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Cancer screening among a population-based sample of insured women

Sharon Hensley Alford [a,b], Steven Leadbetter [c,*], Juan L. Rodriguez [c], Nikki A. Hawkins [c], Lawrence E. Scholl [d], Lucy A. Peipins [c]

[a] Department of Public Health Science, Henry Ford Health System, Detroit, MI, United States
[b] Department of Women's Health, Henry Ford Health System, Detroit, MI, United States
[c] Epidemiology and Applied Research Branch, Division of Cancer Prevention and Control, CDC, Atlanta, GA, United States
[d] ICF International, Fairfax, VA, United States

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ABSTRACT

Purpose. Screening has been shown to lower the morbidity and mortality for breast, cervical, and colorectal cancers. Despite the availability of cancer screening, nearly 70,000 women die each year from these cancers. We conducted a study in 2008 within a privately-insured patient population of women who were members of an integrated health care system in Southeastern Michigan, for whom information on ovarian cancer risk as well as personal and family history of cancer was available. *Methods.* We used a population-based, weighted stratified random sample of women from a single health care institution to assess the proportion with up-to-date breast, cervical, and colorectal screening. Multivariable analyses were conducted to identify predictors of screening behavior. *Results.* In our study, women reported cervical and breast cancer screening above 90% and colorectal cancer screening above 75%. *Conclusions.* The results of our study hold promise that Healthy People 2020 cancer screening objectives might be obtainable as access to health insurance is expanded among US residents.

Introduction

Screening has been shown to lower morbidity and mortality for breast cancer, cervical cancer, and colorectal cancer (CRC) (Zappa et al., 1997; Laara et al., 1987; IARC Working Group, 1986; van der Graaf et al., 1988; Mook et al., 2011). Despite cancer screening, nearly 70,000 women die yearly from these cancers (Jemal et al., 2013). Healthy People 2020 objectives aim to have 81% of the eligible population screened for breast cancer with mammography, 93% for cervical cancer, and 70% for CRC (Healthy People 2020, 2013). However, results from the 2010 US National Health Interview Survey recently showed that overall screening rates are well below Healthy People 2020 targets (Coleman King et al., 2012; Smith et al., 2011). Several studies have shown strong associations between health insurance coverage and uptake of cancer screening services (Farkas et al., 2012; Fedewa et al., 2012; Carney et al., 2012; Akinyemiju et al., 2012; Zhao et al., 2011; Palmer et al., 2011; Shires et al., 2011), recent changes in the US health care system might address this major barrier of access to care.

As opportunities for health care coverage in the US increase, additional factors might continue to pose barriers to cancer screening. Previous studies of cancer screening have highlighted disparities associated with race, ethnicity, income, education, and other socio-economic factors (Smith et al., 2011; Shires et al., 2011; Klabune et al., 2013; U.S. Preventive Services Task Force, 2002; Swan et al., 2010; Courtney-Long et al., 2011; Miller et al., 2012; Shapiro et al., 2012; Joseph et al., 2012; Rauscher et al., 2012; Berry et al., 2009). In addition, several studies have also found that family history of cancer has been associated with uptake of cancer screening (Townsend et al., 2013; Zlot et al., 2012; Vyas et al., 2012; Meissner et al., 2007). As more individuals enter the health insurance market, having a greater understanding of the barriers to cancer screening uptake among insured populations will facilitate more focused strategies and interventions to reach Healthy People 2020 objectives.

We conducted a study within a privately-insured patient population of women who were members of an integrated health care system in Southeastern Michigan. Our sampling method permitted population-based estimates of reported breast, cervical, and CRC screening.

Methods

Study population

We used baseline data from a Centers for Disease Control and Prevention (CDC) study evaluating cancer risk perception and ovarian cancer screening among women within the Henry Ford Health System (HFHS). Eligible women were 30 years of age or older, had no previous diagnosis of ovarian cancer, and had not undergone bilateral

* Corresponding author. Fax: +1 770 488 4286.
E-mail address: SLeadbetter@cdc.gov (S. Leadbetter).

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oophorectomy. We excluded younger women because their risk of ovarian cancer is very low. HFHS provided a list of 55,887 potential eligible patients and their contact information. The survey was conducted in two phases—an eligibility screener and the full interview. The eligibility screener consisted of a five-minute series of questions on personal history of breast or ovarian cancer, bilateral oophorectomy, and breast and ovarian cancers among first- and second-degree relatives. Based on this screener, women were classified into ovarian cancer risk groups (average, elevated, and high) for stratified random sampling purposes, insuring sufficiently-powered subsamples from each risk group, including an oversample of women at high risk. Between January 16, 2008 and December 13, 2008 the programmed computer-assisted telephone interview (CATI) system randomly selected eligible respondents for participation in a full interview (Leadbetter et al., 2013). Approval for the study was obtained from the Institutional Review Boards (IRBs) of the CDC and the HFHS. All respondents provided informed consent before we conducted interviews.

Outcome measures

Respondents were asked if they had ever had a mammography or a Pap test and when they had their most recent exam. Women who reported having had a mammogram in the past two years or a Pap test in the past 3 years were classified as compliant with screening guidelines for a mammography or Pap test, respectively (Smith et al., 2011; Shires et al., 2011; U.S. Preventive Services Task Force (USPSTF), 2011). Respondents were asked if they had ever heard of or had a fecal occult blood test (FOBT), a colonoscopy or a sigmoidoscopy, and when they had their most recent exam. We classified respondents who reported having had a colonoscopy in the past 10 years, a sigmoidoscopy in the past 5 years, or an FOBT in the past year as having had a CRC test within recommended screening guidelines (Smith et al., 2011; U.S. Preventive Services Task Force (USPSTF), 2011). For the analyses of mammography, we included women ≥40 years of age because during the study period the USPSTF recommended ages for screening included women aged 40–49 (U.S. Preventive Services Task Force, 2002). Women ≥30 years of age and without a hysterectomy were included in the Pap test analyses as the youngest women in our sample were age 30; CRC testing analyses included women ≥50 years of age (Smith et al., 2011; U.S. Preventive Services Task Force (USPSTF), 2011). No upper age limit was imposed in these analyses.

Covariates

Using the detailed family cancer history from the baseline survey, we defined an indicator for any breast cancer, cervical cancer or CRC history in the family and used the respondent's personal cancer history information to determine cancer survivorship status. We included age, race/ethnicity, marital status, education, and income. Missing income data were imputed using hot-deck imputation.

Statistical analyses

Prevalence estimates of up-to-date mammography, Pap testing, and CRC testing used responses weighted to reflect selection probabilities based on the risk group-specific sampling rates and also to adjust for non-response. We conducted a bivariate analysis of these prevalence estimates by demographics and by various cancer history covariates, testing for general associations with chi-square statistics. Multivariable logistic regression models for each screening test were used to determine the fully-adjusted associations between each outcome and the demographic variables, and between each outcome and the cancer history variables. For each logistic model, these covariate associations were determined by Wald F-test statistics; potential effect modification and model lack-of-fit were also assessed. We defined the referent level for each covariate as the category with the smallest cancer testing prevalence estimate from the bivariate analysis. Adjusted testing percentages or predicted marginals (PMs) were derived for each category of the model covariates. Rate ratios (RRs) were calculated as the PM of each non-referent category relative to the PM of the referent category for each covariate, with 95% confidence intervals (CIs). All statistical analyses were performed using SAS 9.2 with SUDAAN (Research Triangle Institute, Research Triangle Park, NC) to calculate appropriate standard errors for the stratified sample design. We considered any test with a p-value ≤ 0.05 to be statistically significant.

Results

Of 55,887 women in the master list of patients, 20,483 (36.7%) underwent eligibility screening and 16,720 (81.6%) were determined to be eligible for the study. A total of 3307 women were invited to participate in the study and 2524 women were successfully consented and interviewed (overall response rate 76.3%) (Leadbetter et al., 2013). Table 1 provides sample sizes and unweighted percentages corresponding to the demographic distributions of the participating women.

Bivariate analysis

Table 2a presents the prevalence rates for mammography, Pap test, and CRC testing overall and by demographics. Overall, 91.0% of participants aged ≥40 (n = 2297) had a mammography within the past two years, 91.3% of participants aged ≥30 and who did not have a hysterectomy (n = 2152) had a Pap test within the past three years, and 78.7% of participants aged ≥50 (n = 1755) were compliant with CRC testing.

For mammography, women aged 50–69 were more likely to report having had a screening test than women aged 40–49 (p = 0.0004) and aged ≥70 (p < 0.0001). For Pap tests, women aged 30–69 were more likely to report being tested compared to those aged ≥70 (p <

Table 1
Demographics of study population, women, aged 30 or older, Henry Ford Health System, 2008.

Characteristic	n	(%)
Total study population	2524	(100%)
Age group (n = 2524)		
30–39	227	(9.0)
40–49	542	(21.5)
50–59	837	(33.2)
60–69	641	(25.4)
70 or older	277	(11.0)
Race/ethnicity (n = 2507)		
Non-Hispanic White	1659	(66.2)
Non-Hispanic Black	691	(27.6)
Other[a]	157	(6.3)
Marital status (n = 2523)		
Married/partnered	1692	(67.0)
Separated/divorced	380	(15.1)
Single	231	(9.2)
Widowed	219	(8.7)
Education (n = 2523)		
<High school	89	(3.5)
High school/GED	687	(27.2)
College, <4 years	830	(32.9)
College, ≥4 years	484	(19.2)
Graduate degree	433	(17.2)
Income[b] (n = 2523)		
<$25,000	263	(10.4)
$25,000–<$50,000	706	(28.0)
$50,000–<$75,000	592	(23.5)
$75,000 or more	962	(38.1)

Abbreviation: GED, general educational development (high school equivalency).
[a] "Other" includes Latina, non-Hispanic multiracial, and non-Hispanic of "other" or unspecified race.
[b] Refused or unknown income was imputed with hot-deck imputation procedures.

Table 2a
Prevalence of mammography, Pap test, and colorectal cancer testing compliance by demographics, women of eligible screening age[a], Henry Ford Health System, 2008.

Characteristic	Mammography (n = 2297) %	(95% CI)	Pap test (n = 2152) %	(95% CI)	CRC test[b] (n = 1755) %	(95% CI)
Overall	91.0	(89.4–92.4)	91.3	(89.7–92.6)	78.7	(76.1–81.0)
Age group (*P*-values)	**.0002**		**.0006**		<**.0001**	
30–39	NA		**89.2**	**(83.7–93.0)**	NA	
40–49	**86.8**	**(82.9–89.9)**	**92.0**	**(88.6–94.4)**	NA	
50–59	**92.9**	**(90.4–94.8)**	**93.4**	**(90.6–95.4)**	**71.7**	**(67.7–75.4)**
60–69	**94.8**	**(92.2–96.5)**	**94.0**	**(91.2–96.0)**	**86.9**	**(83.2–89.9)**
70 or older	**86.4**	**(80.2–90.9)**	**76.6**	**(68.3–83.3)**	**81.6**	**(74.8–86.8)**
Race/ethnicity (*P*-values)	.916		**.046**		**.010**	
Non-Hispanic White	90.9	(88.9–92.5)	**92.7**	**(90.8–94.2)**	**77.4**	**(74.3–80.3)**
Non-Hispanic Black	91.6	(88.4–93.9)	**88.2**	**(84.5–91.1)**	**84.1**	**(79.4–88.0)**
Other[c]	91.4	(83.5–95.7)	**89.6**	**(82.0–94.3)**	**68.4**	**(55.2–79.2)**
Marital status (*P*-values)	**.009**		.0503		.119	
Married/partnered	**92.9**	**(91.1–94.3)**	92.7	(90.8–94.2)	80.2	(77.1–82.9)
Separated/divorced	**87.4**	**(82.2–91.2)**	90.0	(85.1–93.4)	74.0	(66.9–80.0)
Single	**83.8**	**(76.1–89.4)**	84.4	(77.6–89.5)	70.3	(58.8–79.6)
Widowed	**89.9**	**(83.2–94.2)**	90.7	(84.1–94.7)	81.3	(73.7–87.2)
Education (*P*-values)	**.010**		<**.0001**		.491	
<High school	**94.9**	**(85.1–98.4)**	**78.2**	**(62.2–88.7)**	76.5	(61.8–86.8)
High school/GED	**90.5**	**(87.1–93.0)**	**86.4**	**(82.3–89.7)**	80.2	(75.4–84.2)
College, <4 years	**88.2**	**(85.1–90.8)**	**92.4**	**(89.9–94.3)**	77.9	(73.4–81.9)
College, ≥4 years	**92.4**	**(88.6–95.0)**	**91.9**	**(88.0–94.6)**	74.7	(67.7–80.6)
Graduate degree	**95.0**	**(91.6–97.0)**	**96.6**	**(93.6–98.3)**	81.9	(75.8–86.7)
Income (*P*-values)	**.048**		<**.0001**		.278	
<$25,000	**89.7**	**(84.0–93.6)**	**81.0**	**(73.5–86.8)**	81.0	(73.9–86.5)
$25,000–<$50,000	**88.0**	**(84.4–90.8)**	**86.5**	**(82.6–90.0)**	81.5	(76.9–85.3)
$50,000–<$75,000	**91.5**	**(88.0–94.1)**	**93.0**	**(89.7–95.3)**	75.6	(69.8–80.6)
$75,000 or more	**93.2**	**(90.9–95.0)**	**95.5**	**(93.4–96.9)**	77.2	(72.7–81.2)

NA: Not applicable. Indicated age groups not included in the analysis domain of mammography or CRC screening test outcomes.
Significant findings are determined by *P*-values ≤ 0.05 and are displayed in bold.
[a] Eligible screening ages are 40 years or older for mammography, 30 years or older for Pap test, and 50 years or older for colorectal cancer (CRC) test.
[b] CRC test compliance includes colonoscopy in the past 10 years, sigmoidoscopy in the past 5 years, or fecal occult blood test within 1 year.
[c] "Other" includes Latina, non-Hispanic multiracial, and non-Hispanic of "other" or unspecified race.

0.0001). Finally, for CRC screening, women aged ≥60 were more likely to have reported a test than women aged 50–59 ($p < 0.0001$). Marital status was significantly associated with mammography ($p = 0.009$) and marginally associated with Pap test ($p = 0.0503$); married or partnered women consistently had the highest observed rates across all three outcomes, while single or never married women had the lowest observed rates. Mammography was significantly associated with education ($p = 0.010$) and income ($p = 0.048$), as was Pap test (both $p < 0.0001$). For both outcomes, observed test proportions were highest among those with graduate degrees and those with annual household incomes of $75,000 or more.

Table 2b presents the proportions tested for mammography, Pap test, and CRC testing outcomes by several cancer history variables. Neither cancer survivorship status nor family cancer history status was associated with mammography screening compliance. However, having a Pap test was significantly associated with any family cancer history status ($p = 0.007$). Among women with any family cancer history, the Pap test proportion was 92.7% compared to 86.6% among those women without any family cancer history. Having a CRC test was significantly associated with CRC family history ($p = 0.003$), with an 85.8% test proportion among those with a CRC family history compared to 77.2% among those without. CRC testing was also significantly associated with personal cancer survivorship ($p = 0.004$), with 85.1% of cancer survivors tested compared to 77.6% among those who had not had cancer.

Table 2b
Prevalence of mammography, Pap test, and colorectal cancer testing compliance by personal and family cancer history, women of eligible screening age[a], Henry Ford Health System, 2008.

Characteristic	Mammography (n = 2297) %	(95% CI)	Pap test (n = 2152) %	(95% CI)	[b]CRC test (n = 1755) %	(95% CI)
Cancer survivor (*P*-values)	0.827		0.422		**0.004**	
Yes	90.7	(87.0–93.4)	92.6	(88.8–95.1)	**85.1**	**(80.4–88.9)**
No	91.1	(89.3–92.6)	91.1	(89.4–92.6)	**77.6**	**(74.7–80.2)**
Any cancer family Hx (p-values)	0.989		**0.007**		0.796	
Yes	91.0	(89.3–92.5)	**92.7**	**(91.1–94.0)**	78.9	(76.1–81.4)
No	91.0	(86.9–93.9)	**86.6**	**(81.9–90.2)**	78.0	(71.4–83.4)
Breast ca. family Hx (*P*-values)	0.256		–		–	
Yes	92.1	(90.2–93.7)	NA		NA	
No	90.6	(88.6–92.4)	NA		NA	
Cervical ca. family Hx (*P*-values)	–		0.648		–	
Yes	NA		93.2	(78.8–98.0)	NA	
No	NA		91.2	(89.6–92.6)	NA	
CRC ca. family Hx (*P*-values)	–		–		**0.003**	
Yes	NA		NA		**85.8**	**(80.0–90.1)**
No	NA		NA		**77.2**	**(74.3–79.8)**

NA: Not applicable. Each cancer type-specific family history covariate was assessed for only one outcome: breast cancer for mammography, cervical cancer for Pap test, and colorectal cancer for CRC testing.
Significant findings are determined by P-values ≤ 0.05 and are displayed in bold.
[a] Eligible screening ages are 40 years or older for mammography, 30 years or older for Pap test, and 50 years or older for colorectal cancer (CRC) test.
[b] CRC test compliance includes colonoscopy in the past 10 years, sigmoidoscopy in the past 5 years, or FOBT within the past year.

Multivariable logistic regression models

Tables 3a, 3b, and 3c provide the multivariable logistic regression modeling results for the mammography, Pap test, and CRC test outcomes, respectively. All three outcomes were characterized by main effects-only models as no significant effect modifiers were detected. The mammography model included three demographic effects: age group, marital status, and education. Mammography screening was 8% higher in the 60–69 age group compared to the 70 or older age group,

Table 3a
Mammography screening compliance predicted marginal rate ratio with 95% confidence interval, women, aged 40 or older, Henry Ford Health System, 2008.

Model effects — demographics only	Rate ratio	(95% CI)
Age group (p-value < 0.001)		
40–49	0.99	(0.91–1.07)
50–59	1.06	(0.99–1.14)
60–69	1.08	(1.01–1.16)
70 or older	Referent	
Marital status (p-value = 0.005)		
Single	Referent	
Married/partnered	1.09	(1.01–1.17)
Separated/divorced	1.02	(0.93–1.11)
Widowed	1.06	(0.96–1.17)
Education (p-value = 0.035)		
College, <4 years	Referent	
<High school	1.08	(1.01–1.15)
High school graduate/GED	1.02	(0.98–1.07)
College, ≥4 years	1.05	(1.00–1.10)
Graduate degree	1.07	(1.03–1.12)

Table 3a displays only significant associations, as determined by P-values ≤ 0.05.

Table 3b
Pap test compliance predicted marginal rate ratio with 95% confidence interval, women, aged 30 or older, Henry Ford Health System, 2008.

Model effects	Rate ratio	(95% CI)
Cancer history		
Any family cancer history (p-value = 0.004)		
No	Referent	
Yes	1.06	(1.01–1.10)
Demographics		
Age group (p-value < 0.001)		
30–39	1.08	(0.98–1.19)
40–49	1.12	(1.02–1.22)
50–59	1.14	(1.04–1.24)
60–69	1.15	(1.06–1.25)
70 or older	Referent	
Education (p-value = 0.003)		
<High school	Referent	
High school graduate/GED	1.05	(0.91–1.21)
College, <4 years	1.11	(0.96–1.28)
College, ≥4 years	1.09	(0.94–1.27)
Graduate degree	1.16	(1.00–1.34)

Table 3b displays only significant associations, as determined by P-values ≤ 0.05.

while married or partnered women were 9% more likely to have a mammogram than single women. Women with at least 4 years of college education or less than a high school education were 5% and 8% more likely to have a mammogram, respectively, than women with less than 4 years of college. Pap test screening effects included having any family cancer history (a 6% increase in Pap test screening compared to those without a family cancer history). Women aged 40–49, 50–59, and 60–69 were 12%, 14%, and 15%, respectively, more likely to have a Pap test than women ages 70 or older, while women with graduate degrees were 16% more likely to have a Pap test than women with less than a high school education. CRC screening test effects included having a CRC family history, which increased the likelihood of having a CRC test by 11%, while women who were cancer survivors had a 9% increased rate of CRC testing. Demographically, women aged 60 and older were more likely to have a CRC test than women aged 50–59, while non-Hispanic Black women were 29% more likely to have a CRC test than a combined race/ethnicity group of Hispanics and all non-Hispanic White women.

Table 3c
Colorectal cancer test compliance associations predicted marginal rate ratio with 95% confidence interval, women, aged 50 or older, Henry Ford Health System, 2008.

Model effects	Rate ratio	(95% CI)
Cancer history		
Colorectal cancer family history (p-value = 0.010)		
None	Referent	
Any	1.11	(1.04–1.19)
Cancer survivor (p-value = 0.016)		
No	Referent	
Yes	1.09	(1.02–1.16)
Demographics		
Age group (p-value < 0.0001)		
50–59	Referent	
60–69	1.21	(1.13–1.29)
70 or older	1.16	(1.05–1.27)
Race/ethnicity (p-value = 0.001)		
Other[a]	Referent	
Non-Hispanic White	1.15	(0.96–1.37)
Non-Hispanic Black	1.29	(1.08–1.54)
Marital status (p-value = 0.028)		
Single	Referent	
Married/partnered	1.16	(0.99–1.36)
Separated/divorced	1.04	(0.87–1.25)
Widowed	1.10	(0.91–1.33)

Table 3c displays only significant associations, as determined by P-values ≤ 0.05.
[a] "Other" includes Latina, non-Hispanic multiracial, and non-Hispanic of "other" or unspecified race.

Discussion

Our results indicate that rates for mammography, Pap testing, and CRC testing are higher within our insured population compared to national estimates (91.0% vs. 72.4% for mammography, 91.3% vs. 83.0% for Pap testing, and 78.7% vs. 58.6% for CRC screening) (Coleman King et al., 2012). Similar to cancer screening studies at a national level, we also found that older age, greater education, being married or partnered, and having a higher income were associated with mammography screening (Coleman King et al., 2012; Swan et al., 2010; Courtney-Long et al., 2011; Miller et al., 2012). Contrary to some previous studies, we found no differences in mammography screening uptake based on racial or ethnic groups (Coleman King et al., 2012; Swan et al., 2010; Courtney-Long et al., 2011; Miller et al., 2012). Studies assessing Pap testing have found that screening rates increase with age (until age 65–70), greater educational attainment, and income (Coleman King et al., 2012; Swan et al., 2010). Among our population, Black women had a lower screening rate than White women, whereas in other studies Black (Coleman King et al., 2012) and Hispanic women (Swan et al., 2010) reported greater adherence to Pap test screening.

A recent publication of CRC screening in a nationally representative sample similarly found that a higher percentage of those aged 60–69 and aged ≥70 were compliant with CRC screening guidelines than those aged 50–59 (Shapiro et al., 2012). They also found that Blacks had a slightly higher screening rate than Whites, Hispanics, and those from other racial and ethnic groups. A previous HFHS study also found that those who were older, Black, or married were more likely to be screened for CRC (Shires et al., 2011). While previous population-based studies have found that having higher education and income levels are associated with CRC screening (Coleman King et al., 2012; Klabune et al., 2013; Shapiro et al., 2012; Joseph et al., 2012), our study did not find a significant difference in screening by educational level or income.

Our analyses found no significant differences in mammography use or Pap testing between women with and without a family history of breast cancer and cervical cancer respectively. Consistent with previous research (Townsend et al., 2013; Zlot et al., 2012; Bostean et al., 2013; Ponce et al., 2012), we did see a significant higher use of CRC screening tests among women with a family history of CRC. While our results on mammography and family history of breast cancer are inconsistent with previous results (Townsend et al., 2013; Zlot et al., 2012; Bostean et al., 2013; Ponce et al., 2012), the lack of association between Pap testing and family history of cervical cancer is consistent with previous research (Bellinger et al., 2013). Highlighting a family history of cancer can provide a particularly salient entry point in patient-provider discussions of the importance of cancer screening, particularly CRC screening. A personal history of cancer, or being a cancer survivor, was associated with CRC screening, but not breast or cervical cancer screening. These results are in contrast with a recent meta-analysis that found that overall, cancer survivors were more likely to receive cancer screening, and specifically more likely to be screened for breast cancer, cervical cancer, and CRC when compared to non-cancer controls (Corkum et al., 2013).

Studies of cancer screening have highlighted disparities based on race, ethnicity, income, education, health insurance status, and other socio-economic factors (Coleman King et al., 2012; Klabune et al., 2013; Swan et al., 2010; Miller et al., 2012; Shapiro et al., 2012; Rauscher et al., 2012; Berry et al., 2009). Our results indicate that even in an insured population with access to health care, some of these disparities persist and vary by screening test. While reforms in health care might lead to a greater number of insured individuals and presumably increased rates of cancer screening, members of medically underserved groups and those with less education and income might still be screened at lower rates (Shi et al., 2011; Stimpson et al., 2012; Doubeni et al., 2012).

These findings must be considered in light of limitations of our data collection, including self-report of screenings and family cancer history. However, other studies at HFHS on cancer screening have used claims data to assess utilization and have similarly high proportions of patients being screened (Shires et al., 2011; Lafata et al., 2005). Patients within HFHS tend to remain in the system for long periods of time (average length 7.5 years, unpublished data), which suggests a strong relationship with HFHS as a medical home. This attribute of HFHS patients was not measured in the current study, but might have contributed to the high screening prevalence found in our study. Of course, given the unique characteristics of patients within HFHS and the system itself, our results are not generalizable to a general population of insured or uninsured.

Participating in a health maintenance organization addresses many of the facilitators and barriers associated with cancer screening, including provider recommendations for screening, continuity with a primary care provider, comprehensive service delivery, strong affiliation with a medical home, and screening reminder systems (Alexandraki and Mooradian, 2010; O'Malley et al., 2002; Sabatino et al., 2012). To improve cancer screening uptake among its enrollees, HFHS sends out patient reminders for screening in annual birthday cards. Given that the Community Guide (U.S. Preventive Services Task Force (USPSTF), 2011) has found patient reminders to be an effective strategy to increase uptake of breast, cervical and CRC screening, screening rates at HFHS might be somewhat higher than expected from insured populations that are not exposed to additional interventions. Furthermore, other intrapersonal and structural barriers—such as lack of transportation or sick leave, personal beliefs and attitudes towards screening, or language and cultural barriers (Alexandraki and Mooradian, 2010; Schueler et al., 2008; Del Carmen and Avila-Wallace, 2013)—might still impede cancer screening, even among an insured population, and will require novel interventions to address appropriately. Further research on cancer screening among insured populations should focus on better understanding the facilitators and barriers to cancer screening to inform what types of interventions might be best suited to those who are insured, yet are non-routinely, rarely, or never screened. Nevertheless, the results of this study hold promise that Healthy People 2020 cancer screening objectives might be obtainable once access to health care insurance among US residents is expanded.

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Conflict of interest statement

The authors declare that there are no conflicts of interest.

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