JOURNAL OF WOMEN'S HEALTH
Volume 25, Number 4, 2016

DOI: 10.1089/jwh.2015.5270

Racial/Ethnic Differences Affecting Adherence to Cancer Screening Guidelines Among Women

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Abstract

Background: Race/ethnicity has been shown to modify the effects between obesity and cancer screening among women. The purpose of this article is to update the literature with recent data to examine how the association between different characteristics, including body mass index (BMI), and cancer screening compliance varies by race/ethnicity in a national sample of women.

Materials and Methods: Three cycles of the Health Information National Trends Survey (HINTS) were combined for this cross-sectional study. Weighted descriptive statistics were evaluated using chi-square tests. Multivariable logistic regression evaluated associations between women with underweight or normal (<25), overweight (25–29.9), and obese (>30) BMIs and cancer screening concordant with guidelines (Papanicolaou [Pap] testing ≤3 years, ages 21+ years; mammography ≤2 years, ages 40+ years) in analyses stratified by race/ethnicity. We also assessed variance between racial/ethnic groups in how age, income, and insurance status were associated with cancer screening compliance.

Results: This study included 4992 women who were evaluated for Pap testing and 3773 for mammography. In analyses stratified by race/ethnicity, whites with a higher household income were more likely to report having a Pap test (adjusted prevalence ratio [aPR] 2.16, 95% confidence interval [95% CI] 1.38–3.40) and a mammogram (aPR 1.63, 95% CI 1.04–2.55) compared to lower income white women. Black women with BMIs between 25 and 30 were less likely to receive a Pap test (aPR 0.38, 95% CI 0.19–0.76) than black women with BMIs <25, while no association was observed among the other groups. Insurance was associated with increased likelihood of Pap testing among white and black women. Insurance coverage was positively associated with mammography only among white and Hispanic women.

Conclusions: We found variations in adherence to cancer screening guidelines by age, insurance coverage, and income between racial/ethnic groups. Little evidence was observed for variations in screening by BMI.

Introduction

It has been suggested that increased cancer mortality among racial minorities is due to cancer screening disparities. Higher breast cancer mortality among black women has been suggested to be attributable to lower utilization of mammograms and lack of follow-up after suspicious results.[1] Papanicolaou (Pap) testing, a test used to screen for cervical cancer, has been found to be inadequately utilized among Hispanics, 51–65-year olds, and uninsured women.[2] However, these characteristics alone do not give enough information about what groups of women are not getting adequate screening. For example, different characteristics have been found to affect screening behaviors between different racial/ethnic groups. One study of black, Arab, and Hispanic women in Michigan found that lower knowledge about health was associated with less frequent screening among black women, while it was not as important a barrier for the other ethnic groups.[3] Hispanic women face other barriers, such as needing to reschedule appointments and lack of provider recommendation.[3] It is important that adherence to guidelines for cancer screening continues to be monitored on a population level so that any widening in disparities can be addressed, as well as to determine whether disparities are decreasing to evaluate the effectiveness of current programs. It is particularly important to continue monitoring screening levels as guidelines change, as these changes may affect disparities in screening between different racial/ethnic groups.

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In addition to other characteristics, it has been found that obesity is associated with reduced cancer screening among women. Obesity and elevated blood glucose level are independent risk factors for the development of breast and cervical cancer and are associated with an increased risk of death after either cancer has developed.[4–7] As a result, screening is particularly important among obese women, especially those from a minority background, who are more likely to be diagnosed with breast and cervical cancers. Although obesity is an important risk factor, several studies have indicated that obese women may have reduced utilization of Pap testing, particularly among white women, but the relationship between obesity and breast cancer screening is less clear.[8] Hispanic women, in particular, experience increased incidence and mortality from cervical cancer and have a higher risk of breast cancer than non-Hispanic white women if they have a higher body mass index (BMI).[9,10] Black women have somewhat lower rates of breast cancer compared to whites, but have a disproportionately high rate of breast cancer mortality.[11,12] In addition, black women experience higher rates of cervical cancer than non-Hispanic whites.[13]

Several past studies have compared how race affects the association between obesity and cancer screening among women. This study compared characteristics by race/ethnicity of female respondents using recent data to provide up-to-date information, as guidelines have changed for both cervical and breast cancer screening over the past decade and may have affected how women access screening services. The purpose of this study was to evaluate how different characteristics, including BMI, affect the association of race/ethnicity with cervical and breast cancer screening.

Materials and Methods

Data source

Data were obtained from the Health Information National Trends Survey 4 (HINTS 4) Cycle 1 collected from October 2011 to February 2012, Cycle 2 collected from October 2012 to January 2013, and Cycle 3 collected from September 2013 to December 2013. All cycles were conducted using mailed self-administered questionnaires. These cross-sectional survey cycles were conducted by the National Cancer Institute to assess how individuals access, use, understand, and trust cancer-related information.[14] Each survey cycle included a stratified sample of the noninstitutionalized US adult population. The sample design consisted of two stages. First, a stratified random sample of addresses was selected from a file of residential addresses. Second, within each sampled household, one adult respondent who would have the next birthday (''Next Birthday'' method) was selected to complete a questionnaire in English or Spanish.[15–17]

According to the HINTS 4 protocol, packets were first mailed with a cover letter, a questionnaire, a $2 bill, and a return envelope to all sampled households. Within 2 weeks, a reminder/thank you postcard was sent to all nonresponding households. Four weeks after the first mailing, a second packet was sent to all nonresponding households. Finally, 4 weeks after the second reminder, a third packet was sent only to the remaining nonresponding households.[2–4] For Cycle 1, a total of 3959 individuals completed the questionnaire (response rate, 36.67%); for Cycle 2, 3630 responded (39.97%), and for Cycle 3, 3185 responded (35.19%). Additional details on the study design, methods, and sampling have been published elsewhere.[14–17] The Institutional Review Board at the University of Texas Medical Branch exempted this study from review.

Study population

For the present study, data from the combined HINTS 4 Cycles 1, 2, and 3 were included. We selected women ≥21 years of age who responded to the question about their most recent cervical cancer screening test (Pap test). We also selected data from women ≥40 years of age who responded to the question about their most recent breast cancer screening test (mammogram). Inclusion of these age groups for Pap test and mammogram was based on the criteria recommended by the American Cancer Society (ACS).[18] Although some women could be following the US Preventive Services Task Force (USPSTF) guidelines, which recommend that women start routine mammography screening at 50 years of age,[19] several studies have found no significant decrease in mammography frequency among 40–49-year olds from the years before this recommendation was issued.[20–23] Inclusion criteria for the Pap test and mammogram groups included available data on race/ethnicity, height, and weight. We included respondents who self-identified as non-Hispanic white, non-Hispanic black, or Hispanic. Those who responded as multiracial or ''other'' were excluded. We included only respondents for whom both height and weight variables were available.

For Pap tests, the HINTS question was ''How long ago did you have your most recent Pap test to check for cervical cancer?'' Responses to this item were (1) a year ago or less, (2) more than 1, up to 2 years ago, (3) more than 2, up to 3 years ago, (4) more than 3, up to 5 years ago, (5) more than 5 years ago, and (6) I have never had a Pap test. For analysis, we combined responses to create a categorical variable of ''≤ past 3 years'' and '' ≥3 years ago.'' For mammograms, the HINTS question was ''When did you have your most recent mammogram to check for breast cancer, if ever?'' Responses to this item were (1) a year ago or less, (2) more than 1, up to 2 years ago, (3) more than 2, up to 3 years ago, (4) more than 3, up to 5 years ago, (5) more than 5 years ago, and (6) I have never had a mammogram. We recategorized these responses as ''≤ past 2 years'' and ''≥ past 2 years.'' The responses for both Pap testing and mammography screening were dichotomized to correspond with the ACS's guidelines.

We also assessed sociodemographic characteristics. Age was categorized in years as 21–29, 30–39, 40–49, 50–59, 60–69, and 70 years or older. Race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, or Hispanic. We categorized respondents' education level (less than high school, high school graduate, and some college/college graduate), annual household income (<$15000, $15000–<$35000, ≥$35000, and unknown), and marital status (never married, living together/married, and divorced/separated/widowed). Weight and height data were used to calculate BMI, which was classified as one of three categories: <25 kg/m^2 (underweight or normal weight), 25 to <30 kg/m^2 (overweight), and >30 kg/m^2 (obese). Other covariates included were health insurance and cancer history.

Statistical analyses

We used Stata 12 (Stata Corporation, College Station, TX) for all analyses. Jackknife replicate weights (provided in the

HINTS data set) were used in all analyses to account for the complex sampling design of HINTS. Pap test and mammography guideline adherence were examined by demographics, BMI, health insurance, and cancer history within each racial/ethnic group. We used log-binomial multivariable generalized estimating equation models with a logit link to observe associations between each variable with guideline-adherent screening behaviors (Pap testing and mammography) based on all races/ethnicities together with main effects and interaction terms. Unadjusted interactions between race/ethnicity and the independent variables were tested, and three separate race/ethnicity-specific models were built to evaluate variations in characteristics between racial/ethnic groups. Although not all characteristics showed interactions between race/ethnicity and screening, we included all variables in the stratified models because we wanted to examine characteristics associated with screening within each group. All models were adjusted for age group, education, income, marital status, BMI, health insurance, and personal history of cancer. All subjects with missing data were excluded from this study with the exception of annual household income, as values were missing for a high proportion of respondents and were treated as a separate (unknown) category.

Results

The study included a total of 4992 respondents eligible to be included in the Pap test analyses (women aged ≥21 years) and 3773 for those eligible to be included in the mammogram analyses (women aged ≥40 years). For both types of screening tests, there were significant differences between racial/ethnic groups in prevalence of age group, education, annual household income, marital status, BMI, insurance coverage, and history of cancer ($p < 0.01$, Table 1). In particular, for both Pap testing and mammography screening groups, a high proportion of Hispanics were in the younger

Table 1. Characteristics of Women Who Had Cancer Screening Tests in the Health Information National Trends Survey 4 (Cycle 1, 2, and 3)

	Pap test study group (N = *4992*)[a]				*Mammogram study group* (N = *3773*)[b]			
	White (n = *3278*), *% (wt)*	*Black* (n = *925*), *% (wt)*	*Hispanic* (n = *789*), *% (wt)*	p	*White* (n = *2568*), *% (wt)*	*Black* (n = *695*), *% (wt)*	*Hispanic* (n = *510*), *% (wt)*	p
Age, years				<0.01[c]				<0.01[c]
21–29	16.4	20.3	24.4					
30–39	16.1	22.7	26.1					
40–49	18.3	20.2	23.0		27.1	35.2	46.2	
50–59	19.7	19.0	13.6		29.2	33.5	27.2	
60–69	14.7	10.7	6.9		21.8	18.8	13.9	
70+	14.7	7.0	6.1		21.8	12.5	12.6	
Education				<0.01[c]				<0.01[c]
Less than HS	5.8	14.3	26.7		6.9	14.5	40.1	
Graduate or GED of HS	20.7	20.0	21.3		25.1	21.9	15.0	
Some college course, work, or degree	73.5	65.7	52.0		67.9	63.6	44.9	
Annual household income				<0.01[c]				<0.01[c]
<$15,000	10.2	26.4	20.2		9.6	21.7	25.4	
$15,000–$34,999	17.8	24.4	25.6		16.2	24.3	24.1	
≥$35,000	62.8	39.5	45.3		62.2	41.6	41.9	
Unknown	9.2	9.6	8.9		12.0	12.3	8.7	
Marital status				<0.01[c]				
Never married	18.0	51.3	24.2		7.0	32.8	10.2	<0.01[c]
Living together/married	60.5	29.5	62.1		63.9	37.2	67.2	
Divorced/separated/widowed	21.5	19.2	13.7		29.1	30.1	22.6	
BMI (kg/m^2)				<0.01[c]				<0.01[c]
<25	43.0	19.4	32.4		39.0	16.4	23.0	
25 to <30	26.7	29.6	33.8		28.7	30.9	40.8	
>30	30.4	50.9	33.8		32.3	52.7	36.2	
Insurance coverage				<0.01[c]				<0.01[c]
Yes	86.9	75.1	66.9		89.4	81.0	67.6	
No	13.0	24.9	33.1		10.6	19.0	32.4	
Past H/O cancer				<0.01[c]				<0.01[c]
Yes	11.3	4.4	4.3		15.2	7.1	6.2	
No	88.7	95.6	95.7		84.8	92.9	93.8	

% (wt), Data are weighted to the US population.
[a]Women aged ≥21 years within all categorized BMI and race/ethnicity groups.
[b]Women aged ≥40 years within all categorized BMI and race/ethnicity groups.
[c]$p < 0.05$ considered statistically significant.
BMI, body mass index; GED, graduate equivalency diploma; H/O, history of; Pap, Papanicolaou.

age groups compared to white and black women. A high proportion of Hispanics were also uninsured.

There were also variations in the prevalence of women who had received a Pap test in the past 3 years, >3 years ago, or never by different characteristics (Table 2). In particular, we found that although a high proportion of Hispanics reported having a Pap test in the past 3 years, 6% reported never having a Pap test compared to 3% among both black and white women ($p < 0.05$). Education ($p < 0.01$), income ($p < 0.001$), marital status ($p < 0.001$), insurance coverage ($p < 0.001$), and a history of cancer ($p < 0.001$) were all associated with Pap testing. Data on Pap test adherence did not vary significantly by BMI ($p < 0.10$). Age ($p < 0.001$), race/ethnicity ($p < 0.05$), income ($p < 0.001$), marital status ($p < 0.001$), insurance coverage ($p < 0.001$), and a history of cancer ($p < 0.001$) were associated with mammography screening.

After adjusting for education, annual income, marital status, BMI, health insurance, and a history of cancer, women ≥50 years old were less likely to receive a Pap test compared to 21- to 29-year-old women (Table 3). Black race/ethnicity, higher income, being married or living with someone, having insurance, and a history of cancer were associated with an increased likelihood of having received a guideline adherent Pap test. For mammograms, 60–69-year olds were more likely to be screened compared to 40–49-year olds. Black race, higher income, insurance coverage, and a history of cancer were associated with mammography screening in the past 2 years in the fully adjusted model. Finally, in unadjusted

Table 2. Characteristics of Women Who Had Cancer Screening Tests in the Health Information National Trends Survey 4 (Cycle 1, 2, and 3)

	Pap test (N = *4992*)[a]				*Mammogram* (N = *3773*)[b]			
	<Past 3 years, % (wt)	*≥3 years ago, % (wt)*	*Never, % (wt)*	p	*<Past 2 years, % (wt)*	*≥2 years ago, % (wt)*	*Never, % (wt)*	p
Age, years				<0.001[c]				<0.001[c]
21–29	83.2	4.0	12.8					
30–39	88.6	8.6	2.8					
40–49	85.4	14.2	0.4		69.4	12.4	18.2	
50–59	76.5	21.9	1.6		75.6	17.3	7.1	
60–69	69.5	30.1	0.4		78.6	17.4	4.0	
70+	51.9	44.4	3.7		72.9	23.2	3.8	
Race/ethnicity				0.022[c]				0.039[c]
Non-Hispanic white	76.5	20.2	3.3		74.1	17.8	8.1	
Non-Hispanic black	80.2	16.4	3.3		75.7	13.0	11.3	
Hispanic	81.1	12.5	6.4		70.3	15.7	14.0	
Education				0.004[c]				0.170[c]
Less than HS	67.6	27.8	5.1		69.2	16.8	14.0	
HS graduate/GED	72.4	23.2	4.4		71.6	18.0	10.4	
Some college/college graduate	80.7	16.0	3.3		75.6	16.5	7.9	
Annual household income				<0.001[c]				<0.001[c]
<$15,000	67.5	24.0	8.4		62.4	20.3	17.4	
$15,000–$34,999	70.0	25.9	4.1		64.9	24.0	11.2	
≥$35,000	83.5	14.2	2.2		78.8	13.8	7.4	
Unknown	72.7	22.1	5.2		75.9	18.5	5.6	
Marital status				<0.001[c]				
Never married	77.8	11.5	10.7		68.2	16.5	15.3	<0.001[c]
Living together/married	82.8	15.7	1.5		77.3	13.8	8.9	
Divorced/separated/widowed	63.4	35.0	1.6		68.3	24.0	7.7	
BMI (kg/m^2)				0.072[c]				0.778[c]
<25	81.0	14.9	4.1		73.6	17.9	8.5	
25 to <30	76.6	19.8	3.6		73.0	16.7	10.4	
>30	74.8	21.9	3.4		74.8	16.5	8.7	
Insurance coverage				<0.001[c]				<0.001[c]
Yes	79.9	16.7	3.4		78.2	15.2	6.6	
No	67.4	27.2	5.4		48.1	27.3	24.7	
Past H/O cancer				<0.001[c]				<0.001[c]
Yes	75.9	23.5	0.5		80.8	17.2	2.1	
No	77.8	18.1	4.1		72.8	17.0	10.3	

% (wt), Data are weighted to the US population.
[a]Women aged ≥21 years within all categorized BMI and race/ethnicity groups.
[b]Women aged ≥40 years within all categorized BMI and race/ethnicity groups.
[c]$p < 0.05$ considered statistically significant.
HS, high school.

Table 3. Adjusted Prevalence Ratios (95% Confidence Interval) of Women Who Had Recent Papanicolaou Test (≤3 Years) and Mammogram (≤2 Years) in the Health Information National Trends Survey 4 (Cycle 1, 2, and 3)

	Pap test ≤3 years (N = 4992), aPR (95% CI)	*Mammogram ≤2 years (N = 3773), aPR (95% CI)*
Age, years		
21–29	Ref	
30–39	1.20 (0.70–2.06)	
40–49	0.85 (0.51–1.40)	Ref
50–59	0.42 (0.26–0.68)[a]	1.34 (0.99–1.82)
60–69	0.28 (0.17–0.45)[a]	1.47 (1.07–2.02)[a]
70+	0.13 (0.07–0.22)[a]	1.06 (0.74–1.49)
Race/ethnicity		
Non-Hispanic white	Ref	Ref
Non-Hispanic black	1.73 (1.24–2.42)[a]	1.48 (1.06–2.07)[a]
Hispanic	1.36 (0.85–2.20)	1.21 (0.84–1.74)
Education		
Less than HS	Ref	Ref
HS graduate/GED	1.13 (0.74–1.72)	0.76 (0.50–1.16)
Some college/ college degree	1.16 (0.78–1.71)	0.87 (0.57–1.31)
Annual household income		
<$15,000	Ref	Ref
$15,000–$34,999	1.14 (0.81–1.61)	1.02 (0.71–1.46)
$35,000 or above	1.69 (1.16–2.46)[a]	1.58 (1.09–2.29)[a]
Unknown	1.74 (0.98–3.11)	1.54 (0.98–2.40)
Marital status		
Never married	Ref	Ref
Living together/ married	1.93 (1.34–2.77)[a]	1.43 (0.96–2.14)
Divorced/ separated/ widowed	1.38 (0.95–2.00)	1.05 (0.69–1.59)
BMI (kg/m^2)		
<25	Ref	Ref
25 to <30	0.83 (0.62–1.10)	1.05 (0.81–1.36)
>30	0.76 (0.57–1.00)	1.20 (0.92–1.56)
Insurance coverage		
No	Ref	Ref
Yes	2.62 (1.85–3.70)[a]	3.49 (2.43–4.99)[a]
Past H/O cancer		
No	Ref	Ref
Yes	1.53 (1.12–2.08)[a]	1.57 (1.17–2.10)[a]

Data are weighted to the US population. Adjusted by age, race, education, income, marital status, BMI, health insurance, and history of cancer. Separate log-binomial regression analysis was used for Pap test and mammogram.

[a]$p < 0.05$ considered statistically significant.

aPR, adjusted prevalence ratio; 95% CI, 95% confidence interval.

analyses, we tested interactions between race/ethnicity and the other characteristics (analyses not shown). We found that the interaction between income and race/ethnicity was associated with Pap testing at $p < 0.10$ ($p = 0.06$). Marital status ($p = 0.006$) and insurance coverage ($p = 0.02$) interactions with race/ethnicity were significantly associated with Pap testing, while no other interactions were found. Marital status ($p = 0.04$) was the only interaction with race/ethnicity that was significantly related to mammography screening.

In analyses stratified by race/ethnicity and adjusted for all model variables, among white women, higher annual household income ($p = 0.02$) was associated with an increased likelihood of having had a recent Pap test, but was not associated with Pap testing among black and Hispanic women (Table 4). White women and Hispanic women who were married or living with a partner were more likely to have had a Pap test compared to never married women of their own racial/ethnic group, whereas only divorced/separated/widowed black women were more likely to have had a Pap test compared to never married black women. Insurance coverage was associated with a higher likelihood of having had a recent Pap test among white ($p < 0.001$) and black women ($p < 0.001$) compared to their corresponding uninsured racial group, but insurance coverage was not significantly associated with Pap testing among Hispanic women. We included estimates for all covariates that were adjusted for in the model so that the effects of the covariate on the associations of income, and marital status with Pap testing could be examined by the reader for each of the observed race/ethnicities.

In fully adjusted models, we found that marital status was not associated with screening mammograms among any of the racial/ethnic groups of women (Table 5). Since the interaction between marital status and race/ethnicity was significantly associated with mammography screening in unadjusted analyses, adjustments in the final stratified model attenuated the association.

Discussion

In this study, married white and Hispanic women were more likely to get Pap tests, while divorced, separated, or widowed black women were more likely than never married women in the same racial/ethnic group. Marital status has been found to affect cancer screening depending on race in other studies. A systematic review found that marital status was associated with screening adherence among Hispanics, but not among white or black women.[24] It also found that finance and insurance status were important factors related to screening behavior among white and black women, but did not influence Hispanic screening behavior as strongly.[24] It is possible that marital status in these two groups is an indicator of more financial stability and, thus, leads to higher screening adherence. Married couples may also participate in healthier behaviors, such as screening, for the sake of their family.[25] These dynamics may work differently for black women in our study, because a high proportion of them reported never being married.

Although the interaction of marital status and race/ethnicity was associated with breast cancer screening in unadjusted analyses, in stratified analyses, no significant associations between marital status and mammography were observed. It is likely that the association was attenuated by insurance coverage. In an examination of insurance among 18–64-year olds diagnosed with cancer, being married was associated with higher insurance enrollment, as well as lower enrollment in Medicaid.[26] Since insurance status was highly associated with increased use of mammography, it likely attenuated the association of marital status and breast cancer screening within each of the racial/ethnic groups.

Table 4. Adjusted Prevalence Ratios (95% Confidence Interval) of Having Recent Papanicolaou Test (≤3 Years) Among Women by Race/Ethnicity in the Health Information National Trends Survey 4 (Cycle 1, 2, and 3)

	Pap test (≤3 years)		
	White, aPR (95% CI)	*Black, aPR (95% CI)*	*Hispanic, aPR (95% CI)*
Age, years			
21–29	Ref	Ref	Ref
30–39	1.15 (0.56–2.37)	0.57 (0.16–2.00)	1.55 (0.65–3.70)
40–49	0.76 (0.40–1.44)	0.38 (0.11–1.32)	1.15 (0.52–2.55)
50–59	0.40 (0.22–0.72)[a]	0.15 (0.05–0.51)[a]	0.68 (0.29–1.61)
60–69	0.24 (0.13–0.43)[a]	0.13 (0.04–0.51)[a]	0.55 (0.22–1.38)
70+	0.13 (0.07–0.24)[a]	0.02 (0.01–0.09)[a]	0.20 (0.04–0.92)[a]
Education			
Less than HS	Ref	Ref	Ref
Graduate/GED of HS	1.42 (0.84–2.37)	2.64 (1.13–6.16)[a]	0.86 (0.35–2.09)
Some college course, work, or degree	1.52 (0.92–2.51)	1.96 (0.84–4.58)	0.64 (0.28–1.44)
Annual household income[b]			
<$15,000	Ref	Ref	Ref
$15,000–$34,999	1.20 (0.78–1.86)	0.79 (0.35–1.76)	2.01 (0.86–4.66)
≥$35,000	2.16 (1.38–3.40)[a]	0.80 (0.33–1.92)	1.40 (0.61–3.23)
Unknown	2.79 (1.66–4.69)[a]	0.84 (0.33–2.15)	0.57 (0.14–2.30)
Marital status[c]			
Never married	Ref	Ref	Ref
Living together/married	1.75 (1.09–2.79)[a]	1.25 (0.66–2.37)	3.15 (1.69–5.88)[a]
Divorced/separated/widowed	1.25 (0.76–2.04)	2.43 (1.23–4.77)[a]	2.05 (0.86–4.91)
BMI (kg/m^2)			
<25	Ref	Ref	Ref
25 to <30	0.88 (0.64–1.21)	0.38 (0.19–0.76)[a]	0.67 (0.32–1.42)
>30	0.77 (0.57–1.04)	0.68 (0.35–1.33)	0.53 (0.25–1.14)
Insurance coverage[d]			
No	Ref	Ref	Ref
Yes	3.07 (2.00–4.69)[a]	4.01 (2.17–7.41)[a]	1.32 (0.66–2.65)
Past H/O cancer			
No	Ref	Ref	Ref
Yes	1.52 (1.07–2.15)[a]	1.13 (0.48–2.65)	3.10 (1.09–8.86)[a]

Data are weighted to the US population. Separate log-binomial regression analysis was used for white, black, and Hispanics. Adjusted by age group, education, income, marital status, BMI, health insurance, and history of cancer. Outcome variable: recent pap test (≤3 years vs. >3 years/never).

[a] $p < 0.05$ considered statistically significant.

Predictor variables: [b]income and race/ethnicity interaction associated with Pap testing ($p = 0.06$ at $\alpha = 0.10$) in unadjusted analyses; [c]marital status and race/ethnicity interaction associated with Pap testing ($p = 0.006$) in unadjusted analyses; [d]insurance coverage and race/ethnicity interaction associated with Pap testing ($p = 0.02$) in unadjusted analyses.

We found that BMI category affected the likelihood of obtaining cancer screening among black women only. Only overweight black women were less likely to receive Pap screening compared to their normal weight counterparts, a finding that is not consistent with some previous research.[27] National Health Interview Survey (NHIS) data from 2000 indicated that obese white women were significantly less likely to have a recent Pap test, although their differences were marginal, while no differences were observed by BMI among black and Hispanic women.[27] The lack of significance in interactions of BMI with race/ethnicity did indicate that any differences that were found in stratified analyses were not likely meaningful. Our results indicate that barriers for obese women may have been reduced since earlier studies. Some of the barriers cited for these women include inadequate facilities without equipment that is appropriate for obese women, negative interactions with their doctor, and ill-fitting gowns.[28] Differences found for overweight black women may have been due, in part, to the relatively low proportion of normal weight black women in our sample.

Similar to a prior study, we found that cervical cancer screening did not vary by BMI among Hispanics. However, ethnicity and norms may also influence screening, regardless of obesity.[27] According to the descriptive analyses of this study, a higher proportion of Hispanics had never had a Pap test. Although the number of Hispanic women was relatively small, other studies have also found that Hispanic women have inadequate levels of screening. Low screening in this ethnic group may be due to lack of health provider recommendations for screening or missed appointments that are unable to be rescheduled due to clinics' unwillingness to accept patients with multiple missed visits.[3] Other reasons for low screening may be related to language skills, lower ability in navigating the healthcare system in the United States, and lack of access to health services.[29] These findings have important implications for public health, as Hispanics are more likely to be diagnosed with cervical cancer.[10,30,31]

Increased age was associated with cancer screening, although it did not differ significantly by race/ethnicity. Guideline changes have been occurring frequently, with

Table 5. Adjusted Prevalence Ratios (95% Confidence Interval) of Having Recent Mammogram (≤2 Years) Among Women by Race/Ethnicity in the Health Information National Trends Survey 4 (Cycle 1, 2, and 3)

	Mammogram (≤2 years)		
	White, aPR (95% CI)	*Black, aPR (95% CI)*	*Hispanic, aPR (95% CI)*
Age, years			
40–49	Ref	Ref	Ref
50–59	1.22 (0.84–1.77)	1.61 (0.86–2.99)	2.13 (1.03–4.40)[a]
60–69	1.30 (0.89–1.91)	1.77 (0.86–3.63)	3.86 (1.58–9.42)[a]
70+	1.01 (0.67–1.51)	0.88 (0.36–2.17)	1.68 (0.63–4.46)
Education			
Less than HS	Ref	Ref	Ref
Graduate/GED of HS	0.69 (0.40–1.19)	1.19 (0.42–3.34)	0.70 (0.33–1.49)
Some college/college degree	0.82 (0.48–1.41)	1.02 (0.36–2.88)	0.79 (0.38–1.64)
Annual household income			
<$15,000	Ref	Ref	Ref
$15,000–$34,999	0.99 (0.63–1.54)	0.69 (0.34–1.41)	1.88 (0.70–5.07)
≥$35,000	1.63 (1.04–2.55)[a]	1.50 (0.64–3.49)	1.58 (0.64–3.86)
Unknown	1.74 (1.03–2.93)[a]	0.71 (0.29–1.77)	1.90 (0.44–8.09)
Marital status[b]			
Never married	Ref	Ref	Ref
Living together/married	1.41 (0.82–2.43)	1.11 (0.55–2.22)	1.57 (0.64–3.86)
Divorced/separated/widowed	1.07 (0.60–1.90)	1.20 (0.63–2.29)	0.70 (0.30–1.64)
BMI (kg/m^2)			
<25	Ref	Ref	Ref
25 to <30	1.22 (0.91–1.69)	0.58 (0.27–1.26)	0.55 (0.25–1.19)
>30	1.24 (0.91–1.70)	1.40 (0.66–3.00)	0.49 (0.24–0.96)[a]
Insurance coverage			
No	Ref	Ref	Ref
Yes	3.55 (2.20–5.71)[a]	3.48 (1.80–6.71)[a]	3.04 (1.56–5.91)[a]
Past H/O cancer			
No	Ref	Ref	Ref
Yes	1.54 (1.12–2.11)[a]	1.86 (0.75–4.60)	1.59 (0.37–6.87)

Data are weighted to the US population. Separate log-binomial regression analysis was used for white, black, and Hispanics. Adjusted by age group, education, income, marital status, BMI, health insurance, and history of cancer. Outcome variable: recent mammogram (≤2 years vs. >2 years/never).

[a]$p < 0.05$ considered statistically significant.

Predictor variables: [b]marital status and race/ethnicity interaction associated ($p = 0.04$) with mammography in unadjusted analyses.

different medical societies only recently coming into concordance with recommendations for screening guidelines among women older than 30 years of age.[18,32,33] In particular, 2009 guideline changes, which recommended longer intervals between Pap tests, may have caused some women older than 30 years of age to seek longer intervals (5 years) between screenings if they had negative human papillomavirus (HPV) and Pap cotests, which may have affected the results of our study.[34] Low rates of guideline-consistent screening in our study also are likely due, in part, to a high proportion of Hispanics who were younger than 50. Our results suggest that Hispanics may have been following the USPSTF guidelines that recommend routine mammography screening is not necessary among 40- to 49-year-old women, but were getting screened at higher rates at the recommended age intervals.[19]

Unadjusted analyses indicated that race/ethnicity and age interactions were not significantly associated with mammography use. The literature says little about interactions between race and age in breast cancer screening compliance, but this topic is particularly important, as guidelines are not consistent across medical societies and these variations may affect groups differently. For example, the USPSTF recommended in 2009 that 40- to 49-year-old women should take into account the benefits and harms of screening mammography before initiating regular biennial screening, whereas ACS recommends annual screening in this group.[18,19] Evidence indicates that 40- to 49-year-old women have been continuing to receive mammography screening,[20,21,23] therefore, it is somewhat surprising that women in the 70+ age group have similar screening rates to 40–49-year olds across all races/ethnicities. The USPSTF recommendations state that there is not enough evidence of the benefits and harms of screening mammography among women 75 years and older, and ACS recommends annual screening for as long as a woman is in good health.[18,19] Since chronic health issues are more common after 70 years of age, screening levels could be expected to drop.

We also found that older age was associated with lower Pap testing in the past 3 years among all women. Similar results were found in unadjusted analyses of data from the NHIS and the Behavioral Risk Factor Surveillance System (BRFSS) databases.[35] Age variations in Pap testing by race/ethnicity are one contributing source of variation between the groups. When age has been included in models comparing Pap testing of whites with non-Hispanic black women and Hispanic women, age attenuated the association between

race/ethnicity and recent cervical cancer screening.[35] Lower Pap testing adherence among women in older age groups is of concern, considering that a Swedish study found that women >65 years of age who were diagnosed with cervical cancer had decreased rates of survival, mainly because lack of screening led to later-stage diagnosis.[36] It has been argued that screening may be unnecessary among 70+-year-old women who have not had histories of cervical lesions, which is reflected in current ACS guidelines. However, this does not explain the reduction in guideline compliant screening among 50- to 69-year-old white and black women.[37]

The interaction between income and race/ethnicity was associated with Pap testing. We found that higher income among white women was associated with Pap testing in adjusted stratified analyses, but not among black or Hispanic women. Another study, which used data from the BRFSS, also found that there was a significant association between the interaction of household income and race/ethnicity with Pap testing in the 3 years before the survey.[38] It found that higher household income was associated with a strong increase in the probability of having had a Pap test, while the association was much weaker for black and Hispanic women.[38] This may indicate that lower income minorities may be more efficacious in finding healthcare at lower income levels than white women, even though white women have a higher frequency of Pap testing at the higher income levels than Black and Hispanic women. This is consistent with prior studies, which have shown that socioeconomic status affects cancer screening rates.

The association between insurance status and Pap testing varied by race/ethnicity, where insurance was particularly important for white and black women. White women in another study were more likely to receive a Pap test if insured similar to our findings.[39] In contrast, we found that Hispanics were equally likely to get a Pap test regardless of insurance, while the other study found that uninsured Hispanic women older than 40 years of age were less likely to get a Pap test compared to insured Hispanics.[39] These results indicate that insurance may not be as important of a barrier to screening among Hispanics as it is for other ethnic groups. Uninsured Hispanics and blacks utilize preventive services at a higher rate than whites, although the reason is not known.[40] One reason may be that Hispanics are more adept at taking advantage of screening opportunities that are offered to low-income groups.

This study has many strengths, including use of a large nationally representative sample. Much of the previous information on this topic comes from studies conducted using more restricted samples. Because of our large sample size, we were able to include novel comparisons between racial/ethnic groups. Furthermore, the HINTS questionnaire had a special focus on cancer-related questions and healthcare utilization related to cancer screening and information seeking. Finally, we were able to use sophisticated analytical methods to combine several cycles of data, which allowed us to increase the sample size.

The study also has some limitations. Data were taken from responses to a mailed survey. Since the survey was a self-report, it is difficult to determine how accurate responses were. The response rate was lower than if it had been collected from personal interviews, and response bias was likely. In general, responses may have been biased toward more well-educated women, as the questionnaire was a mailed self-report survey. Finally, we were unable to account for the effects of screening guideline changes across time. This point is particularly important for women older than 30 years of age, as screening guidelines are more complicated for this group. Women 30 years of age and older who receive a negative Pap test only are recommended to return for another Pap test in 3 years. However, those who receive both a HPV and a Pap test—both with negative results—are recommended to return for screening in 5 years. These guidelines were announced in 2009 and may have affected the results from this study.

In conclusion, this study demonstrates that many of the associations detected in prior studies have persisted, although disparities in cancer screening appear to be slowly narrowing. We did not find racial/ethnic variations in the association between obesity and cancer screening among women. However, this study does articulate the continuing importance of insurance in the utilization of cancer screenings among women. Even though the Affordable Care Act is expected to reduce the number of uninsured individuals in the United States, more screening opportunities need to be given to women who are uninsured and may not know how to access care for low-income households.

Acknowledgments

This study was conducted with the support of the Institute for Translational Sciences at the University of Texas Medical Branch, supported, in part, by a Clinical and Translational Science Award (UL1TR000071) from the ''National Center for Advancing Translational Sciences, National Institutes of Health.'' Dr. Hirth is a scholar supported by a research career development award (K12HD052023: Building Interdisciplinary Research Careers in Women's Health Program [BIRCWH]; Principal Investigator: Berenson) from the Office of Research on Women's Health (ORWH), the Office of the Director (OD), the National Institute of Allergy and Infectious Diseases (NIAID), and the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Author Disclosure Statement

No competing financial interests exist.

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