Original Article

Elimination of Cost-Sharing and Receipt of Screening for Colorectal and Breast Cancer

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BACKGROUND: The aim of the cost-sharing provision of the Patient Protection and Affordable Care Act (ACA) was to reduce financial barriers for preventive services, including screening for colorectal cancer (CRC) and breast cancer (BC) among privately and Medicare-insured individuals. Whether the provision has affected CRC and BC screening prevalence is unknown. The current study investigated whether CRC and BC screening prevalence among privately and Medicare-insured adults by socioeconomic status (SES) changed before and after the ACA. **METHODS:** Data obtained from the National Health Interview Survey pertaining to privately and Medicare-insured adults from 2008 (before the ACA) and 2013 (after the ACA) were used. There were 15,786 adults aged 50 to 75 years in the CRC screening analysis and 14,530 women aged ≥40 years in the BC screening analysis. Changes in guideline-recommended screening between 2008 and 2013 by SES were expressed as the prevalence difference (PD) and 95% confidence interval (95% CI) adjusted for demographics, insurance, income, education, body mass index, and having a usual provider. **RESULTS:** Overall, CRC screening prevalence increased from 57.3% to 61.2% between 2008 and 2013 ($P<.001$). Adjusted CRC screening prevalence during the corresponding period increased in low-income (PD, 5.9; 95% CI, 1.8 to 10.2), least-educated (PD, 7.2; 95% CI, 0.9 to 13.5), and Medicare-insured (PD, 6.2; 95% CI, 1.7 to 10.7) individuals, but not in high-income, most-educated, and privately insured respondents. BC screening remained unchanged overall (70.5% in 2008 vs 70.2% in 2013) and in the low SES groups. **CONCLUSIONS:** Increases in CRC screening prevalence between 2008 and 2013 were confined to respondents with low SES. These findings may in part reflect the ACA's removal of financial barriers. ***Cancer* 2015;000:000–000**. © *2015 American Cancer Society.*

KEYWORDS: early detection of cancer, insurance, breast neoplasms, colorectal neoplasms.

INTRODUCTION

The 2010 Patient Protection and Affordable Care Act (ACA) required private health insurers to cover US Preventive Services Task Force (USPSTF)-recommended services with "A" or "B" ratings and removed patient cost-sharing, including deductibles, co-insurance, and co-pays. This provision was extended to new and renewed private health plans after September 2010 and cost-sharing was eliminated on January 1, 2011.[1] The Centers for Medicare and Medicaid Services also removed cost-sharing of some preventive services for Medicare recipients under its authority.[2] Patient costs were eliminated with the hope of improving access to and use of 45 preventive services, including screening for cancer, because cost is a recognized barrier even among the insured.[1,3-5] The cost of some cancer screenings, particularly colonoscopy, which is the most common type of colorectal cancer (CRC) screening test, is substantial. For example, in 2008, the Medicare average allowable charge was $82 to $115 for mammography[6] and $642 to $842 for colonoscopy,[7] although the cost of colonoscopy may be well over $2000 because prices for these procedures vary widely across geography, insurers, provider, and indication.[6,8] Before the ACA, Medicare enrollees without supplemental insurance were responsible for up to 20% of the allowable charges, and privately insured individuals may have been responsible for a range of costs including co-insurance, co-pays, and meeting deductibles.

In recent years, breast cancer (BC) screening prevalence has stabilized after a period of decline between 2000 and 2005,[9] and CRC screening prevalence has also stabilized after steep increases between 2000 and 2008.[10,11] To our knowledge, it is unknown whether uptake of CRC and BC screening has changed since the ACA's cost provision went into

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effect. We evaluated changes in these preventive measures between 2008 and 2013 using the data from the National Health Interview Survey (NHIS). Changes in cervical cancer screening patterns were not examined due to the addition of human papillomavirus testing (in combination with Papanicolaou testing) to the 2012 USPSTF guideline, which lengthened screening intervals for women who are co-tested.[12]

MATERIALS AND METHODS

Study Population

The current study used data from the 2008 and 2013 NHIS, which is a multistaged, cross-sectional, household, in-person interview survey administered among the noninstitutionalized population of the United States.[13] We used 2008 data to measure cancer screening prevalence in the pre-ACA period. The 2013 data were selected for comparison because these provide the most up-to-date information after the implementation of the ACA cost provision. Data from the 2010 NHIS were not used because the ACA had just been enacted. There were 2 primary outcomes of the study: receipt of CRC and BC screening according to the 2008 CRC and 2002 BC USPSTF screening recommendations, respectively.[14]

Because the ACA limited cost-sharing for privately insured individuals and the Centers for Medicare and Medicaid Services also approved this provision for Medicare recipients, analyses were restricted to respondents with private, Medicare, or both (Medicare plus private) types of insurance at the time of the survey.[1,2] Dual-eligible (Medicare and Medicaid) subjects were included in the Medicare group, but represented a small percentage of respondents (3.1% for the CRC screening-eligible and 3.6% for the BC screening-eligible groups). Analyses removing dual-eligible individuals did not appear to alter the results. For CRC screening, there were 16,433 respondents aged 50 to 75 years with Medicare and/or private insurance at the time of the interview. Those who reported a history of CRC (138 respondents) and those who were missing data regarding CRC history (27 respondents) or CRC screening (482 respondents) were excluded, leaving 15,786 respondents available for analyses. Of the 15,940 women eligible for BC screening, those who reported a history of BC (790 women) and those who were missing data regarding BC history (32 women) or BC screening (588 women) were excluded, leaving 14,530 women available for analysis.

Measures

Receipt of guideline-concordant CRC screening was defined as colonoscopy within the past 10 years, at-home fecal occult blood test (FOBT) within the past year, or flexible sigmoidoscopy within the past 5 years with FOBT performed every 3 years for individuals aged 50 to 75 years.[15] Receipt of guideline BC screening was defined as mammography every 2 years for women aged $\geq$40 years.[16] Primary independent variables of interest were year of survey (2013 vs 2008) and socioeconomic (SES) factors, including insurance type (Medicare, private, or Medicare plus private), annual household income (low [<$35,000], medium [$35,000-$74,999], and high [>$75,000]), and education (<high school [HS] or General Educational Diploma [GED], HS or GED only, some college, and at least a college degree). Household income cutpoints were determined a priori based on income tertiles in the current study population. Several covariates were considered based on previous studies of cancer screening determinants[17] and included age; sex (for CRC analyses only); race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, or other); immigration status (US born vs foreign born); having a usual source of preventive care (yes/no); and body mass index, which was classified as underweight, normal, overweight, and obese according to the World Health Organization criteria.[18]

Statistical Analysis

Weighted prevalence estimates, accounting for the NHIS sample design, and chi-square tests were used to assess changes in screening by year (2013 vs 2008). Adjusted prevalence difference (PD) and 95% confidence intervals (95% CIs) of CRC and BC screening were estimated using logistic regression models with predicted marginal probabilities.[19] Adjusted models comparing screening prevalence in 2013 with that in 2008 were stratified by insurance, income, race/ethnicity, and educational attainment to examine potential differences in PDs across these groups. Collinearity among independent variables was assessed and none was detected. Model fit was assessed with the Hosmer-Lemeshow test. Two-way interaction terms between survey year and each covariate were assessed and none was observed. All models were constructed using data on respondents for whom data regarding covariate or outcome were present.

Four sensitivity analyses were conducted. First, we compared respondents who indicated their tests were for routine/preventive (as opposed to diagnostic) reasons with respondents without screening to assess whether associations were similar to those observed in the primary analyses (ie, using screening for any reason as the main exposure of interest). Second, we examined changes in

screening patterns between 2003 and 2008 (ie, in the 5 years that preceded the current study) to determine whether changes observed between the 2008 and 2013 surveys possibly represented a continuation of an ongoing trend. Third, BC screening patterns according to the 2009 USPSTF guidelines (which recommended screening biannually for women aged 50-74 years) were conducted to determine whether they varied from our primary analysis, which used the 2002 USPSTF BC screening guidelines as described above. All statistical tests used 2-sided *P* values with an α of .05 in accordance with previous studies examining cancer screening patterns over time using NHIS data.[9,11] All analyses were conducted with SAS statistical software (version 9.4; SAS Institute Inc, Cary, NC) and SAS callable SUDAAN (version 9.0.3; SAS Institute Inc).

RESULTS

Among the 15,786 CRC screening-eligible respondents, the average age was 61.6 years and the majority of respondents were non-Hispanic white (78.6%) and privately insured (61.8%) (Table 1). Among the CRC screening-eligible population, the percentage of respondents who had Medicare insurance, higher income (≥$75,000), and higher education (completed college) and who were older (aged 60-75 years) was higher in the 2013 survey compared with that from 2008 (Table 1).

Among the 14,530 BC screening-eligible respondents, the average age was 61.7 years and the majority of respondents were non-Hispanic white (76.6%) and privately insured (62.5%). Among the BC screening-eligible population, the percentage of respondents with Medicare insurance, higher income, and higher education was higher in the 2013 survey compared with that from 2008 (Table 1).

CRC Screening Results

Overall, CRC screening prevalence increased from 57.3% in 2008 to 61.2% in 2013 ($P<.001$) (Table 2). This increase was statistically significant in low-income (4.3% change; $P = .024$) and middle-income (3.5% change; $P = .043$) groups, and in individuals insured with Medicare only (9.8% change; $P<.001$) and Medicare plus private insurance (5.9% change; $P = .002$). No change was observed among privately insured or high-income respondents. In the analyses by educational attainment, CRC screening prevalence increased among respondents who had completed HS or had a GED only (4.1% change; $P = .038$). Results adjusted for sociodemographic factors, body mass index, usual source of preventive care, and immigration status are presented in Table 3. Patterns in the adjusted analyses were similar to those in the unadjusted analyses. The increase in CRC screening was evident in the low-income (PD, 5.9; 95% CI, 1.8 to 10.2), Medicare (PD, 6.2; 95% CI, 1.7 to 10.2), and lower educational attainment (<HS: PD, 7.2 [95% CI, 0.9 to 13.5] and HS or GED: PD, 5.3% [95% CI, 1.2 to 9.2]) groups, but not among higher SES groups. There were no significant changes in CRC screening noted for any racial/ethnic group after adjustment.

By screening modalities, overall adjusted colonoscopy use increased from 53.1% in 2008 to 60.6% in 2013 ($P<.001$) and FOBT use declined from 11.0% to 8.7% during the same time period ($P = .001$). The adjusted PD was 8.9%, 6.4%, and 6.8% higher, respectively, in 2013 compared with 2008 for low-income, medium-income, and high-income respondents (Fig. 1 Top). Colonoscopy increased across race/ethnicity, educational status, and the 3 insurance types examined herein. During the study period, use of FOBT did not change for respondents with lower educational attainment (<HS or GED and completed HS or GED) or low-income and medium-income respondents (Fig. 1 Bottom), but declined for high-income (PD, -3.3; 95% CI, -5.6 to -0.9), privately insured (PD, -2.2; 95% CI -4.0 to -0.4), and privately plus Medicare-insured (PD, -5.4; 95% CI -8.3 to -2.5) respondents and those with higher education (some college: PD, -5.0 [95% CI -7.5 to -2.4] and college graduates: PD, -3.5 [95% CI, -5.9 to -1.1]).

Sensitivity Analyses for CRC Screening

Analyses restricted to individuals reporting CRC screening for routine reasons (77.7% of those reporting CRC screening) are shown in Supporting Information Table 1. Between 2008 and 2013, adjusted CRC screening prevalence increased across all insurance and income groups. The greatest change in CRC screening was observed among low-income and Medicare-only groups, which was similar to the main analyses. In the second sensitivity analyses examining changes in CRC screening between 2003 and 2008 among privately and Medicare-insured respondents (see Supporting Information Table 2a), the magnitude of change (PD, 12.7; 95% CI, 10.3 to 15.0) in the earlier period (2003-2008) was greater than the change observed during the study period (2008-2013). The changes in CRC screening between 2003 and 2008 were observed across all insurance types, income levels, and education groups in the adjusted analyses.

BC Screening

In unadjusted analyses, BC screening prevalence in 2013 (70.2%) was nearly identical to that observed in 2008

TABLE 1. Respondent Characteristics Among Adults With Private or Medicare Insurance Who Were Eligible for CRC and BC Screening, NHIS 2008 and 2013

	CRC Screening-Eligible Adults Aged 50–75 Years						BC Screening-Eligible Women Aged ≥40 Years					
	Total		2008		2013		Total		2008		2013	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	15,786		5853		9933		14,530		5664		8866	
Insurance[a,b]												
Private	8742	61.8	3405	63.4	5337	60.3	7937	62.5	3246	64.0	4691	61.1
Medicare	3868	19.2	1251	16.9	2617	21.3	3479	18.7	1218	16.9	2261	20.4
Medicare plus private	3176	19.0	1197	19.7	1979	18.4	3114	18.8	1200	19.1	1914	18.5
Income[a,b]												
<$35,000	4852	24.5	1799	25.4	3053	23.7	5081	27.9	1956	28.4	3125	27.5
$35,000-$74,999	4909	33.7	1868	35.3	3041	32.4	4343	33.3	1747	34.8	2596	31.9
≥$75,000	4742	41.8	1660	39.4	3082	43.9	3911	38.8	1449	36.8	2462	40.7
Missing data	1283		526		757		1195		512		683	
Education[a,b]												
<HS	1555	9.0	622	10.1	933	8.0	1507	9.4	647	10.6	860	8.3
Completed HS or GED	4325	28.1	1671	29.2	2654	27.1	4056	29.3	1645	30.4	2411	28.2
Some college	4510	29.6	1609	29.3	2901	29.9	4226	30.2	1603	29.9	2623	30.4
Completed college	4756	33.4	1672	31.5	3084	35.1	4100	31.2	1489	29.2	2611	33.1
Missing data	640		279		361		641		280		361	
Race/ethnicity[a,b]												
Hispanic	1538	7.4	570	7.0	968	7.7	1576	8.2	592	7.5	984	8.8
Non-Hispanic white	11,227	78.6	4186	79.2	7041	78.2	10,025	76.6	3933	77.5	6092	75.6
Non-Hispanic black	2211	9.4	803	9.5	1408	9.4	2105	10.2	829	10.3	1276	10.1
Non-Hispanic other	810	4.6	294	4.4	516	4.7	824	5.1	310	4.7	514	5.4
Immigration status[a,b]												
Born outside United States	2098	12.2	769	11.1	1329	13.1	2037	12.8	760	11.2	1277	14.2
US-born	13,686	87.8	5083	88.9	8603	86.9	12,489	87.3	4901	88.8	7588	85.8
Missing data	2		1		1		4		3		1	
Sex												
Male	6774	46.6	2505	46.7	4269	46.5	–					
Female	9012	53.4	3348	53.3	5664	53.5	–					
Age (CRC), y[a]												
50–59	6758	47.8	2660	49.5	4098	46.3	–					
60–75	9028	52.2	3193	50.5	5835	53.7	–					
Age (BC), y[b]												
40–49	–						3376	27.5	1461	29.6	1915	25.6
50–59	–						3596	27.8	1421	27.4	2175	28.2
60–74	–						4979	30.8	1758	28.8	3221	32.6
≥75	–						2579	13.9	1024	14.1	1555	13.6
Usual source of care												
No	593	3.9	238	4.2	355	3.7	592	4.3	247	4.6	345	4.0
Yes	14,376	96.1	5312	95.8	9064	96.3	13,367	95.7	5189	95.4	8178	96.0
Missing data	817		303		514		571		228		343	
BMI												
Underweight	197	1.1	67	1.1	130	1.1	307	2.0	113	1.8	194	2.1
Normal	4439	29.6	1663	29.7	2776	29.6	5170	39.4	2046	39.6	3124	39.1
Overweight	5562	37.5	2082	37.5	3480	37.4	4087	29.6	1633	29.8	2454	29.4
Obese	4866	31.8	1767	31.8	3099	31.9	4099	29.1	1531	28.8	2568	29.4
Missing data	722			274	448		867		341		526	

Abbreviations: BC, breast cancer; BMI, body mass index; CRC, colorectal cancer; GED, General Educational Diploma; HS, high school; NHIS, National Health Interview Survey.
[a] $P < .05$ among CRC analysis.
[b] $P < .05$ among BC analysis.

(70.5%) ($P = .586$) (Table 2). The results of multivariable analysis presented in Table 3 indicated modest but statistically significant declines in BC screening between 2008 and 2013 among women who were privately insured (PD, -3.2; 95% CI, -5.6 to -0.8), had high income (PD, -4.2; 95% CI, -7.1 to -1.3), or were non-Hispanic white (PD, -2.8; 95% CI, -5.2 to -0.4). There was no difference in BC screening prevalence noted among low-income individuals, those with lower educational attainment, or Medicare-only respondents.

BC Screening Supplementary Analyses

In sensitivity analyses restricted to women who indicated that their mammogram was performed for routine reasons

TABLE 2. Prevalence and 95% CIs of CRC and BC Screening Among Eligible Adults With Private or Medicare Insurance, NHIS 2008 and 2013

	CRC Screening Among Adults Aged 50–75 Years (n = 15,786)						BC Screening Within the Past 2 Years Among Women Aged ≥40 Years (n = 14,530)					
	2008		2013		Differences Between 2013 and 2008		2008		2013		Differences Between 2013 and 2008	
	%	(95% CI)	%	(95% CI)	% Change	*P*	%	(95% CI)	%	(95% CI)	% Change	*P*
Total	57.3	(55.7 to 58.9)	61.2	(59.9 to 62.5)	3.9	<.001	70.5	(69.1 to 71.8)	70.2	(68.9 to 71.5)	−0.3	.586
Insurance												
Private	55.7	(53.6 to 57.7)	57.6	(55.7 to 59.4)	1.9	.204	73.9	(72.2 to 75.6)	73.1	(71.4 to 74.8)	−0.8	.490
Medicare	50.4	(47.1 to 53.6)	60.2	(57.7 to 62.7)	9.8	<.001	59.4	(55.9 to 62.8)	58.9	(56.4 to 61.4)	−0.5	.821
Medicare plus private	68.4	(65.3 to 71.3)	74.3	(71.8 to 76.6)	5.9	.002	68.8	(66.0 to 71.4)	73.0	(70.1 to 75.6)	4.2	.034
Income												
<$35,000	51.0	(48.1 to 53.8)	55.3	(52.9 to 57.7)	4.3	.024	58.8	(56.3 to 61.3)	59.6	(57.3 to 62.0)	0.8	.640
$35,000–74,999	56.7	(54.2 to 59.2)	60.2	(58.0 to 62.2)	3.5	.043	70.1	(67.4 to 72.6)	69.9	(67.4 to 72.2)	−0.2	.922
≥$75,000	62.2	(59.5 to 64.7)	64.9	(62.8 to 67.1)	2.7	.134	79.6	(77.3 to 81.7)	76.8	(74.6 to 78.8)	−2.8	.063
Education												
<HS	47.4	(43.2 to 51.6)	53.1	(48.7 to 57.4)	5.7	.069	52.9	(47.8 to 57.9)	57.5	(52.9 to 61.9)	4.6	.188
Completed HS or GED	52.4	(49.5 to 55.3)	56.5	(54.2 to 58.8)	4.1	.038	68.0	(65.3 to 70.7)	67.2	(64.5 to 69.8)	−0.8	.680
Some college	59.1	(56.3 to 61.8)	61.0	(58.5 to 63.4)	1.9	.333	72.2	(69.3 to 74.9)	70.5	(68.1 to 72.8)	−1.7	.373
Completed college	65.7	(62.9 to 68.5)	68.3	(66.2 to 70.4)	2.6	.170	79.7	(77.3 to 81.9)	77.0	(74.9 to 79.1)	−2.7	.085
Race/ethnicity												
Hispanic	43.0	(38.1 to 48.1)	48.8	(44.7 to 53.0)	5.8	.085	67.1	(62.4 to 71.5)	69.3	(65.5 to 72.9)	2.2	.478
Non-Hispanic white	59.3	(57.5 to 61.1)	62.6	(61.1 to 64.1)	3.3	.007	70.7	(69.1 to 72.3)	70.0	(68.5 to 71.5)	−0.7	.542
Non-Hispanic black	53.5	(48.8 to 58.1)	62.3	(58.9 to 65.7)	8.8	.003	73.0	(68.6 to 77.0)	71.8	(68.4 to 75.0)	−1.2	.649
Non-Hispanic other	52.0	(45.5 to 58.3)	56.3	(50.4 to 62.0)	4.3	.369	66.5	(59.8 to 72.6)	71.3	(66.6 to 75.5)	4.8	.232
Immigration status												
Born outside United States	48.0	(43.6 to 52.3)	54.7	(51.1 to 58.3)	6.7	.021	67.9	(64.2 to 71.4)	69.8	(66.4 to 73.0)	1.9	.441
Born in United States	58.5	(56.8 to 60.1)	62.2	(60.8 to 63.5)	3.7	<.001	70.8	(69.3 to 72.3)	70.3	(68.9 to 71.6)	−0.5	.608
Sex												
Male	58.1	(55.6 to 60.6)	59.4	(57.5 to 61.4)	1.3	.413	–					
Female	56.6	(54.5 to 58.6)	62.8	(61.1 to 64.4)	6.2	<.001	–					
Age (CRC), y												
50–59	52.2	(49.8 to 54.7)	53.8	51.7	1.6	.371	–					
60–75	62.2	(60.2 to 64.2)	67.6	66.1	5.4	<.001	–					
Age (BC), y												
40–49	–						68.2	(65.2 to 71.1)	64.6	(61.5 to 67.6)	−3.6	.086
50–59	–						77.6	(75.1 to 80.0)	77.5	(75.2 to 79.6)	−0.1	.932
60–74	–						74.4	(72.0 to 76.7)	75.9	(74.1 to 77.7)	1.5	.326
≥75	–						53.4	(49.6 to 57.1)	51.9	(48.4 to 55.3)	−1.5	.554
Usual source of care												
No	48.9	(41.9 to 55.9)	50.8	43.3	1.9	.711	60.7	(53.3 to 67.7)	59.3	(52.0 to 66.2)	−1.4	.769
Yes	59.4	(57.8 to 61.0)	63.6	62.2	4.2	<.001	72.4	(71.0 to 73.8)	71.9	(70.6 to 73.2)	−0.5	.609
BMI												
Underweight	55.3	(40.6 to 69.1)	59.1	47.7	3.8	.691	45.0	(34.3 to 56.2)	55.1	(46.4 to 63.6)	10.1	.157
Normal	53.5	(50.7 to 56.3)	59.5	56.9	6.0	.003	70.5	(68.3 to 72.6)	69.8	(67.6 to 72.0)	−0.7	.695
Overweight	59.1	(56.5 to 61.7)	61.2	59.2	2.1	.209	71.8	(69.1 to 74.4)	71.3	(68.9 to 73.6)	−0.5	.782
Obese	59.0	(56.3 to 61.7)	64.1	61.8	5.1	.006	70.6	(67.7 to 73.3)	71.3	(69.0 to 73.5)	0.7	.656

Abbreviations: 95% CI, 95% confidence interval; BC, breast cancer; BMI, body mass index; CRC, colorectal cancer; GED, General Educational Diploma; HS, high school; NHIS, National Health Interview Survey.

(95.9% of women reporting mammography), the results were the same as those in the primary analyses (data not shown). In supplemental analyses examining BC screening between 2003 and 2008, there was a decline in BC screening prevalence overall (adjusted PD, -2.4; 95% CI, -4.4 to -0.4) (Supporting Information Table 2b). Results restricted to women aged 50 to 74 years in accordance with 2009 USPSTF BC screening guidelines were similar to those of our primary analysis among women aged ≥40 years (Supporting Information Table 3).

DISCUSSION

In the current study of a nationally representative sample of Medicare-insured and privately insured individuals, there were modest gains (5.9%-7.2%) noted in CRC screening between 2008 (before the ACA) and 2013 (after

TABLE 3. Adjusted PD and 95% CIs of CRC Screening and BC Screening for 2013 Versus 2008 Among Eligible Adults With Private or Medicare Insurance by SES, NHIS 2013 and 2008

	CRC Screening Among Adults Aged 50–75 Years[a,b]				BC Screening Within the Past 2 Years Among Women Aged ≥40 Years[a,c]			
	2008 (95% CI)	2013 (95% CI)	PD (95% CI)	*P*	2008 (95% CI)	2013 (95% CI)	PD (95% CI)	*P*
Total	60.5 (58.8 to 62.2)	63.3 (61.8 to 64.7)	2.7 (0.54 to 4.9)	.016	73.1 (71.7 to 74.5)	70.9 (69.4 to 72.3)	−2.3 (−4.3 to −0.3)[b]	.011
Insurance								
Private	58.2 (56.0 to 60.4)	59.6 (67.6 to 61.6)	1.4 (−1.5 to 4.3)	.356	76.4 (74.5 to 78.1)	73.2 (71.3 to 75.0)	−3.2 (−5.6 to −0.8)	.005
Medicare	57.1 (53.4 to 60.7)	63.3 (60.6 to 65.9)	6.2 (1.7 to 10.7)	.008	63.2 (59.3 to 66.9)	60.8 (57.8 to 63.7)	−2.4 (−7.1 to 2.3)	.273
Medicare plus private	71.2 (67.9 to 74.3)	74.7 (71.9 to 77.2)	3.4 (−0.5 to 7.3)	.087	71.4 (68.5 to 74.2)	72.5 (69.2 to 75.5)	1.0 (−3.3 to 5.3)	.834
Income								
<$35,000	53.5 (50.5 to 56.6)	59.4 (56.8 to 62.0)	5.9 (1.8 to 10.2)	.009	62.6 (60.2 to 65.0)	61.5 (58.8 to 64.0)	−1.1 (−4.6 to 2.4)	.380
$35,000–74,999	60.0 (57.3 to 62.6)	62.4 (60.1 to 64.7)	2.4 (−0.9 to 5.7)	.139	71.8 (69.0 to 74.5)	71.2 (68.6 to 73.6)	−0.6 (−4.3 to 3.1)	.707
≥$75,000	64.7 (62.0 to 67.2)	66.0 (63.7 to 68.3)	1.3 (−2.4 to 5.0)	.475	81.4 (79.0 to 83.5)	77.1 (74.9 to 79.2)	−4.2 (−7.1 to −1.3)	.002
Race/ethnicity								
Hispanic	48.8 (42.9 to 54.7)	55.0 (49.8 to 60.0)	6.2 (−1.4 to 13.8)	.099	70.3 (64.6 to 75.5)	73.7 (69.4 to 77.6)	3.4 (−3.1 to 9.9)	.338
Non-Hispanic black	58.5 (53.5 to 63.3)	63.1 (59.3 to 66.8)	4.7 (−1.4 to 10.8)	.121	76.4 (71.5 to 80.6)	71.8 (68.1 to 75.2)	−4.6 (−9.9 to 0.7)	.116
Non-Hispanic white	62.0 (60.0 to 63.8)	64.1 (62.5 to 65.7)	2.2 (−0.35 to 4.8)	.108	72.1 (70.3 to 73.8)	69.2 (67.5 to 71.0)	−2.8 (−5.2 to −0.4)	.012
Non-Hispanic other	55.5 (48.2 to 62.6)	58.7 (52.3 to 64.8)	3.1 (−6.9 to 13.1)	.573	65.7 (58.3 to 72.5)	74.0 (69.0 to 78.4)	8.3 (0.3 to 16.3)	.066
Education								
<HS	50.4 (45.9 to 55.0)	57.7 (53.3 to 61.9)	7.2 (0.9 to 13.5)	.022	54.3 (49.0 to 59.4)	58.2 (53.4 to 62.9)	4.0 (−2.9 to 10.9)	.192
HS or GED	53.3 (50.0 to 56.5)	58.6 (56.1 to 61.1)	5.3 (1.2 to 9.2)	.015	68.4 (65.4 to 1.3)	67.4 (64.4 to 70.3)	−1.0 (−5.3 to 3.3)	.512
Some college	61.7 (58.7 to 64.6)	62.5 (60.0 to 65.0)	0.8 (−3.1 to 4.7)	.689	73.1 (70.2 to 75.7)	69.7 (67.0 to 72.3)	−3.3 (−7.0 to 0.4)	.054
College graduate	67.9 (64.9 to 70.8)	69.4 (67.1 to 71.7)	1.5 (−2.4 to 5.4)	.443	80.4 (77.7 to 82.7)	76.8 (74.4 to 79.1)	−3.5 (−6.8 to −0.2)	.025

Abbreviations: 95% CI, 95% confidence interval; BC, breast cancer; CRC, colorectal cancer; GED, General Educational Diploma; HS, high school; NHIS, National Health Interview Survey; PD, prevalence difference; SES, socioeconomic status.

[a] Adjusted for insurance, income, race/ethnicity, education, sex (CRC only), age, immigration status, body mass index, and usual source of preventive care.

[b] Includes 12,678 respondents for whom there were no missing data.

[c] Includes 11,603 respondents for whom there were no missing data.

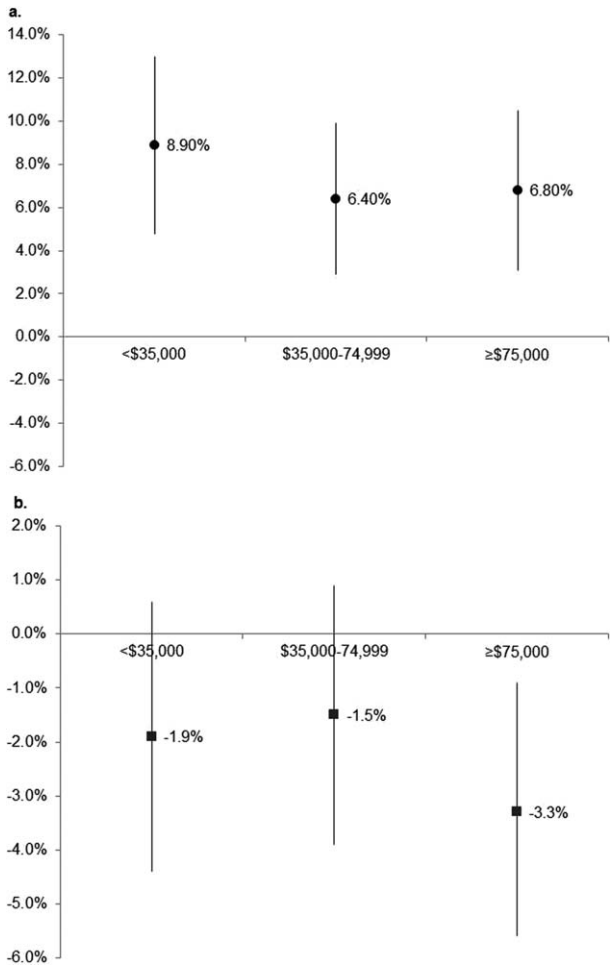

Figure 1. (*Top*) Adjusted prevalence difference in colonoscopy use between 2008 and 2013 by income among adults aged 50 to 75 years with private or Medicare insurance using the National Health Interview Survey from 2008 (before the Patient Protection and Affordable Care Act [ACA]) and 2013 (after the ACA). (*Bottom*) Adjusted prevalence difference in fecal occult blood test use between 2008 and 2013 by income among adults aged 50 to 75 years with private or Medicare insurance using the National Health Interview Survey from 2008 (before the ACA) and 2013 (after the ACA).

the ACA) among low-income and lower educated individuals as well as Medicare-only respondents. A higher prevalence of CRC screening in these groups was attributable to increased colonoscopy use as opposed to FOBT, which was stable during the current study period. Colonoscopy use also increased in the group with higher SES but a concomitant decrease in FOBT suggested migration from FOBT to colonoscopy among individuals with higher SES.[20] Changes in CRC screening among groups with lower SES may in part reflect the removal of costs because there are known financial barriers to cancer screening,[3,4] and the cost of colonoscopy is substantial.[4,21] Before the ACA's elimination of cost-sharing for preventive services, Medicare enrollees were responsible for up to 20% of allowable charges and, along with privately insured individuals, may have been responsible for a range of costs including co-pays and meeting deductibles, thereby posing a challenge to receiving CRC screening,[3,4] particularly among those with fixed incomes. Although our observations are consistent with the ACA's removal of financial barriers, it is also possible that increases in CRC screening among lower socioeconomic groups may reflect the continuation of increasing secular trends that have been observed nationwide as well as in private health plans.[10,11,22] In the previous 5-year period (between 2003 and 2008), there was a significant increase in CRC screening among privately insured and Medicare-insured individuals; however, the increase was universal across socioeconomic measures, including income and educational status. By contrast, the change in CRC screening between 2008 and 2013 was limited to subjects with lower income and lower levels of education (ie, the population subgroup that is expected to benefit the most from the ACA). In addition, the increase in CRC screening among individuals with lower SES may reflect a greater potential to improve given their lower prevalence of CRC screening.

Despite increases in CRC screening for respondents with lower income, Medicare insurance, and lower educational attainment, gains in CRC screening were modest and screening for CRC remains well below the target of 80% CRC screening prevalence by 2018 set forth by the National Colorectal Cancer Roundtable.[23] Patients' perception of insurance coverage (as opposed to actual coverage) has been shown to impede cancer screening use,[24] which highlights the need for increased awareness of the ACA's cost-sharing provision among insured individuals. There are several patient-reported obstacles to CRC screening other than costs, including embarrassment, fear, system/logistical challenges, lack of awareness, not receiving a physician's recommendation for CRC screening, and believing that CRC screening is not important or necessary, which need to be addressed to increase CRC screening uptake.[11,17,25-27] Although these factors are not directly addressed by the ACA cost-sharing provision, some of these barriers, including the belief that CRC screening is not important, may be indirectly influenced by this provision because the removal of cost for CRC screening may highlight the importance and societal value of preventive services, including CRC screening.[5]

Unlike CRC screening, there was no change in BC screening prevalence noted among low-income women

and those with lower educational attainment. This may be due to fewer pre-ACA financial barriers because the cost of mammography is substantially lower than that of colonoscopy,[28] and BC screening is better supported by women's health initiatives such as the Centers for Disease Control and Prevention's National Breast and Cervical Cancer Early Detection Program.[29] In addition, BC screening prevalence may have less room for improvement because it has already been markedly higher than the corresponding estimate for CRC screening.[30] The modest declines noted among women of higher SES are in keeping with previous findings noting declining mammography rates in these groups.[9]

The current study has some limitations. First, we were only able to examine the initial 2-year period after the ACA cost-sharing provision. Second, screening data were based on self-report. Validation of other survey data indicate an overreporting of mammography whereas FOBT and endoscopy may be underreported.[31] In addition, the reason for tests (screening vs diagnostic) was also based on self-report and has not been validated. The NHIS is cross-sectional, which limits the causal inferences that can be made from the current study, and it only captures insurance and income at the time of the survey and not before or during screening, thereby leading to possible misclassification of these factors. The NHIS also lacked information regarding benefit structures and coverage details among privately insured individuals, which is likely to vary across insurance plans and influence access to cancer screening. Although the NHIS sample in the current study represented 63.4 million screening-eligible adults, the analytic sample sizes in some of our stratified analyses were relatively small and led to fairly wide 95% CIs, but our standard errors were well below and sample sizes were well above the recommended NHIS thresholds for data suppression.[32] Last, we excluded respondents with missing screening data from the current study and those with missing covariates from adjusted results. Income was the most common independent variable with missing data, although the percentage of subjects who did not report their income was relatively small (8.1% for CRC and 8.2% for BC). It is important to note that failure to report income was not associated with CRC or BC screening status. The inclusion of individuals with missing income data as well as other missing covariates did not alter the results (data not shown). The percentage of respondents with missing screening data was relatively small (2.9% for CRC and 3.7% for BC), and was not related to SES.

Increases in CRC screening prevalence between 2008 and 2013 were confined to respondents with low SES. These findings may reflect the ACA's removal of financial barriers. It is also possible that these results reflect a continuation of underlying trends in CRC screening in this group. Despite the modest gain in CRC screening observed in the group with low SES, the current prevalence of screening in this group and overall in the United States is still suboptimal. Financial barriers are only part of the constellation of factors, which include inconsistent physician recommendations, fear, insufficient awareness, and beliefs that CRC screening is not necessary or important,[24,27,33] that must be addressed to achieve nationwide screening goals.

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CONFLICT OF INTEREST DISCLOSURES

Dr. Doubeni has acted as a paid consultant for Exact Sciences for work performed outside of the current study.

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