.0, 59.0
Age		
50-54	45.4 (1,160)	41.1, 49.8
55-64	59.3 (1,758)	55.9, 62.6
65+	61.2 (2,500)	58.3, 64.0
Education		
Less than high school	49.1 (1,182)	44.9, 53.3
Completed high school	57.5 (1,631)	53.9, 61.0
Some college	59.3 (1,187)	55.2, 63.3
Greater than college	63.1 (1,397)	59.1, 66.9
Income		
Less than \$15,000	54.0 (701)	48.2, 59.8
\$15,000-\$24,999	54.0 (900)	49.2, 58.8
\$25,000-\$34,999	56.4 (629)	50.7, 62.0
\$35,000-\$49,999	60.2 (634)	54.5, 65.7
\$50,000+	61.8 (1,094)	57.4, 66.0
Health Insurance		
Yes	58.8 (5,014)	56.8, 60.8
No	34.8 (399)	28.3, 41.9

promote CRC screening in six local health departments.

Medicare and the North Carolina General Assembly implemented policy changes in 1998 and 2001 that may have contributed to the increasing proportion of North Carolina respondents who were up-to-date. In January 1998, Medicare began to cover screening FOBT, sigmoidoscopy, and barium enema for average-risk enrollees 50 years old and older. Medicare further broadened its coverage in 2001 to cover screening colonoscopy for average-risk enrollees 50 years old or older.²⁴ Also in 2001, the North Carolina General Assembly passed legislation mandating that state and private insurance plans cover CRC screening tests.²⁵ The 2002 North Carolina BRFSS, however, showed only a small increase in up-to-date status compared to previous years. It will be interesting to see whether rates of up-to-date status in subsequent surveys reflect these policy changes.

Although the percentage of North Carolina adults 50 years old and older reporting CRC screening within recommended time intervals is increasing, approximately 46% of adults are not up-to-date with screening. In addition, not all socio-demographic

subgroups experienced improvements in up-to-date status. There were significant improvements in whites, those with incomes less than \$25,000, and those with a high school or some college education. There was no significant increase in up-to-date status, however, among respondents with less than a high school education and those with incomes between \$25,000-\$50,000, indicating a possible need for interventions in these populations to help increase levels of screening. In addition, screening among all respondents 50-54 years old improved from 30% to 43% from 1998-2002, but the proportion who were up-to-date among this age group in 2002 was still low. It may be important to target individuals in this age group in order to help them start and continue with screening according to guidelines.

Prior research has found that increasing age, higher levels of education, having health insurance, and being of non-Hispanic background²⁶⁻³² are associated with higher rates of CRC screening. The findings from our study are consistent with results from these prior studies. In 2001-2002, North Carolina BRFSS respondents 50-54 years old had low rates of up-to-date screening compared to those of older age, and individuals with low educational attainment and low incomes had lesser rates of up-to-date screening compared to those with higher levels of education and income. Rates of up-to-date screening among the insured were almost twice as high as those among the uninsured. Fewer Hispanics were up-to-date compared to non-Hispanics. Current educational and awareness programs to promote screening may not be reaching the groups who had low percentages of individuals who were up-to-date; poor access to healthcare and lack of income to pay for tests are other possible reasons for these low rates.

African Americans have higher rates of colorectal cancer death and are diagnosed at a more advanced stage more often than whites.^{1,33} These disparities may be due in part to low rates of CRC screening in African Americans.³⁴ In our current study, we found that rates of up-to-date screening among African-Americans did not increase significantly over time, but that the actual rates of up-to-date screening in 2001-2002 were comparable to whites. It is encouraging that African Americans had similar rates of up-to-date status in recent years compared to whites, and the lack of a significant trend may be due in part to sampling error due to small sample sizes in 1998-1999. Efforts to promote CRC screening among African-Americans should continue given their higher rates of mortality and diagnosis in advanced stages of disease.

There are a number of limitations to this study. First, the change in wording from "sigmoidoscopy/proctoscopy" in 1998 to "sigmoidoscopy/colonoscopy" in 1999 may have resulted in higher screening rates in 1999, 2001, and 2002 due to a previously unmeasured use of colonoscopy. The change from proctoscopy to colonoscopy may mean that the increasing trends are due in part to the change in question wording, which could have introduced measurement error and potential bias into our results. The extent to which this change may have affected the results is unclear. Defining up-to-date screening status for the analysis of trends as a sigmoidoscopy or colonoscopy within the past five

years may underestimate the actual percentage of those who are up-to-date, since individuals who had colonoscopy between five and ten years ago are in compliance with current guidelines. The BRFSS questions on CRC screening did not distinguish between diagnostic and screening procedures, possibly resulting in overestimates of actual screening rates. Another limitation is that the percentages of up-to-date by socio-demographic characteristics in 2001-2002 are not adjusted for the other variables. Further investigation of these associations with a multivariate model might help define which characteristics are most strongly associated with up-to-date status. This was a telephone survey, so responses were limited to individuals who owned home telephones. The response rates were low, and respondents may have answered differently compared to those who chose not to participate. Another limitation is recall bias; responses were self-reported and may not accurately reflect the actual performance of screening tests. Comparisons of self-report and chart audits, however, have found fair-to-good agreement between patient self-report and medical records.³⁵⁻³⁷ And finally, the small numbers of African Americans surveyed in the 1998 and 1999 BRFSS may have affected the accuracy of these estimates.

Conclusions

The percentage of North Carolina adults who are up-to-date with CRC screening is increasing, and state rates of up-to-date status parallel trends seen on the national level. Although this is an encouraging finding, many adults 50 years old or older are still not up-to-date with current guidelines, and some socio-demographic subgroups, such as the uninsured, Hispanics, and those 50-54 years of age, have particularly low rates of individuals who are up-to-date with screening. There is a need for educational programs and screening initiatives for the public and for healthcare providers, especially targeted toward populations who had low percentages of respondents who were up-to-date, in order to improve the performance of colorectal cancer screening in North Carolina.

Acknowledgement: Dr. Kim was supported by a Physician Training Award in Preventive Medicine (#PTAPM-01-085-01) from the American Cancer Society. NCMedJ

REFERENCES

- Jemal A, Murray T, Ward E, et al. Cancer statistics, 2005. *CA Cancer J Clin* 2005;55(1):10-30.
- Mandel JS, Church TR, Bond JH, et al. The effect of fecal occult-blood screening on the incidence of colorectal cancer. *N Engl J Med* 2000;343(22):1603-1607.
- Mandel JS, Bond JH, Church TR, et al. Reducing mortality from colorectal cancer by screening for fecal occult blood. Minnesota Colon Cancer Control Study. *N Engl J Med* 1993;328(19):1365-1371.
- Muller AD, Sonnenberg A. Prevention of colorectal cancer by flexible endoscopy and polypectomy. A case-control study of 32,702 veterans. *Ann Intern Med* 1995;123(12):904-910.
- Selby JV, Friedman GD, Quesenberry CP, Jr, Weiss NS. A case-control study of screening sigmoidoscopy and mortality from colorectal cancer. *N Engl J Med* 1992;326(10):653-657.
- Kronborg O, Fenger C, Olsen J, Jorgensen OD, Sondergaard O. Randomised study of screening for colorectal cancer with faecal-occult-blood test. *Lancet* 1996;348(9040):1467-1471.
- Pignone M, Saha S, Hoerger T, Mandelblatt J. Cost-effectiveness analyses of colorectal cancer screening: A systematic review for the US Preventive Services Task Force. *Ann Intern Med* 2002;137(2):96-104.
- Frazier AL, Colditz GA, Fuchs CS, Kuntz KM. Cost-effectiveness of screening for colorectal cancer in the general population. *JAMA* 2000;284(15):1954-1961.
- Pignone M, Rich M, Teutsch SM, Berg AO, Lohr KN. Screening for colorectal cancer in adults at average risk: A summary of the evidence for the US Preventive Services Task Force. *Ann Intern Med* 2002;137(2):132-141.
- Smith RA, Cokkinides V, Eyre HJ. American Cancer Society guidelines for the early detection of cancer, 2003. *CA Cancer J Clin* 2003;53(1):27-43.
- Winawer S, Fletcher R, Rex D, et al. Colorectal cancer screening and surveillance: Clinical guidelines and rationale-Update based on new evidence. *Gastroenterology* 2003;124(2):544-560.
- Centers for Disease Control and Prevention. Colorectal cancer test use among persons aged 50 years—United States, 2001. *MMWR* 2003;52(10):193-196.
- Trends in screening for colon cancer—United States, 1997 and 1999. *MMWR* 2001;50(9):162-166.
- Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System-Prevalence Data, Mammography, 2002. Available at: <http://apps.nccd.cdc.gov/brfss/display.asp?cat=WH&yr=2002&qkey=1984&state=US>. Accessed August 16, 2005.
- Sirovich BE, Schwartz LM, Woloshin S. Screening men for prostate and colorectal cancer in the United States: Does practice reflect the evidence? *JAMA* 2003;289(11):1414-1420.
- Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System-Prevalence Data, Pap Smear Testing, 2002. Available at: <http://apps.nccd.cdc.gov/brfss/display.asp?cat=WH&yr=2002&qkey=3597&state=US>. Accessed August 16, 2005.
- Nelson DE, Holtzman D, Waller M, Leutzinger CL, Condon K. Objectives and design of the Behavioral Risk Factor Surveillance System. In: Proceedings of the Section on Survey Methods, American Statistical Association National Meeting; 1998; Dallas, TX; 1998.
- Centers for Disease Control and Prevention (CDC). 2002 Behavioral Risk Factor Surveillance System Summary Data Quality Report. CDC: Atlanta, GA: 2003. Available at: http://www.cdc.gov/brfss/technical_infodata/pdf/2002SummaryDataQualityReport.pdf. Accessed November 2005.
- SUDAAN software for the statistical analysis of correlated data Version 8. Research Triangle Institute: Research Triangle Park, NC: 2000.
- Centers for Disease Control and Prevention. Colorectal cancer test use among persons aged > or = 50 years—United States, 2001. *JAMA* 2003;289(19):2492-2493.
- Centers for Disease Control and Prevention. Spotlight on Screen for Life. Available at <http://www.cdc.gov/cancer/screenforlife/spotlight2004.htm>. Accessed December 14, 2004.
- Centers for Disease Control and Prevention. Donated television airplay of colorectal cancer education public service announcements—United States, 1999-2002. *MMWR* 2003;52(10):196-199.

- 23 Centers for Disease Control and Prevention. A Call to Action. 2004. Available at: <http://www.cdc.gov/cancer/colorctl/calltoaction/index.htm>. Accessed November 2005.
- 24 Centers for Medicare and Medicaid Services (CMS). CRC Screening – For People with Medicare. CMS Publication #11039; 2003.
- 25 NC General Assembly Senate Bill 132/S.L. 2001-116. Available at: <http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2001&BillID=S132>. Accessed August 15, 2005.
- 26 Seeff LC, Nadel MR, Klabunde CN, et al. Patterns and predictors of colorectal cancer test use in the adult US population. *Cancer* 2004;100(10):2093-2103.
- 27 Walsh JM, Posner SF, Perez-Stable EJ. Colon cancer screening in the ambulatory setting. *Prev Med* 2002;35(3):209-218.
- 28 Etzioni DA, Ponce NA, Babey SH, et al. A population-based study of colorectal cancer test use: Results from the 2001 California Health Interview Survey. *Cancer* 2004;101(11):2523-2532.
- 29 Nadel MR, Blackman DK, Shapiro JA, Seeff LC. Are people being screened for colorectal cancer as recommended? Results from the National Health Interview Survey. *Prev Med* 2002;35(3):199-206.
- 30 Shapiro JA, Seeff LC, Nadel MR. Colorectal cancer-screening tests and associated health behaviors. *Am J Prev Med* 2001;21(2):132-137.
- 31 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(22):1704-1713.
- 32 Potosky AL, Breen N, Graubard BI, Parsons PE. The association between health care coverage and the use of cancer screening tests. Results from the 1992 National Health Interview Survey. *Med Care* 1998;36(3):257-270.
- 33 Clegg LX, Li FP, Hankey BF, Chu K, Edwards BK. Cancer survival among US whites and minorities: A SEER (Surveillance, Epidemiology, and End Results) Program population-based study. *Arch Intern Med* 2002;162(17):1985-1993.
- 34 Cooper GS, Koroukian SM. Racial disparities in the use of and indications for colorectal procedures in Medicare beneficiaries. *Cancer* 2004;100(2):418-424.
- 35 Baier M, Calonge N, Cutter G, et al. Validity of self-reported colorectal cancer screening behavior. *Cancer Epidemiol Biomarkers Prev* 2000;9(2):229-232.
- 36 Hall HI, Van Den Eeden SK, Tolsma DD, et al. Testing for prostate and colorectal cancer: Comparison of self-report and medical record audit. *Prev Med* 2004;39(1):27-35.
- 37 Mandelson MT, LaCroix AZ, Anderson LA, Nadel MR, Lee NC. Comparison of self-reported fecal occult blood testing with automated laboratory records among older women in a health maintenance organization. *Am J Epidemiol* 1999;150(6):617-621.

Call for Papers

John W. Williams, Jr., MD, MHS
Scientific Editor, *North Carolina Medical Journal*

North Carolina is blessed with some of the finest medical research institutions in the world. The work of the medical scientists that labor in our research facilities becomes complete (in many ways) and public when it is published in peer-reviewed journals.

While medical researchers in North Carolina have many journals to which they can submit their manuscripts, we want them to consider keeping their work here at home. To be more specific, we invite the authors of our state to submit their papers to the *North Carolina Medical Journal*.

The Journal seeks papers that convey the results of original research. We are especially interested in publishing research papers that have relevance to the health of the people of our state.

An editor reviews all papers received and those of sufficient quality are peer-reviewed. As with any journal of merit, only papers of high quality will be published. Papers printed in the Journal are indexed in the National Library of Medicine's MEDLINE public database.

We generally accept two types of manuscripts for review: (1) original clinical or health services research contributions and (2) systematic reviews (both regardless of specific topic).

The *North Carolina Medical Journal* is published six times a year. It is distributed free of charge to the members of the North Carolina Medical Society, the North Carolina Hospital Association, the North Carolina College of Internal Medicine, the North Carolina Academy of Physician Assistants, the North Carolina Board of Pharmacy, the North Carolina Association of Pharmacists, the North Carolina Division of Public Health, the North Carolina Association of Health Plans, and the Medical Review of North Carolina. The Journal is available by subscription to others.

For guidance on manuscript preparation, authors should consult the "Author Guidelines," which can be found at www.ncmedicaljournal.com.

North Carolina
MEDICAL JOURNAL