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Research Article

Patterns of Colorectal Cancer Test Use, Including CT Colonography, in the 2010 National Health Interview Survey

Jean A. Shapiro[1], Carrie N. Klabunde[2], Trevor D. Thompson[1], Marion R. Nadel[1], Laura C. Seeff[1], and Arica White[1]

Abstract

Background: Recommended colorectal cancer (CRC) screening tests for adults ages 50 to 75 years include home fecal occult blood tests (FOBT), sigmoidoscopy with FOBT, and colonoscopy. A newer test, computed tomographic (CT) colonography, has been recommended by some, but not all, national organizations.

Methods: We analyzed 2010 National Health Interview Survey data, including new CT colonography questions, from respondents ages 50 to 75 years ($N = 8,952$). We (i) assessed prevalence of CRC test use overall, by test type, and by sociodemographic and health care access factors and (ii) assessed reported reasons for not having a CRC test.

Results: The age-standardized percentage of respondents reporting FOBT, sigmoidoscopy, or colonoscopy within recommended time intervals was 58.3% [95% confidence interval (CI), 57.0–59.6]. Colonoscopy was the most commonly reported test [within past 10 years: 54.6% (95% CI, 53.2–55.9)]. Home FOBT and sigmoidoscopy with FOBT were less frequently used [FOBT within past year: 8.8% (95% CI, 8.1–9.6); sigmoidoscopy within past 5 years with FOBT within past 3 years: 1.3% (95% CI, 1.0–1.6)]. CT colonography was rare: 1.3% (95% CI, 1.0–1.7). Increasing age, education, income, having health care insurance, and having a usual source of health care were associated with higher CRC test use. Test use within recommended time intervals was particularly low among individuals ages 50 to 64 years without health care insurance [21.2% (95% CI, 18.3–24.4)]. The most common reason for nonuse was "no reason or never thought about it."

Conclusions: About 40% of Americans ages 50 to 75 years do not meet the recommendations for having CRC screening tests.

Impact: Expanded health care coverage and greater awareness of CRC screening are needed to further decrease CRC mortality. *Cancer Epidemiol Biomarkers Prev; 21(6); 895–904. ©2012 AACR.*

Introduction

A variety of tests are available for colorectal cancer (CRC) screening. The U.S. Preventive Services Task Force (USPSTF) recommends that adults ages 50 to 75 years be screened with fecal occult blood testing (FOBT) every year, or sigmoidoscopy every 5 years with FOBT every 3 years, or colonoscopy every 10 years (1). Evidence clearly indicates that screening with any of these 3 tests reduces CRC mortality in this age group (2–7). For adults ages 76 to 85 years, routine CRC screening is not recommended by the USPSTF, although CRC screening in an individual patient in this age group may be appropriate if the patient has not been previously screened and is reasonably healthy (1). For adults older than 85 years, the USPSTF recommends against CRC screening (1). Recommendations from other organizations have not specified an age to stop CRC screening (8).

A newer test that can be used for CRC screening is computed tomographic (CT) colonography, also called virtual colonoscopy. CT colonography is an X-ray test, which uses CT scanning and computer software to generate 2- and 3-dimensional images of the colon and rectum, simulating a colonoscopy. In its most recent update, the USPSTF concluded that there is insufficient evidence to recommend CT colonography for CRC screening (1). However, other organizations have recommended CT colonography every 5 years as a CRC screening option (8). In the National CT Colonography Trial of the American College of Radiology Imaging Network (ACRIN), CT colonography identified 90% of subjects with large adenomas or cancers on colonoscopy but had a lower sensitivity for smaller CRC lesions (9). A recent study in the Netherlands found that participation was higher for CT colonography than for colonoscopy and found a similar diagnostic yield for advanced neoplasia for both strategies (10).

Authors' Affiliations: [1]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia; and [2]Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, Maryland

Corresponding Author: Jean A. Shapiro, Centers for Disease Control and Prevention, DCPC, 4770 Buford Highway, NE, Mailstop K-55, Atlanta, GA 30341. Phone: 770-488-3010; Fax: 770-488-4639; E-mail: zga9@cdc.gov

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The prevalence of use of the different types of CRC screening tests has changed over time (11, 12). To assess the current prevalence of use of CRC screening tests overall and by specific test types, we analyzed data from the 2010 National Health Interview Survey (NHIS) on use of home FOBT, sigmoidoscopy, colonoscopy, and CT colonography for the U.S. adult population. We also examined use of the different types of CRC tests by sociodemographic and health care access factors. For those respondents who had never had or were not up-to-date with CRC testing, we assessed the reported reasons they did not have a CRC test.

Materials and Methods

Study population

The NHIS is an in-person survey of the civilian, noninstitutionalized U.S. population, conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC; ref. 13). A representative sample of households is selected by a multistage cluster sample design. U.S. Census Bureau interviewers visit each selected household to administer the survey. CDC's Division of Cancer Prevention and Control and the National Cancer Institute's Division of Cancer Control and Population Sciences sponsor the Cancer Control Supplement to the NHIS. The Cancer Control Supplement and Sample Adult Core obtain information from a randomly selected adult in each family of related household members. The 2010 Sample Adult conditional response rate, which is only for those adults identified as eligible and does not take into account family nonresponse, was 77.3% (13). The unconditional Sample Adult response rate was 60.8%, calculated by multiplying the conditional rate by the family response rate.

Some respondents did not complete the survey and were not asked any of the CRC questions. These respondents were excluded from all analyses ($N = 725$ for ages 50–75 years and $N = 127$ for ages 76–84 years). Respondents with a personal history of CRC or missing information on history of CRC were also excluded from all analyses ($N = 105$ for ages 50–75 years and $N = 46$ for ages 76–84 years). For most of our analyses, only respondents ages 50 to 75 years were included ($N = 8{,}952$). We conducted a subanalysis among respondents ages 76 to 84 years ($N = 1{,}442$).

CRC test use

Respondents were asked separate questions about the use of sigmoidoscopy, colonoscopy, the blood stool or occult blood test, and, for the first time in the NHIS, CT colonography or virtual colonoscopy. Descriptions of each test were provided so that the respondents could identify the tests even if they did not know the name of the test (13). Separate questions were asked about home FOBT, described as a blood stool test using a home test kit, and office FOBT, described as a blood stool test in which a doctor or other health care professional collects a stool sample during an office visit. In our primary analysis, we only include information on use of home FOBT, not office FOBT, because national guidelines recommend use of home FOBT (1, 8). We analyzed use of CT colonography separately because it is not recommended for CRC screening by the USPSTF (1). Use of any CRC test within the recommended time interval was defined as use of home FOBT within the past year, use of sigmoidoscopy within the past 5 years in combination with home FOBT within the past 3 years, or use of colonoscopy within the past 10 years.

For each type of CRC test, respondents were asked when they had their most recent test. Respondents who had not had a colonoscopy in the past 10 years, a sigmoidoscopy in the past 5 years, a CT colonography in the past 5 years, or an FOBT in the past year were also asked the most important reason why they did not have any kind of test to look for problems in their colon or rectum.

While the NHIS asks about test indication, CRC tests conducted for any indication were included in the analysis because the reported indication for a CRC test may not always be accurate (14), and even if a test was conducted for nonscreening purposes, a person would have been considered effectively screened.

Correlates

Table 1 lists the self-reported variables that were examined in relation to CRC test use. Respondents who reported they were of multiple races but also reported a primary race were included in the primary race category. Missing data for race and ethnicity were imputed by hotdeck imputation (13). Missing income data were imputed using multiple imputation (15).

Respondents were asked whether there was a place where they usually go when they are sick or need advice about their health. Respondents reporting the hospital emergency room as their only usual source of health care were included among those categorized as having no usual source of health care, whereas those respondents who reported other places were classified as having a usual source of health care.

For Table 1, the health care insurance variable was grouped into different categories depending on age. For ages 50 to 64 years, the health care insurance categories were (i) any private insurance, with or without other coverage; (ii) military health coverage without private insurance, but including those with other government/public coverage; (iii) only government/public coverage other than military (without private insurance; includes Medicare, Medicaid, state-sponsored health plan, Indian Health Service, Children's Health Insurance Program); and (iv) no coverage or single service plans only. Single service plans only pay for one type of service such as dental care, vision care, or prescriptions. For ages 65 to 75 years, the health care insurance categories were (i) private insurance, with or without Medicare or other coverage; (ii) Medicare coverage without private insurance, including those with Medicare plus other public coverage; (iii) only

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Table 1. Age-adjusted percentages of respondents ages 50 to 75 years who reported CRC tests within recommended time intervals, by sociodemographic and health care access variables, National Health Interview Survey (NHIS), 2010

	Home FOBT within past year			Sigmoidoscopy within past 5 years with FOBT within past 3 years			Colonoscopy within past 10 years			Any CRC test within recommended time interval		
Characteristic	***N*[a]**	**%[b]**	**(95% CI)**	***N*[a]**	**%[b]**	**(95% CI)**	**N[a]**	**%[b]**	**(95% CI)**	**N[a]**	**%[b]**	**(95% CI)**
Total	8,816	8.8	(8.1–9.6)	8,871	1.3	(1.0–1.6)	8,857	54.6	(53.2–55.9)	8,825	58.3	(57.0–59.6)
Gender												
Male	3,884	8.9	(7.9–10.0)	3,901	1.6	(1.2–2.2)	3,898	54.4	(52.4–56.4)	3,885	58.2	(56.3–60.1)
Female	4,932	8.7	(7.7–9.7)	4,970	1.0	(0.7–1.4)	4,959	54.7	(53.0–56.5)	4,940	58.4	(56.6–60.1)
Race												
White	6,728	8.9	(8.1–9.8)	6,776	1.3	(1.0–1.6)	6,771	55.4	(54.0–56.8)	6,744	59.2	(57.8–60.6)
Black	1,515	8.2	(6.6–10.0)	1,519	1.5	(0.9–2.3)	1,513	52.4	(49.5–55.3)	1,510	55.6	(52.6–58.6)
Asian	470	8.0	(5.4–11.6)	471	1.6	(0.7–3.6)	468	43.5	(38.6–48.5)	467	46.9	(41.9–52.0)
American Indian/Alaska native	80	7.1	(3.3–14.6)	82	0.0	(0.0–4.4)	82	46.3	(33.9–59.2)	81	48.1	(35.5–61.0)
Hispanic or Latino												
No	7,654	9.1	(8.3–9.9)	7,697	1.4	(1.1–1.7)	7,687	55.5	(54.1–56.9)	7,663	59.4	(58.0–60.7)
Yes	1,162	5.6	(4.3–7.3)	1,174	0.6	(0.2–1.4)	1,170	44.8	(41.4–48.3)	1,162	47.3	(43.8–50.9)
Age, y												
50–59	4,166	7.0	(6.1–8.0)	4,184	0.9	(0.6–1.3)	4,173	46.3	(44.5–48.3)	4,159	50.0	(48.1–51.8)
60–69	3,329	10.5	(9.4–11.7)	3,353	1.6	(1.2–2.1)	3,353	61.9	(60.0–63.8)	3,339	65.8	(63.9–67.7)
70–75	1,321	10.8	(9.0–12.9)	1,334	2.0	(1.2–3.3)	1,331	64.5	(61.6–67.4)	1,327	68.2	(65.2–71.0)
Education												
<12 y	1,512	5.4	(4.3–6.7)	1,527	0.9	(0.6–1.3)	1,519	38.8	(36.0–41.7)	1,506	41.6	(38.7–44.6)
High school graduate	2,436	6.9	(5.8–8.2)	2,454	0.8	(0.5–1.5)	2,453	50.4	(48.1–52.6)	2,445	53.3	(51.0–55.5)
Some college	2,486	10.6	(9.2–12.2)	2,497	1.1	(0.8–1.7)	2,493	57.3	(55.0–59.5)	2,489	61.8	(59.6–63.9)
College graduate	2,349	10.7	(9.2–12.4)	2,358	2.0	(1.5–2.7)	2,360	63.8	(61.4–66.1)	2,353	67.7	(65.4–70.0)
Annual family income												
<$35,000	3,664	8.2	(7.2–9.3)	3,688	0.9	(0.6–1.2)	3,677	42.3	(40.5–44.2)	3,656	46.6	(44.6–48.5)
$(35.000–49.999)	1,284	7.8	(6.1–10.0)	1,294	1.0	(0.5–1.8)	1,291	51.2	(48.1–54.4)	1,287	54.6	(51.5–57.8)
$(50.000–74.999)	1,484	8.7	(7.1–10.6)	1,492	1.4	(0.8–2.5)	1,489	57.1	(54.2–60.0)	1,486	59.8	(56.9–62.7)
$(75.000–99.999)	912	11.2	(8.8–14.0)	918	2.1	(0.9–4.6)	917	60.3	(56.7–63.9)	916	65.5	(61.9–69.0)
≥$100,000	1,472	10.2	(8.5–12.1)	1,480	1.7	(0.8–3.5)	1,483	68.6	(65.7–71.4)	1,479	71.5	(68.6–74.2)
Health care insurance—ages 50–64												
Private	3,968	8.0	(7.1–9.0)	3,983	1.2	(0.9–1.7)	3,984	56.7	(54.8–58.6)	3,977	60.2	(58.4–62.1)
Military without private	269	19.2	(12.4–28.4)	268	1.9	(1.0–3.7)	269	62.8	(54.5–70.4)	269	74.6	(67.0–80.9)
Only government/public	822	8.2	(6.2–10.7)	829	0.7	(0.3–1.5)	821	40.7	(36.6–44.9)	813	44.7	(40.3–49.1)
None/single service	972	3.0	(2.0–4.6)	977	0.2	(0.0–1.4)	973	19.1	(16.3–22.2)	968	21.2	(18.3–24.4)
Health care insurance—ages 65–75												
Private	1,331	11.6	(9.6–13.9)	1,340	1.7	(1.1–2.7)	1,340	69.6	(66.8–72.2)	1,334	73.1	(70.5–75.7)
Medicare without private	1,354	10.4	(8.5–12.6)	1,373	2.0	(1.2–3.4)	1,369	58.5	(55.3–61.7)	1,364	62.8	(59.5–65.9)
Only government/public	39	11.3	(5.2–22.7)	40	0.0	(0.0–8.8)	40	42.0	(24.2–62.2)	39	46.8	(27.6–66.9)
None/single service	42	0.0	(0.0–8.4)	42	0.0	(0.0–8.4)	42	14.2	(6.6–27.7)	42	14.2	(6.6–27.7)
Usual source of health care												
No	868	2.4	(1.4–3.9)	873	0.2	(0.0–1.2)	871	20.5	(16.4–25.2)	866	22.4	(18.1–27.3)
Yes	7,946	9.4	(8.6–10.2)	7,996	1.4	(1.1–1.7)	7,985	57.7	(56.3–59.0)	7,958	61.6	(60.2–62.9)
Family history of CRC												
No or do not know	7,741	9.1	(8.4–10.0)	7,777	1.4	(1.1–1.8)	7,760	53.5	(52.1–54.9)	7,736	57.5	(56.2–58.9)
Yes	678	7.5	(5.5–10.0)	683	0.4	(0.1–1.3)	687	72.3	(68.3–75.9)	685	73.8	(69.7–77.5)

[a]Sample size for each response category.

[b]Estimates are age-adjusted to the 2000 U.S. standard population using the following age groups: 50–54, 55–59, 60–64, 65–69, and 70–75.

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government/public coverage other than Medicare (includes military, Medicaid, state-sponsored health plan, Indian Health Service, Children's Health Insurance Program); and (iv) no coverage or single service plan only.

Statistical analysis

To provide national estimates of the prevalence of CRC test use, responses were weighted to reflect the probability of selection with adjustments for nonresponse and poststratification. Percentages with 95% confidence intervals (CI) based on a logit transformation were calculated using SAS version 9.2 (SAS Institute Inc.) and SUDAAN version 10.0.1 (Research Triangle Institute) to account for the complex survey design.

Adjusted percentages (predictive margins) in Table 2 were computed from multivariate logistic regression models controlling for all variables in Table 2 (16). Predictive margins are a type of direct standardization that averages the predicted values from the logistic regression models over the covariate distribution in the study population (16). The predictive margin for a specific group represents the average predicted response if everyone in the sample had been in that group. The *P* values in Table 2 are based on overall Wald F tests for association from multivariate logistic regression models. The family history of CRC variable was excluded from the predictive margins model due to the large amount of missing data (4.7%).

Percentages in Tables 1 and 3 were age-standardized to the 2000 U.S. standard population using the direct method (17).

Results

A total of 67.7% (95% CI, 66.4–68.9) of respondents ages 50 to 75 years had ever had a home FOBT, sigmoidoscopy, or colonoscopy. The age-standardized percentage that had ever had each type of test was highest for colonoscopy [57.8% (95% CI, 56.5–59.1)], followed by home FOBT [32.9% (95% CI, 31.7–34.2)] and sigmoidoscopy [12.5% (95% CI, 11.7–13.4)].

Table 1 shows the age-standardized percentages of respondents ages 50–75 years that reported CRC tests within recommended time intervals, by sociodemographic and health care access variables. A total of 58.3% (95% CI, 57.0–59.6) of respondents reported use of any CRC test within the recommended time interval (home FOBT within the past year, sigmoidoscopy within the past 5 years with home FOBT within the past 3 years, or colonoscopy within the past 10 years). Colonoscopy within the past 10 years was the most commonly reported test, with 54.6% (95% CI, 53.2–55.9) of respondents reporting use of this test. Home FOBT and sigmoidoscopy were less frequently used [home FOBT within the past year: 8.8% (95% CI, 8.1–9.6); sigmoidoscopy within the past 5 years with FOBT within the past 3 years: 1.3% (95% CI, 1.0–1.6)]. Office FOBT, which is not recommended for CRC screening, was used by 5.3% (95% CI, 4.7–5.9) within the past year (data not shown). A total of 4.3% (95% CI, 3.8–4.9) had office FOBT but did not also have home FOBT within the past year.

The age-standardized percentage of respondents who reported CRC testing within the recommended time interval was highest (>70%) for respondents with high family incomes (>$100,000 annually) or with a family history of CRC, and for respondents ages 50 to 64 years with military health care insurance or ages 65 to 75 years with private health care insurance (Table 1). Use of CRC tests was particularly low among those lacking a usual source of health care [22.4%, (95% CI, 18.1–27.3)] or lacking health care insurance coverage [21.2% (95% CI, 18.3–24.4) for ages 50–64 years and 14.2% (95% CI, 6.6–27.7) for ages 65–75 years].

The largest differences in the age-standardized percentages of those reporting CRC testing were between subgroups defined by income, education, type of health care insurance, and having a usual source of health care (Table 1). Respondents with higher incomes, higher levels of education, or with a usual source of health care were more likely to report having a CRC test than were respondents with lower incomes, lower levels of education, or without a usual source of health care. Use of CRC tests also varied by type of health care insurance. For ages 50 to 64 years, respondents with military or private health care insurance were much more likely to have had CRC tests than respondents with no health care insurance or with government/public health care coverage. For ages 65 to 75 years, respondents with private health care insurance and/or Medicare were much more likely to have had CRC tests than were the few respondents with no health care insurance or with only government/public health care coverage.

In the age-adjusted analyses, there were moderate differences in the percentages reporting CRC testing between subgroups defined by race, ethnicity, and family history of CRC (Table 1). Asians and Hispanics were less likely to have had CRC tests than were whites, blacks, or non-Hispanics. Respondents with a family history of CRC were more likely to have had CRC tests than respondents who did not have a family history.

In Table 2, we present the multivariate-adjusted percentages of respondents who reported CRC tests within recommended time intervals. For use of any CRC test within the recommended time interval in the multivariate models, there were statistically significant differences ($P < 0.05$) in use by race, age, education, income, type of health care insurance, and usual source of health care. After multivariate adjustment, the associations with education and income were attenuated as compared with the age-adjusted results. However, the associations with type of health care insurance and having a usual source of health care remained strong. The association with Hispanic or Latino ethnicity was eliminated after multivariate adjustment.

For all of the sociodemographic and health care access variables that we examined, colonoscopy was used much

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Table 2. Multivariate-adjusted percentages of respondents ages 50 to 75 years who reported CRC tests within recommended time intervals, by sociodemographic and health care access variables, National Health Interview Survey (NHIS), 2010

	Home FOBT within past year			Sigmoidoscopy within past 5 y with FOBT within past 3 y			Colonoscopy within past 10 y			Any CRC test within recommended time interval		
Characteristic	**%[a]**	**(95% CI)**	***P*[b]**	**%[a]**	**(95% CI)**	***P*[b]**	**%[a]**	**(95% CI)**	***P*[b]**	**%[a]**	**(95% CI)**	***P*[b]**
Gender			0.79			0.20			0.80			0.82
Male	8.9	(8.0–10.0)		1.5	(1.1–2.0)		54.5	(52.6–56.4)		58.3	(56.5–60.1)	
Female	8.7	(7.8–9.7)		1.1	(0.8–1.5)		54.8	(53.2–56.5)		58.6	(56.9–60.2)	
Race			0.84			0.58			<0.0001			<0.0001
White	8.9	(8.1–9.7)		1.3	(1.0–1.6)		55.0	(53.6–56.4)		58.9	(57.5–60.3)	
Black	8.6	(6.8–10.7)		1.6	(1.1–2.6)		57.5	(54.6–60.4)		60.6	(57.6–63.5)	
Asian	7.5	(5.0–10.9)		1.3	(0.5–3.1)		41.3	(36.5–46.2)		44.3	(39.2–49.4)	
American Indian/ Alaska native[c]	8.8	(4.1–17.9)					48.8	(35.7–62.1)		51.7	(38.6–64.5)	
Hispanic or Latino			0.12			0.32			0.46			0.20
No	8.9	(8.2–9.7)		1.3	(1.1–1.7)		54.8	(53.4–56.2)		58.7	(57.3–60.0)	
Yes	7.1	(5.4–9.3)		0.8	(0.3–2.1)		53.4	(49.9–57.0)		56.4	(52.9–59.8)	
Age, y			0.06			0.13			<0.0001			<0.0001
50–59	7.6	(6.4–8.9)		0.9	(0.6–1.4)		48.0	(45.8–50.2)		52.0	(49.9–54.1)	
60–69	9.9	(8.8–11.1)		1.5	(1.1–2.1)		60.3	(58.4–62.2)		64.0	(62.1–65.9)	
70–75	10.0	(7.9–12.5)		2.0	(1.0–3.8)		62.9	(59.0–66.6)		66.2	(62.3–69.8)	
Education			<0.0001			0.023			<0.0001			<0.0001
<12 y	6.1	(4.7–7.8)		1.1	(0.7–1.7)		47.6	(44.4–50.9)		50.8	(47.5–54.2)	
High school graduate	6.8	(5.8–8.1)		0.8	(0.5–1.5)		51.9	(49.5–54.3)		54.7	(52.3–57.0)	
Some college	10.5	(9.1–12.0)		1.1	(0.7–1.6)		56.6	(54.4–58.7)		61.0	(58.8–63.1)	
College graduate	10.3	(9.0–11.8)		1.9	(1.5–2.6)		58.7	(56.3–61.1)		63.1	(60.8–65.3)	
Annual family income			0.45			0.69			<0.0001			<0.0001
<$35,000	9.7	(8.3–11.2)		1.1	(0.7–1.7)		49.1	(46.8–51.4)		54.1	(51.8–56.4)	
$35,000–49,999	7.9	(6.3–9.9)		1.1	(0.6–2.0)		52.7	(49.6–55.9)		56.0	(52.9–59.0)	
$50,000–74,999	8.4	(6.9–10.2)		1.3	(0.8–2.2)		55.4	(52.6–58.2)		58.0	(55.2–60.8)	
$75,000–99,999	9.6	(7.6–12.0)		1.9	(1.1–3.4)		56.2	(52.6–59.7)		61.0	(57.5–64.5)	
≥$100,000	8.3	(6.9–9.9)		1.3	(0.7–2.2)		61.6	(58.6–64.5)		64.5	(61.5–67.4)	
Health care insurance			0.0001			0.43			<0.0001			<0.0001
Private (50–64)	8.3	(7.2–9.4)		1.3	(0.9–1.8)		56.9	(54.9–58.8)		60.3	(58.4–62.2)	
Private (65–75)	9.8	(7.8–12.2)		1.3	(0.7–2.1)		60.8	(57.1–64.3)		64.7	(61.0–68.1)	
Medicare without private (65–75)	9.4	(7.3–12.0)		1.6	(0.9–2.9)		54.0	(49.9–57.9)		58.1	(54.1–61.9)	
Military without private (50–64)	17.5	(12.4–24.2)		2.3	(1.1–4.8)		64.0	(57.5–70.0)		74.5	(68.3–79.9)	
Only government/public (other than above)	9.6	(7.2–12.8)		1.0	(0.4–2.3)		50.4	(45.7–55.1)		54.2	(49.5–58.8)	
None/single service	4.3	(2.7–6.7)		0.4	(0.0–2.9)		31.4	(27.4–35.6)		34.4	(30.3–38.7)	
Usual source of health care			0.0001			0.31			<0.0001			<0.0001
No	3.1	(1.8–5.3)		0.5	(0.1–3.4)		29.7	(25.2–34.6)		32.4	(27.7–37.3)	
Yes	9.2	(8.5–10.0)		1.3	(1.1–1.7)		56.7	(55.3–58.0)		60.6	(59.2–61.8)	

[a]Adjusted percentages presented as predictive margins from multivariate logistic regression models (adjusted for all other characteristics in Table 2).

[b]*P* values are based on an overall Wald *F* test for association from multivariate logistic regression models.

[c]American Indians/Alaska natives could not be included in the sigmoidoscopy model due to insufficient numbers.

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Table 3. Awareness and use of CT colonography among respondents ages 50 to 75 years, by sociodemographic and health care access variables, National Health Interview Survey (NHIS), 2010

	Heard of CT colonography		Ever had CT colonography	
Characteristic	***N*[a]**	**%[b] (95% CI)**	***N*[a]**	**%[b] (95% CI)**
Total	8,848	20.3 (19.2–21.4)	8,843	1.3 (1.0–1.7)
Gender				
Male	3,891	19.8 (18.2–21.5)	3,888	1.7 (1.2–2.4)
Female	4,957	20.8 (19.4–22.2)	4,955	1.0 (0.7–1.3)
Race				
White	6,756	21.7 (20.4–23.0)	6,751	1.3 (1.0–1.7)
Black	1,517	12.8 (11.1–14.8)	1,517	1.8 (1.2–2.7)
Asian	470	12.9 (9.6–17.2)	470	0.4 (0.1–1.6)
American Indian/Alaska native	82	17.3 (9.9–28.6)	82	1.1 (0.2–5.7)
Hispanic or Latino				
No	7,676	21.4 (20.2–22.6)	7,672	1.3 (1.0–1.6)
Yes	1,172	9.5 (7.7–11.7)	1,171	2.0 (1.1–3.7)
Age, y				
50–59	4,172	19.6 (18.0–21.2)	4,171	0.8 (0.5–1.3)
60–69	3,348	22.3 (20.6–24.2)	3,347	2.0 (1.5–2.7)
70–75	1,328	18.4 (16.0–21.1)	1,325	1.5 (0.9–2.4)
Education				
<12 y	1,523	9.5 (7.6–11.6)	1,521	1.4 (0.8–2.5)
High school graduate	2,451	13.2 (11.7–14.9)	2,450	1.0 (0.7–1.7)
Some college	2,490	22.3 (20.1–24.6)	2,488	1.2 (0.7–1.9)
College graduate	2,351	31.0 (28.6–33.4)	2,351	1.6 (1.1–2.5)
Health care insurance—ages 50–64				
Private	3,969	23.2 (21.5–24.9)	3,967	1.0 (0.7–1.5)
Military without private	269	17.5 (12.4–24.1)	269	2.5 (1.2–5.2)
Only government/public	826	12.4 (10.0–15.4)	826	2.0 (1.1–3.7)
None/single service	975	13.4 (11.0–16.3)	975	0.3 (0.1–0.8)
Health care insurance—ages 65—75				
Private	1,338	23.8 (21.1–26.8)	1,337	1.5 (0.9–2.5)
Medicare without private	1,370	15.6 (13.5–18.0)	1,368	1.9 (1.2–3.0)
Only government/public	40	10.8 (4.8–22.6)	40	3.2 (0.8–12.3)
None/single service	42	2.8 (0.4–16.7)	42	0.0 (0.0–8.4)
Usual source of health care				
No	872	15.9 (12.9–19.4)	871	1.5 (0.7–2.9)
Yes	7,975	20.7 (19.5–21.9)	7,971	1.3 (1.0–1.7)

[a]Sample size for each response category.

[b]Estimates are age-adjusted to the 2000 U.S. standard population using the following age groups: 50–54, 55–59, 60–64, 65–69, and 70–75.

more frequently within the recommended time period than the other types of CRC tests. The associations of sociodemographic and health care access variables with colonoscopy use were similar to the associations with use of any CRC test (Table 2). Colonoscopy use was statistically significantly associated with race, age, education, income, health care insurance, and usual source of health care, after multivariate adjustment. FOBT use was statistically significantly associated with education, health care insurance, and usual source of health care. Use of FOBT was highest among respondents with military health care insurance (for ages 50–64 years, multivariate-adjusted: 17.5%; 95% CI, 12.4–24.2). Patterns of association of certain factors with FOBT use and sigmoidoscopy use were unclear due to infrequent use of these tests.

In age-standardized estimates, 20.3% (95% CI, 19.2–21.4) of respondents had heard of CT colonography (Table 3). The age-standardized percentage of respondents who reported that they had heard of CT colonography was highest for college graduates (31.0%). Whites and non-Hispanics were more likely than other races or Hispanics to have heard of CT colonography. Respondents with

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Table 4. Reasons for not having a CRC test, among respondents ages 50 to 75 years, National Health Interview Survey (NHIS), 2010

	For respondents who never had any kind of CRC test ($N = 2,964$)		For respondents who had a CRC test, but not within recommended time interval ($N = 3,749$)	
Most important reason for not having CRC test	***N***	**% (95% CI)**	***N***	**% (95% CI)**
No reason or never thought about it	1,281	41.0 (38.6–43.3)	1,548	39.5 (37.4–41.6)
Doctor did not order it or did not say I needed it	435	14.9 (13.3–16.7)	578	15.1 (13.7–16.7)
Have not had any problems	388	13.6 (12.1–15.1)	509	14.2 (12.9–15.6)
Did not need it or did not know I needed this type of test	329	12.1 (10.7–13.8)	403	11.7 (10.4–13.2)
Too expensive or no insurance or cost	174	5.4 (4.5–6.4)	228	5.8 (5.0–6.8)
Put it off or did not get around to it	121	4.6 (3.8–5.7)	172	5.1 (4.4–6.0)
Do not have doctor	99	3.4 (2.7–4.3)	110	3.0 (2.4–3.7)
Too painful, unpleasant, or embarrassing	57	2.0 (1.4–2.8)	79	2.1 (1.6–2.8)
Had another type of colorectal examination	4	0.1 (0.0–0.4)	5	0.1 (0.0–0.3)
Other	76	2.8 (2.1–3.7)	117	3.3 (2.7–4.1)

NOTE: This question was asked of respondents who had not had a colonoscopy in the past 10 years, sigmoidoscopy in the past 5 years, CT colonography in the past 5 years, or FOBT in the past year.

private health care insurance or a usual source of health care were more likely to have heard of CT colonography than were those without private health care insurance or without a usual source of health care. Only a small percentage of respondents had ever had CT colonography [1.3% (95% CI, 1.0–1.7)]. Use of CT colonography was very low in all subgroups (Table 3).

The frequency of reported reasons for not having a CRC test was similar among respondents who had never had any kind of CRC test and those respondents who had a CRC test but not within the recommended time interval (Table 4). The most commonly reported reason for not having a CRC test was "no reason or never thought about it," reported by about 40%. About 15% reported the reason for not having a CRC test as "doctor did not order it or did not say I needed it." Other reasons reported by more than 10% of respondents were "Have not had any problems" or "Did not need it or did not know I needed this type of test."

While most of our analyses were among persons ages 50 to 75 years, we also examined the percentage of respondents ages 76 to 84 years who reported home FOBT use within the past year, sigmoidoscopy use within the past 5 years in combination with FOBT use within the past 3 years, or colonoscopy use within the past 10 years. The percentage of respondents ages 76 to 84 that reported use of any of these CRC tests within these time intervals was 62.5% (95% CI, 59.4–65.5), very similar to the percentage for respondents ages 50 to 75 years. The percentages that used each type of test within these time intervals were also very similar for ages 76 to 84 years (data not shown). For ages 76 to 84 years, the percentage that had never been screened for CRC with home FOBT, sigmoidoscopy, or colonoscopy was 22.7% (95% CI, 20.2–25.3).

Discussion

According to the data from the NHIS, a national survey of the general population, an estimated 58.3% of the U.S. population ages 50 to 75 years met recommendations for CRC testing in 2010. Colonoscopy was, by far, the most commonly used CRC test, with an estimated 54.6% of respondents reporting use of this procedure within the past 10 years. Home FOBT was used by 8.8% of respondents within the past year. Sigmoidoscopy was infrequently used.

The estimated percentage of the U.S. population ages 50 to 75 years that has used CRC tests within recommended time intervals has increased since 2008, from approximately 54.5% (11, 18). Use of CRC tests has been increasing since 1992 (11, 18–20). Since 2000, this increase reflects an increased use of colonoscopy because use of FOBT and sigmoidoscopy has been steadily declining (11).

Compared with the 2010 NHIS, results from the state-based 2010 Behavioral Rick Factor Surveillance System (BRFSS) survey showed that a slightly higher proportion (65.4%) of the U.S. population ages 50 to 75 years had reported CRC testing within recommended time intervals (21). Differences in the results from the 2 surveys may have been due to the different modes of administration and different response rates for the 2 surveys. The BRFSS is a telephone survey and has a lower response rate than the NHIS. BRFSS rates were also higher than NHIS rates in earlier years, both for CRC testing and mammography (12, 22–24).

The factors that we found to be associated with CRC testing among respondents ages 50 to 75 years in the 2010 NHIS were similar to the factors associated with CRC testing in earlier NHIS surveys (11, 12, 22).

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Sociodemographic factors, such as age, education, and income, and factors related to health care access, such as type of health care insurance and having a usual source of health care, were associated with CRC test use. The proportion that had a CRC test within the recommended time interval was particularly high for respondents who had military health care insurance. Use of CRC screening tests may be high in those with military health care insurance because the Veterans Health Administration has established performance measures for CRC screening, uses electronic clinical reminders for CRC screening, and initiated a CRC screening and diagnosis quality improvement effort in 2005 (25). In addition, a Veterans Health Administration directive on CRC screening in January 2007 mandated that each eligible veteran must be offered CRC screening (26).

Use of CRC tests was also high for respondents with private health care insurance, with high family income, for college graduates, and for respondents ages 60 to 75 years. Use of CRC tests was particularly low for respondents without health care insurance and those without a usual source of health care. The great majority of respondents without health care insurance were younger than 65 years, due to Medicare coverage for those ages 65 years and older. Changes in health care coverage may be particularly important for increasing CRC screening.

The most common reason for nonuse among respondents who had not had a CRC test within the recommended time period was "no reason or never thought about it." This has not changed since 2000, the first time a question on the reason for nonuse of CRC tests was included on the NHIS (22). These results highlight the continued need to educate the public and health care professionals about the importance of CRC screening.

A newer type of CRC test is CT colonography, which is not recommended by the USPSTF due to insufficient evidence to support its use in population screening (1). However, it has been recommended by other national organizations (8). Questions about awareness and use of CT colonography were included on the NHIS for the first time in 2010. Awareness of this test appears to be quite low; only about a fifth of respondents reported that they had heard of CT colonography or virtual colonoscopy. Whites, non-Hispanics, college graduates, and respondents with private health care insurance or a usual source of health care were more likely to have heard of CT colonography. Results from the 2010 NHIS indicated that CT colonography was infrequently used in all subgroups, with only 1.3% overall ever having had this type of test. Infrequent use of CT colonography is likely due to the fact that Medicare and other national health care plans do not currently pay for this test for CRC screening.

Office FOBT was reported by 5.3% of respondents, even though it is not considered an acceptable CRC screening test (1, 8) because of very poor sensitivity (27). Only home FOBT has been shown to reduce CRC mortality in randomized controlled trials (2, 3, 7). Since 2002, national screening guidelines have explicitly recommended against use of office FOBT (1, 8, 28, 29). Medicare has not reimbursed for CRC screening with office FOBT since 2007 (30). Despite efforts to stop use of office FOBT, many physicians continue to perform it (31). Although the percentage of adults reporting office FOBT in 2010 was lower than in the 2000 NHIS (32), use of office FOBT was still at an unacceptable level for such a poor test and efforts to stop its use should continue.

For the first time in 2008, the USPSTF recommended an age to stop CRC screening (1). Results of a decision analysis using microsimulation models indicated that continuing screening after the age of 75 years for those individuals who have had regular, negative screenings would add little benefit (33, 34). The decision analysis that contributed to this recommendation was based on chronologic age, but the recommendations acknowledge that, in practice, the decision to stop screening should also consider the health of the patient (1, 33, 34). Our results from the 2010 NHIS indicated that 23% of respondents ages 76 to 84 years had never been screened and should possibly be considered for screening, taking into account their health care status. Because the USPSTF recommendations for an age to stop screening are relatively recent, use of CRC screening in older persons may decrease in the future if this recommendation is followed, although other organizations have not specified an age to stop screening (8).

There are several limitations to this analysis. Some respondents may have incorrectly reported their use of CRC tests. However, studies comparing self-report of CRC test use with information from medical records have generally found moderate-to-good agreement between the 2 data sources (35–39). In addition, the response rate for the survey was only 60.8% and respondents may have differed from nonrespondents in use of CRC tests.

In conclusion, data from the 2010 NHIS show that there has been some progress in use of CRC testing in the last few years. However, approximately 40% of the U.S. population ages 50 to 75 years have not had a CRC test within recommended time intervals. CT colonography appears to be little known and infrequently used. Use of CRC screening tests is particularly low in certain population subgroups, especially those without a usual source of health care and without health care insurance. Expansion of health care coverage to more of the U.S. population may increase use of CRC screening tests and thereby accelerate the decline in CRC mortality (21, 40). Moreover, as our results indicate that many people are still not aware of the need for CRC screening, the active engagement of public health and health care professionals in educating the public and talking to patients is needed to increase awareness of the importance of screening for this often preventable disease.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Authors' Contributions

Conception and design: J.A. Shapiro, C.N. Klabunde, L.C. Seeff, A. White
Acquisition of data (provided animals, acquired and managed patients, provided facilities, etc.): C.N. Klabunde

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Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis): J.A. Shapiro, C.N. Klabunde, T.D. Thompson, M.R. Nadel, L.C. Seeff, A. White
Writing, review, and/or revision of the manuscript: J.A. Shapiro, C.N. Klabunde, T.D. Thompson, M.R. Nadel, L.C. Seeff, A. White

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Jean A. Shapiro, Carrie N. Klabunde, Trevor D. Thompson, et al.

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