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Race/Ethnicity and the Socioeconomic Status Gradient in Women's Cancer Screening Utilization: A Case of Diminishing Returns?

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Abstract

Using three years (2006, 2008, 2010) of nationally representative data from the Behavioral Risk Factor Surveillance System, I assessed the socioeconomic status (SES) gradient for odds of receiving a mammogram in the past two years and a Pap test in the past three years among White, Black, Hispanic, and Asian women living in the U.S. Mammogram and Pap test utilization were less likely among low-SES women. However, women of color experience less benefit than Whites from increasing SES for both screenings; as income and education increased, White women experienced more pronounced increases in the likelihood of being screened than did women of color. In what might be referred to as *paradoxical returns*, Asian women actually experienced a decline in the likelihood of obtaining a recent Pap test at higher levels of education. My findings suggest that women of color differ from Whites in the extent to which increasing socioeconomic resources is associated with increasing cancer screening utilization.

Keywords

Health disparities; race/ethnicity; mammograms; Pap tests; screening utilization; diminishing returns; SES gradient

Breast cancer is the most commonly diagnosed cancer and second leading cause of cancer death among women in the U.S.¹ Diagnostic screening has proven extremely effective at improving breast cancer mortality outcomes,² and efforts to promote mammogram utilization over the past two decades have led to increased screening, especially among women of color.^{1,3} Similarly, while cervical cancer was once the leading cause of cancer death for women in the U.S., the significant decline in cervical cancer mortality over the past 40 years is attributable to more women getting regular Pap tests.⁴

Research consistently demonstrates that household income and educational attainment are crucial enabling factors in mammogram and Pap test utilization; women at higher levels of income and education are more likely to use their financial and knowledge- based resources

to obtain timely screenings than their peers at lower levels of socioeconomic status (SES).^{3,5-10} There are inconsistencies in the literature, however, about the continued existence of racial/ethnic disparities in mammogram and Pap test utilization. On the one hand, some recent studies suggest that Black and Hispanic women continue to have lower rates of screening than White women.¹¹⁻¹⁵ However, much of that research is based on samples limited to specific states or regions, Medicare beneficiaries, or HMO enrollees. Other recent studies demonstrate that screening rates among Black and Hispanic women are now equal to or higher than rates among White women.^{3,16-19} Less is known about screening use among Asian women living in the U.S., but based on samples of women living in California, researchers have found that Asian women are significantly less likely than White women to report receiving recent mammograms and Pap tests.^{11,12,20}

We also know little about the ways in which race/ethnicity attenuates or conditions SES differences in screening use. Previous research on screening use within specific racial/ethnic groups in individual states lends some support to the idea that increases in screening associated with increased SES may be smaller for women of color than for Whites.^{14,20,21} Understanding the direct and interactive influences of race/ethnicity and SES on the use of health care services is important for improving knowledge about population- based patterns in service utilization and designing appropriate interventions based upon these patterns. Population- based patterns in breast and cervical cancer screening could be masked when not considering heterogeneity within populations. If a public health goal is to design culturally and socioeconomically appropriate interventions to increase the use of screenings among women who currently have low rates of use, an important step is uncovering the extent to which SES differentially influences screening practices across diverse racial groups. For example, while screening utilization may increase as SES increases,⁷⁻⁹ it may increase at a weaker rate for certain racial/ethnic groups. Armed with this information, public health experts could design culturally tailored interventions to target these specific groups of women. Accordingly, this study used three years of nationally representative data to examine the conditional effect of race/ethnicity on the relationship between SES and mammogram and Pap test utilization among White, Black, Hispanic, and Asian women living in the U.S.

This paper makes a substantial contribution to our understanding of the extent to which race/ethnicity moderates associations between SES and cancer screening utilization among women and the extent to which women of color receive diminished returns from SES in screening utilization. Although research on disparities in mammogram and Pap test utilization has generally moved beyond debates about whether it is race or class that influences screening utilization, much of this literature focuses only on the main effects of race/ethnicity and SES without utilizing an interactive approach to examine conditional effects on cancer screening use. This study is the first to examine interactions between race/ethnicity and SES on mammogram and Pap test utilization among a nationally representative sample of White, Black, Hispanic, and Asian women living in the U.S..

The SES gradient and racial/ethnic differences in cancer screening use

There is a long history of public health and social science research on the SES gradient in health. This research consistently finds that individuals at higher levels of SES enjoy better health than those at the levels directly below.²²⁻²⁴ According to Link and Phelan,²⁵ socioeconomic status is a “fundamental cause” of health disparities because it influences access to and use of health promoting resources. Mirowsky and Ross²⁶ suggest that education creates knowledge, skills, and resources that enable individuals to make better-informed choices, including those related to obtaining medical services and health screenings. When information about health promotion is available, those with more resources should be best able to take advantage of protective opportunities like routine cancer screenings. However, as suggested by Link and Phelan,²⁵ we must ask under which social conditions income and education might be stronger or weaker predictors of health care use. Applied to the present study, this means exploring whether the relationship between SES and screening utilization is context- dependent in the sense of increasing screening use at a greater rate for one racial/ethnic group vs. another.²⁷ Farmer and Ferraro apply this “diminishing returns” perspective in their analysis of the interactive effects of race/ethnicity and education on self-rated health, finding that as education levels increased, Black adults did not report the same improvements in self- rated health as White adults.²⁸

As suggested by Hayward *et al.*, not only does race differentially channel groups into positions of social advantage, but race may also transform the meaning of socioeconomic status.²⁹ For example, Blacks and Hispanics may receive diminished returns from educational attainment because the quality of education in predominantly Black and Hispanic communities lags behind that in schools that serve predominantly White communities. Lower quality education may be related to lower health literacy, reduced likelihood of health information seeking, and less efficacy in health care use.^{30,31} The health- promoting characteristics of social control, mastery, and social standing that are supposed to increase with rising levels of education²⁶ may increase less for women of color than for White women. Because belief in personal control and mastery are learned experiences, women of color who have lifetime experiences with racism and discrimination may have perceptions of less mastery and social control relative to their similarly educated White peers. The income that is used to purchase screening services or to cover the co-pays of those services may also have lower benefits for racial minorities compared with Whites because of perceived or actual racial discrimination in the quality of care.^{19,32,33} In addition, highly educated women of color are more likely to work in occupations that are predominantly occupied by White workers,³⁴ wherein they may experience a greater sense of isolation, exclusion from informal interaction networks, role overload, and greater stress than similarly educated White women.^{35,36} Such stress and isolation have been found to be inversely associated with cancer screening utilization.^{37,38} Ultimately, race/ethnicity may influence an individual’s exposure to adverse conditions throughout the life course that may transform the meaning of acquired socioeconomic resources that are thought to increase the use of cancer screenings. The hypothesis of this study is that the SES gradient in screening will be stronger for White women than for women of color; White women should

experience the greatest gains in likelihood of obtaining screenings as income and educational attainment increase.

Methods

Data and sample

Data came from the 2006, 2008, and 2010 Behavioral Risk Factor Surveillance System (BRFSS)—the only three years for which the cancer screening questions were used by all states.³⁹ The BRFSS is an annual cross-sectional random-digit-dial (RDD) telephone survey conducted by the Centers for Disease Control (CDC) and U.S. states to collect information on preventive health practices, access to health resources, health behaviors, and demographic characteristics among the civilian, non-institutionalized household population. The BRFSS is the largest telephone-based health survey in the world and has been used by multiple researchers to examine trends in and predictors of mammogram and Pap test use.^{5,6,16,40} Although BRFSS sampling strategies and certain questionnaire modules vary across states and over time, the cancer screening questions were consistent across the three years included in this study. Accordingly, the BRFSS is uniform enough to permit pooling data across states and years for items that were asked of all states.⁸ Throughout all analyses, I used the BRFSS final person weight to adjust for post-stratification non-response and non-coverage bias.

There has been a great deal of variation in the age groups included in previous studies on mammogram and Pap test utilization. Part of the inconsistency is due to contradictions in the recommended age groups by the American Cancer Society (ACS) and U.S. Preventive Screening Task Force (USPSTF). While the ACS recommends annual mammograms beginning at age 40 and continuing for as long as the woman is in good health,⁴¹ the USPSTF recommends biennial screening mammography for women aged 50–75.⁴² Both recommending bodies encourage Pap tests every three years for women aged 21–65. Because Black women present with breast cancer earlier than age 50 and have more advanced tumor diagnosis, I elected to include women aged 40–75 in the mammogram sample for this study.^{15,16,43} For the Pap test analysis I included women aged 25–65, although most Pap studies include women aged 18 and older or women aged 18–65 who have not undergone hysterectomies.^{5,16,18,20,44} The reason for this difference is that—as educational attainment was one of the main independent variables of interest in this study—starting the sample at age 25 is more empirically sound under the presumption that most women have completed their education by that age.^{3,10} To assess the sensitivity of my results to the selected age groups, I repeated all analyses with the various recommended age groups discussed above. The results were robust to all age specifications.

Sample sizes within the BRFSS were large enough to include White, Black, Hispanic, and Asian women. Small sample sizes prevented the inclusion of other racial groups (e.g., American Indians, and mixed-race). The BRFSS does not ask about ethnic subgroups or national origin, so I was unable to explore differences in screening likelihood across those subgroups. Across the three years, a total of 475,822 White, Black, Hispanic, and Asian women aged 40–75 completed the survey, and a total of 352,374 White, Black, Hispanic, and Asian women aged 25–65 who had not undergone hysterectomy completed the survey.

After eliminating respondents with missing information on any of the variables of interest, my analytic sample was 366,194 for the mammogram analysis (women aged 40–75) and 289,161 for the Pap test analysis (women aged 25–65). Supplemental analyses revealed no significant differences in the characteristics of women who answered all of the relevant questions *vs.* those with missing information on the variables of interest.

Dependent variables—I explored two cancer screening indicators. First, among women aged 40–75, I assessed whether the respondent reported receiving a mammogram (“an x-ray of each breast to look for breast cancer”) within the past two years. The BRFSS data do not distinguish between mammograms for the purpose of screening *vs.* diagnosis. Second, among women aged 25–65, I assessed whether the respondent reported receiving a “Pap test for cancer of the cervix” within the past three years. Although the validity of self-report measures have been questioned for the purposes of monitoring individual women’s routine timely screening, and there is some evidence that self-report data overestimate recent mammography more for Black women than for White women,⁴⁵ other researchers have found that self-report data are generally valid for population surveillance of screenings.^{46,47} The implications of these potential recall biases and overestimations are discussed at the end of the paper.

Independent variables—Race/ethnicity was determined using two questions. In the BRFSS, respondents were asked to identify themselves as Hispanic or non-Hispanic *and* to identify the racial category or categories that best represent them. From the responses to these questions, I created four mutually exclusive categories: non-Hispanic White (referent), non-Hispanic Black, non-Hispanic Asian, and Hispanic (any race). I measured socioeconomic status with household income and educational attainment. Household income was an eight-category measure asking respondents to report annual household income: less than \$10,000, \$10,000–14,999, \$15,000–19,999, \$20,000–24,999, \$25,000–34,999, \$35,000–49,999, \$50,000–74,999, and \$75,000 or more. I created dummy variables for each of the income categories and used less than \$10,000 as the reference groups. I assessed educational attainment with three categories indicating highest degree attained: less than high school (referent), high school graduate, and four-year college graduate. The BRFSS does not ask respondents about graduate level education or professional degrees, so the highest educational level available for analysis is four-year college graduate.

Control variables—I included several demographic and health characteristics based upon findings from previous studies on mammogram and Pap test utilization.^{12–15} To adjust household income for the number of people in the household, I included variables for the number of children and number of adults living in the household. Dichotomous variables indicated whether the respondent was employed; married; always or usually got the emotional support needed; had any type of health insurance coverage; experienced a cost barrier to obtaining medical care in the past year; had one or more personal doctors; received a routine physical checkup in the past two years; rated her health as fair or poor; reported being limited in any activities because of physical, mental, or emotional problems; and lived outside of a metropolitan area. Smoking status was measured with three categories: never smoked (referent), former smoker, and current smoker. Weight was measured with three

categories that were pre-constructed within the BRFSS: not overweight or obese (referent), overweight (BMI between 25 and 30), and obese (BMI over 30). For the mammogram analysis, I grouped age into three categories: 40–49 (referent), 50–59, and 60–75. For the Pap test analysis, I used four age groups: 25–34 (referent), 35–44, 45–54, and 55–65. I controlled for survey year in all analyses with 2006 as the referent. In the interest of space, coefficients for the covariates are not presented in the regression tables but are available upon request.

Approach

I began by collating descriptive statistics. I then used binary logistic regression to examine the relationship between race/ethnicity, SES, and mammogram and Pap test utilization and to explore the interactive effects of race/ethnicity with household income and educational attainment on odds of having a recent screening. Given that states administer their own surveys and response rates vary across states, I also tested for the necessity of multilevel models with random intercepts to adjust for the clustering of respondents within states. Although null models for both dependent variables produced significant state-level (level 2) intercept variances, those variances were quite low, resulting in intraclass correlation coefficients of only .02. In addition, the direction, significance, and magnitude of the coefficients were similar across both types of models, and all independent variables included in my models are individual-level rather than state-level characteristics. Therefore, I elected to present the results of the more parsimonious binary logistic regression models here. Results of the multilevel models are available upon request. I conducted all analyses with SAS 9.3.⁴⁸

Results

Descriptive data

Table 1 presents descriptive statistics for all variables used in both analyses. Nearly 77% of women aged 40–75 reported receiving a mammogram within the past two years, and 91% of women aged 25–65 reported receiving a Pap test within the past three years. Figure 1 displays the percentages of women reporting recent mammogram and Pap test use by race/ethnicity. Black women were significantly more likely and Hispanic and Asian women were significantly less likely than White women to report recent mammograms. Black, Hispanic, and Asian women were all significantly more likely than White women to report recent Pap tests.

Table 2 demonstrates racial/ethnic variation in the household income and educational attainment gradients on recent mammogram and Pap test use. Consistent with the diminishing returns perspective, although the percentage of women from each racial/ethnic group who reported obtaining a recent mammogram and Pap test generally rose with levels of household income and educational attainment, the increases from the lowest to highest household income and educational attainment categories was more substantial for White women than for the other groups. It is also noteworthy that although the lowest-income White women were the least likely to report recent mammograms and Pap tests, the percentages converged at the highest income categories for White, Black, and Hispanic

women, with Asian women having the lowest rates of recent mammogram and Pap test use among the highest household income groups. Further, while educational attainment increased the likelihood of having a recent mammogram and Pap test for White, Black, and Hispanic women, the percentage of Asian women reporting a recent Pap test was lower among college educated Asians compared with Asian women with only a high school diploma. This indicates a potential case of paradoxical returns to education for Asian women; rather than educational attainment resulting in increased screening use as would be expected based on the concept of the SES gradient, educational attainment is inversely associated with Pap test use among Asian women.

Regression results

Table 3 presents the results of the main effects regression analysis for both mammogram and Pap test utilization, controlling for various demographic and health history characteristics. For both analyses, Black and Hispanic women were significantly more likely and Asian women were significantly less likely than White women to report recent screenings; compared with White women, Black women had 32% greater odds of reporting a recent mammogram (Odds Ratio = $\exp^{.280} = 1.32$) and 47% greater odds of reporting a recent Pap test (O.R. = $\exp^{.387} = 1.47$), Hispanic women had 59% greater odds of reporting a recent mammogram (O.R. = $\exp^{.466} = 1.59$) and 96% greater odds of reporting a recent Pap test (O.R. = $\exp^{.673} = 1.96$), and Asian women had 30% lower odds of reporting a recent mammogram (O.R. = $\exp^{-.296} = 0.70$) and 20% lower odds of reporting a recent Pap test (O.R. = $\exp^{-.198} = 0.80$). Relative to women with household incomes of less than \$10,000 per year, those in the household income categories of \$20,000 and above were significantly more likely to report having a recent mammogram. The relationship between household income and Pap test utilization was more complicated. Relative to women with household incomes of less than \$10,000, those with incomes of \$10,000–14,999 had about 9% lower odds of reporting a recent Pap test (O.R. = $\exp^{-.088} = 0.91$), while those at the highest income levels (\$50,000–74,999 and \$75,000 and above) were significantly more likely to report a recent Pap test (O.R.s = 1.14 and 1.41, respectively).

Table 4 presents the results of the models that tested interactions between race/ethnicity and household income. As demonstrated by the significant negative race/ethnicity and income interactions, the associations between household income and mammogram use were weaker for Black and Hispanic women than for White women (Model 3). This is consistent with the descriptive results presented earlier in Table 2. In addition, with the exception of the \$15,000–19,999 and \$75,000 or more household income groups, there were no significant income interactions for Asian women. The negative interaction between Asian and the highest household income category suggests that being in the highest category of household income is not as strongly related to an increase in mammogram utilization for Asian women as it is for White women. Because interaction effects cannot be interpreted in isolation from main effects, and in an effort to present a clear visual representation of the interaction effects, I calculated predicted probabilities of mammogram utilization for the typical woman, allowing only household income and race/ethnicity to vary (all other characteristics being held at their means). These predicted probabilities are presented in Figure 2. Consistent with the descriptive results presented earlier, White women experience a more

pronounced household income gradient in mammogram use than do women of color. The curious rapid increase and subsequent decrease in the predicted probability of mammogram use among Asian women between the less than \$10,000 and the \$15,000–19,999 household income categories should be considered with caution since it may be explained by the relatively small sample size for Asians with a household income of \$10,000–14,999. At an N of 135, Asian women in the \$10,000–14,999 category represent the smallest sample size of any of the racial/ethnic- household income groups.

Results were only slightly different for the Pap test analysis (Model 4). Negative income interactions for Hispanics indicate that increases in household income were more weakly associated with Pap test utilization for Hispanics than for Whites. The negative interaction for Black women at the highest level of household income (\$75,000 or more) suggests that experiencing an increase in income from the lowest to highest income category was more weakly related to increases in odds of Pap test utilization for Black women than for White women. Among Asian women, the significant negative interactions at the \$20,000–24,999, \$35,000–49,999, and \$75,000+ categories suggests that being in these household income categories relative to the lowest household income category was more weakly associated with increased likelihood of Pap test use for Asian women than for White women. In fact, adding the applicable main effect and interaction effect coefficients for the Asian x \$75,000+ interaction produces a negative coefficient; Asian women at the highest household income level have significantly lower probability of reporting a recent Pap test relative to White women at the same high- income level. This can be seen more clearly in Figure 3, which displays variation in predicted probabilities of Pap test use by race/ethnicity and household income for the typical woman based upon the coefficients from Model 4 presented in Table 4. White women at the lowest levels of household income start with the lowest predicted probabilities of Pap test use, but the increase in use is quite steep for White women and much weaker for women of color, who have significantly higher probabilities of Pap test use at the lowest levels of household income.

The results of the tests for interactions between race/ethnicity and educational attainment are presented in Table 5. For both analyses, the significant negative educational attainment interactions for Blacks, Hispanics, and Asians suggest that while educational attainment increased odds of mammogram and Pap test use for women in general, it did so at significantly weaker rates for women of color than for White women. Predicted probabilities from Models 5 and 6 are presented in Figures 4 and 5. As demonstrated in Figure 4, the educational attainment gradient for mammogram use was much stronger for White women than for women of color. White women with less than high school also had the lowest predicted probability of mammogram use (.64). As can be seen in Figure 5, the significant negative educational attainment interactions for Pap test use among Asian women were so substantial that once they were added to the main effects coefficients, educational attainment was actually negatively associated with Pap test use among Asian women. Relative to Asian women without a high school diploma, Asian women with a high school diploma or college degree had significantly lower odds of reporting a recent Pap test.

Discussion

Some researchers have suggested that racial minorities differ from Whites in their ability to transform socioeconomic resources into good health.^{27,28,49-51} Yet we know little about the extent to which race/ethnicity and SES interact to influence various types of health care utilization. The present research takes a first step toward understanding the interactive influences of race/ethnicity and SES on one particular type of health care utilization—women's use of mammograms and Pap tests—among White, Black, Hispanic, and Asian women living in the U.S. There are a number of important findings that both support and extend the existing research on racial/ethnic and SES disparities in women's cancer screening utilization.

First, consistent with a number of previous studies, mammogram and Pap test screening continue to be less likely among lower-income women than among higher-income women, and with the exception of Asians, more highly educated women have a greater likelihood of obtaining screenings than women with less education.^{3,5-7,9,10} Second, the finding that Black and Hispanic women have higher odds of reported screenings than White women net of controls for a host of individual characteristics is consistent with other recent nationally representative studies of women in similar age groups.^{16,43,44} Higher utilization rates among Black and Hispanic women may indicate greater success at intervention efforts, including media campaigns, interventions directed at health care providers, increased use of mobile screening vans, and Medicare reimbursement for screening.⁵²

The main objective of this study was to test the applicability of the SES diminishing-returns perspective²⁸ to mammogram and Pap test utilization. I found that, relative to White women, women of color did not experience as pronounced increases in the likelihood of receiving recent mammograms and Pap tests with rising levels of household income and education; this supports the diminishing returns perspective. The simplest explanation for this finding is that these groups simply had less ground to make up than White women. For example, Black and Hispanic women at the lowest levels of household income still had probabilities of mammogram and Pap test use in the low 70s and high 80s, respectively, and Black, Hispanic, and Asian women all had probabilities of Pap test use at .86 or above. Therefore, the results of the interaction analyses may simply reflect a ceiling effect.

Nevertheless, there is a clear pattern in which higher-income and higher-education are associated with increased cancer screening utilization at a greater rate for White women than for women of color. There are several potential explanations for why the SES returns may be lower for women of color. First, given the finding by LaVeist *et al.*³³ that high-SES women of color are more likely than low-SES women of color to perceive racial discrimination within the health care system, one possibility for my findings is that the greater perception of discrimination may act as a deterrent to physician visits and subsequent screenings among high-SES women of color. In addition, social awareness of and personal experiences with racial injustices in society may reduce the sense of personal control, social status, and mastery among higher-SES women of color,²⁶ contributing to a weaker SES gradient in health-promoting behaviors such as cancer screening utilization than what might otherwise be anticipated based on SES alone. Further, it is possible that women of color,

particularly Blacks and Hispanics, experience diminished returns to SES because of the lower quality of education in predominantly Black and Hispanic communities. The lower quality of education may be related to low health literacy, less health information seeking, and less efficacy in health care use. Unfortunately, research on the relationship between quality of primary education and health related behaviors among high-SES women of color is lacking, and the data available here do not allow for empirical tests of these hypotheses. Finally, through processes of occupational segregation,³⁴ more highly educated women of color are more likely than low-education women of color to work in occupations with higher concentrations of Whites. Accordingly, they may experience feelings of isolation, exclusion from informal interaction networks, and stress associated with role overload.^{35,36} Stress and feelings of isolation have been found to be important indicators of failure to obtain timely screening services.^{37,38} Although it was not one of the purposes of this paper to test potential explanations for the diminished returns to SES experienced by women of color, and future research should explore these possibilities, I did run some supplemental analyses (results not shown here but available upon request) that demonstrated that college-educated women of color were less likely than college-educated White women to report usually or always getting the emotional support they need. In addition, in the main effects regression analysis, getting emotional support was positively associated with obtaining mammograms and Pap tests. Public health interventions that rely on peer advisors to encourage screening should be flexible in taking into account the fact that highly-educated women of color, many of whom spend large percentages of their days at workplaces wherein they are in a very small minority³⁵ may feel isolated from the social support systems that encourage screening. Although I was unable to test these potential pathways with existing data, future research should explore the ways in which race/ethnicity transforms the meaning of socioeconomic status in health care utilization.²⁹

My findings also extend the literature on cancer screening utilization among Asian women, a group that is often overlooked in nationally representative research on mammogram and Pap test use. With the exception of a positive interaction with Asians at the \$15,000–19,999 and \$75,000+ levels of household income, there were no significant income or education interactions with Asian women in the mammogram analyses. While the finding for the \$15,000–19,999 may represent a statistical anomaly due to small cell size, the interaction at the highest level of household income demonstrates that compared to White women, Asian women receive diminished returns for high SES when it comes to mammogram use. In addition, in what might be referred to as paradoxical returns, Asian women actually experienced declines in the likelihood of obtaining a recent Pap test at higher levels of education; compared with Asian women with less than a high school diploma, Asian women with a high school diploma or college degree had lower likelihoods of reporting a recent Pap test. This reflects a similar pattern found by Kagawa- Singer *et al.* in their research on Asian women in California: South Asian women with the most education had fewer screenings.²⁴ They suggested that this might be partially explained by length of time in the U.S.. Recently arriving immigrants tend to have less education and locate in ethnic enclaves where ethnic-specific health services are provided. With increased time in the U.S., these women are able to obtain more education, become more economically stable, and move to suburbs⁵³ where access to culturally competent health services is less likely. Unfortunately, the BRFSS does

not request information about national origin, immigration status, or length of time in the U.S.. Previous research has demonstrated that there is a great deal of variation in screening use among subgroups of Asians and Hispanics.^{20,43} If the BRFSS under samples the Asian subgroups that are the least likely to be screened, this may explain the very high rates of Pap test use among low education Asian respondents.

The finding that low- SES women of color had substantially higher likelihood of recent screening use relative to low- SES White women was unexpected and puts a glitch in the diminishing returns understanding of these phenomena. The diminishing returns understanding of these phenomena suggests that the White advantage should be the greatest at the highest levels of SES.²⁸ However, the results of my research demonstrate that women of color actually have higher odds of reporting recent mammograms and Pap tests relative to White women, and their advantage relative to White women is the greatest at the lowest levels of income and educational attainment. This is largely consistent with Farmer and Ferraro's finding that Black adults at the lowest levels of education reported slightly better self- rated health than their White counterparts.²⁸ Based on their research conducted with low-income urban Black women in Missouri, Lukawago *et al.* concluded that there was a growing awareness among low-income women of color that programs exist to pay for screenings if they cannot afford them.²¹ Makuc *et al.* found that increases in mammography use since 1987 have been most pronounced among- low income Black women.⁵² The CDC's National Breast and Cervical Cancer Early Detection Program provides funding to all states to help minority and underserved women gain access to cancer screening. Many interventions throughout the late 1980s targeted low- income women of color with educational campaigns and free or low-cost mammography.^{54,55} Low-SES White women may be less likely to live in the communities that have been targeted for these interventions. In addition, women of color— particularly Black women—are more likely to use community- based health clinics and family planning clinics that offer free or reduced cost Pap tests,⁵⁶ and where women are more likely to be up- to-date on their screenings.⁵⁷

These findings raise questions about the potential impact of the Patient Protection and Affordable Care Act's (ACA) expanded access to health insurance on screening use. On the one hand, we know that having health insurance is positively associated with screening use.^{7,11,14,43} As a result of provisions in the ACA, Medicare now covers USPSTF's strongly recommended and recommended clinical preventive services at no cost to patients. Beginning in 2014, these services will also be covered for women under the newly qualified health plans operating within state-based insurance exchanges. This enhanced coverage of screening services is expected to increase screening use among the women who qualify for these plans.^{40,58} On the other hand, simply enhancing access to screening services alone will likely be insufficient in reducing disparities in screening use among low- income women. Indeed, even in settings where women have unrestricted access to care, including managed care and government sponsored health programs, there remain disparities at stage of diagnosis.^{59,60} Further, simply improving access through health insurance coverage does not ensure equity in quality of screening and physician follow-up. Ultimately, the simultaneous use of multiple interventions directed at both individuals and health care providers, including efforts to increase women's access to a *regular* source of care and efforts to

increase physician recommendation, are likely to be more effective than any single approach.^{37,61}

These findings should be considered in light of some additional limitations. Because the data are cross-sectional, I was only able to examine associations between current education, income, and cancer screening use. These measures capture only a small part of individuals' socioeconomic experiences and do not include accumulated wealth, childhood socioeconomic experiences, or neighborhood socioeconomic conditions. Women of color are disadvantaged relative to Whites on each of these measures, and they may all be significantly associated with use of cancer screenings.¹² In addition, because these data relied on self-reports rather than Medicare or other administrative claims, the results are subject to recall bias. Previous research suggests that self-report data overestimates screenings more so for Black women than for White women.⁴⁵ However, that research did not control for SES and other demographic and social predictors of screening use. Other previous research suggests that the accuracy of recall for mammogram and Pap tests is reasonably good.^{46,47} I can be further confident in my results because the percentages of women reporting recent mammograms and Pap tests are consistent with previous recent studies.^{7,16,18}

Conclusions

The present study adds evidence to the growing body of research suggesting that the relationship between socioeconomic status and health is conditional on race/ethnicity. Relative to White women, women of color experience diminished returns to household income and educational attainment on mammogram and Pap test utilization, but an additional compelling storyline for these findings is that use of these screenings are relatively high among the lowest-SES women of color and are the lowest among low-SES White women. Based upon findings from previous research that rates of screening have increased more substantially for low-SES women of color than for low-SES White women, it appears that interventions designed to increase breast and cervical cancer screening among low-SES women of color have been effective.⁵² Future interventions that aim to increase the use of other types of preventive health care and screening services may wish to model their strategies after those used by the mammogram and Pap test community intervention experts. In addition to continuing these efforts, future mammogram and Pap test campaigns should focus on increasing screening use among low-SES White women. This may mean stepping up efforts in low-income and low-education rural communities that house a larger percentage of poor White women. We must also keep in mind that women of color, particularly Black women, continue to be diagnosed at later stages and have higher mortality rates from these cancers than White women.⁶² This suggests the need to promote earlier and more frequent (e.g., annual) screenings among women of color, improve follow-up to treatment after positive screening results, and ensure equitable quality of screening services across groups. One-size-fits-all screening intervention efforts may not be enough to increase the use of routine screening and to reduce breast and cervical cancer mortality rates across racially and socioeconomically diverse groups of women. Continued monitoring of population-based and geographic area-specific trends in mammogram and Pap test use by racial/ethnic and SES categories is also needed to determine where and for which groups

interventions have been the most effective. This would provide community health experts with the information they need to design culturally and socioeconomically appropriate interventions to increase the use of screenings among women who currently have low rates of use. Future research is also needed on whether the interactive relationship between race/ethnicity and SES on screening utilization exists for the *regular use* of mammograms and Pap tests, compliance with follow-up visits, and efficacy of treatment for women who test positive for cancer. Increasing screening alone is not enough if it is not also associated with decreasing disparities in breast and cervical cancer mortality.

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Notes

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Figure 1.

Percentages of women reporting recent mammogram and pap test by race/ethnicity.

***p < .001 significantly different from Whites; two- tailed test.

Figure 2.

Predicted probabilities of mammogram use by race/ethnicity and household income.^a

^aAll control variables held at means (Weighted Based on results from Model 3).

Figure 3.

Predicted probabilities of pap test use by race/ethnicity and household income.^a

^aAll control variables held at means (Based on results from Model 4).

Figure 4.

Predicted probabilities of mammogram use by race/ethnicity and educational attainment.^a

^aAll control variables held at means (Based on results from Model 5).

Figure 5.

Predicted probabilities of pap test use by race/ethnicity and educational attainment.^a

^aAll control variables held at means (Based on results from Model 6).

Table 1**DESCRIPTIVE STATISTICS FOR MAMMOGRAM AND PAP TEST SAMPLES^a**

	Mammogram Sample (N=366,194)	Pap Test Sample (N=289,161)
Mammogram in past 2 years	76.9	—
Pap test in past 3 years	—	91.2
INDEPENDENT VARIABLES		
Race/Ethnicity		
White	77.1	72.3
Black	10.6	10.9
Hispanic	10.0	13.6
Asian	2.3	3.2
Household Income (\$)		
Less than \$10,000	4.8	4.4
10,000–14,999	4.9	3.9
15,000–19,999	6.4	5.6
20,000–24,999	8.0	7.1
25,000–34,999	10.6	9.6
35,000–49,999	14.8	14.3
50,000–74,999	17.5	18.5
75,000 or more	33.1	36.6
Educational Attainment		
Less than high school	8.2	7.3
High school graduate	55.5	49.8
Four-year college graduate	36.3	42.9
COVARIATES		
Currently employed	58.1	67.7
Has health insurance	89.5	85.6
Experienced medical cost barrier in past year	14.0	16.6
Has at least one personal doctor/HCP	90.6	85.3
Has had a routine health checkup in past 2 years	87.3	83.9
Poor/fair self-rated health	18.2	12.0
Has a functional limitation	25.5	17.2
Smoking status		
Never smoked	57.0	62.3
Former smoker	26.0	19.9
Current smoker	17.1	17.8
Weight		
Not overweight or obese	38.7	44.3
Overweight	31.8	29.3
Obese	29.4	26.4
Married	66.0	68.0
Number of adults in household	2.19 (.92)	2.20 (.90)

	Mammogram Sample (N=366,194)	Pap Test Sample (N=289,161)
Number of children in household	.59 (1.00)	1.16 (1.27)
Usually/always gets emotional support needed	81.4	82.2
Lives in nonmetropolitan county	18.6	16.5
Pap test age groups		
25–34	—	27.5
35–44	—	30.2
45–54	—	25.5
55–65	—	16.9
Mammogram age groups		
40–49	37.4	—
50–59	33.2	—
60 and older	29.4	—
Survey year		
2010	35.3	34.5
2008	33.5	33.9
2006 (ref)	31.3	31.6

^a Percentages reported for all variables except number of adults in household and number of children in household where I report means and standard deviations; Weighted; Mammogram sample includes ages 40–75; Pap test sample includes ages 25–65.

Table 2

PERCENTAGES OF WOMEN REPORTING RECENT MAMMOGRAM AND PAP TEST BY SES AND RACE/ETHNICITY

	Mammogram				Pap test			
	White	Black	Hispanic	Asian	White	Black	Hispanic	Asian
Household Income (\$)								
Less than \$10,000	58.6	70.8	72.5	63.5	77.9	87.9	90.8	87.0
10,000–14,999	61.8	71.7	71.1	68.1	75.6	89.8	90.6	93.7
15,000–19,999	63.6	74.1	73.8	60.1	78.6	91.3	91.2	90.0
20,000–24,999	68.8	74.5	72.3	67.0	81.8	91.2	91.1	86.7
25,000–34,999	72.7	76.6	75.0	71.8	85.2	93.8	92.8	92.7
35,000–49,999	77.0	82.4	76.1	71.4	88.7	94.5	92.7	90.4
50,000–74,999	79.6	85.1	77.3	75.5	92.3	96.4	93.6	95.0
75,000 or more	83.1	84.2	82.6	77.8	95.1	96.2	96.5	93.1
Educational Attainment								
Less than high school	62.5	74.0	72.6	72.5	76.3	87.4	91.6	98.7
High school graduate	75.0	77.3	75.6	67.9	87.8	92.8	91.8	91.2
Four-year college grad.	81.7	82.2	79.3	76.5	94.4	95.7	95.7	92.7

Table 3**LOGISTIC REGRESSION COEFFICIENTS PREDICTING RECENT MAMMOGRAM AND PAP TEST USE^a**

	Model 1 Mammograms (N = 366,194)	Model 2 Pap Tests (N = 289,161)
Race/Ethnicity		
White (ref)	—	—
Black	.280 (.015) ***	.387 (.028) ***
Hispanic	.466 (.017) ***	.673 (.027) ***
Asian	-.296 (.028) ***	-.198 (.046) ***
Household Income (\$)		
Less than \$10,000 (ref)	—	—
10,000–14,999	-.018 (.026)	-.088 (.042) *
15,000–19,999	.022 (.025)	-.027 (.039)
20,000–24,999	.076 (.024) **	-.053 (.038)
25,000–34,999	.130 (.024) ***	-.014 (.038)
35,000–49,999	.238 (.024) ***	-.042 (.038)
50,000–74,999	.302 (.024) ***	.128 (.039) **
75,000 or more	.458 (.025) ***	.341 (.040) ***
Educational Attainment		
Less than high school (ref)	—	—
High school graduate	-.011 (.017)	-.015 (.027)
Four-year college graduate	.086 (.019) ***	.235 (.032) ***
Intercept	1.157 (.024) ***	2.474 (.040) ***
-2 Log Likelihood ^b	331427.86	172883.19

*
p < .05**
p < .01***
p < .001

^a Models control for employment status, health insurance coverage, medical cost barrier in past year, personal doctor, receipt of routine health checkup in past 2 years, self-rated health, functional limitation, smoking status, weight status, marital status, number of children and adults living in household, emotional support, metropolitan vs. nonmetropolitan residence, age, and survey year.

^b Log odds (standard errors); weighted.

Table 4

LOGISTIC REGRESSION COEFFICIENTS FOR RACE/ETHNICITY X HOUSEHOLD INCOME INTERACTIONS ON RECENT MAMMOGRAM AND PAP TEST USE^a

	Model 3 Mammograms (N=366,194)	Model 4 Pap Tests (N=289,161)
Race/Ethnicity		
White (ref)	—	—
Black	.615 (.046) ***	.448 (.074) ***
Hispanic	.942 (.048) ***	1.002 (.075) ***
Asian	-.111 (.124)	.658 (.217) **
Household Income (\$)		
Less than \$10,000 (ref)	—	—
10,000–14,999	.052 (.034)	-.152 (.055) **
15,000–19,999	.081 (.032) *	-.040 (.052)
20,000–24,999	.231 (.031) ***	.045 (.049)
25,000–34,999	.305 (.030) ***	.054 (.048)
35,000–49,999	.431 (.030) ***	.079 (.047)
50,000–74,999	.516 (.030) ***	.261 (.048) ***
75,000 or more	.681 (.030) ***	.516 (.048) ***
Educational Attainment		
Less than high school (ref)	—	—
High school graduate	.038 (.017) *	.024 (.028)
Four-year college graduate	.134 (.019) ***	.273 (.032) ***
INTERACTIONS		
Black x		
Less than \$10,000 (ref)	—	—
\$10,000–14,999	-.197 (.066) **	.260 (.116) *
\$15,000–19,999	-.104 (.063)	.179 (.107)
\$20,000–24,999	-.305 (.063) ***	-.099 (.104)
\$25,000–34,999	-.401 (.060) ***	.126 (.104)
\$35,000–49,999	-.286 (.061) ***	-.073 (.103)
\$50,000–74,999	-.331 (.063) ***	-.011 (.113)
\$75,000 or more	-.629 (.058) ***	-.544 (.104) ***
Hispanic x		
Less than \$10,000 (ref)	—	—
\$10,000–14,999	-.073 (.066)	.103 (.103)
\$15,000–19,999	.010 (.064)	.010 (.098)
\$20,000–24,999	-.306 (.063) ***	-.252 (.096) **
\$25,000–34,999	-.380 (.062) ***	-.264 (.097) **

	Model 3 Mammograms (N=366,194)	Model 4 Pap Tests (N=289,161)
\$35,000–49,999	–.699 (.062) ***	–.450 (.097) ***
\$50,000–74,999	–1.018 (.063) ***	–.921 (.101) ***
\$75,000 or more	–.860 (.060) ***	–.709 (.104) ***
Asian x		
Less than \$10,000 (ref)	—	—
\$10,000–14,999	.365 (.199)	.600 (.434)
\$15,000–19,999	–.346 (.170) *	–.299 (.230)
\$20,000–24,999	–.175 (.161)	–.877 (.277) **
\$25,000–34,999	.024 (.156)	–.296 (.268)
\$35,000–49,999	–.100 (.147)	–.909 (.245) ***
\$50,000–74,999	–.149 (.143)	–.392 (.250)
\$75,000 or more	–.280 (.130) *	–1.347 (.226) ***
Intercept	.938 (.029) ***	2.332 (.048) ***
–2 Log Likelihood ^b	330725.80	172883.19

*
p<.05

**
p<.01

p<.001

^a Models control for employment status, health insurance coverage, medical cost barrier in past year, personal doctor, receipt of routine health checkup in past 2 years, self-rated health, functional limitation, smoking status, weight status, marital status, number of children and adults living in household, emotional support, metropolitan vs. nonmetropolitan residence, age, and survey year.

^b Log odds (standard errors) reported; weighted.

Table 5

LOGISTIC REGRESSION COEFFICIENTS FOR RACE/ETHNICITY X EDUCATION INTERACTIONS
ON RECENT MAMMOGRAM AND PAP TEST USE^a

	Model 5 Mammograms (N=366,194)	Model 6 Pap Tests (N=289,161)
Race/Ethnicity		
White (ref)	—	—
Black	.644 (.043) ***	.570 (.077) ***
Hispanic	1.041 (.033) ***	1.272 (.077) ***
Asian	-.069 (.116)	3.017 (.547) ***
Household Income (\$)		
Less than \$10,000 (ref)	—	—
10,000–14,999	-.012 (.026)	-.086 (.042) *
15,000–19,999	.039 (.025)	-.011 (.039)
20,000–24,999	.094 (.024) ***	-.036 (.038)
25,000–34,999	.151 (.024) ***	.004 (.038)
35,000–49,999	.259 (.024) ***	-.024 (.038)
50,000–74,999	.321 (.024) ***	.146 (.039) ***
75,000 or more	.472 (.025) ***	.355 (.040) ***
Educational Attainment		
Less than high school (ref)	—	—
High school graduate	.242 (.022) ***	.268 (.036) ***
Four-year college graduate	.380 (.024) ***	.572 (.039) ***
INTERACTIONS		
Black x		
Less than high school (ref)	—	—
High school graduate	-.311 (.047) ***	-.093 (.084)
Four-year college graduate	-.584 (.052) ***	-.423 (.094) ***
Hispanic x		
Less than high school (ref)	—	—
High school graduate	-.663 (.038) ***	-.758 (.060) ***
Four-year college graduate	-.899 (.046) ***	-.788 (.077) ***
Asian x		
Less than high school (ref)	—	—
High school graduate	-.215 (.126)	-2.765 (.553) ***
Four-year college graduate	-.254 (.121) *	-3.553 (.549) ***
Intercept	.893 (.027) ***	2.175 (.046) ***
-2 Log Likelihood ^b	396210.51	172883.19

* p<.05

**
p<.01

p<.001

^a Models control for employment status, health insurance coverage, medical cost barrier in past year, personal doctor, receipt of routine health checkup in past 2 years, self-rated health, functional limitation, smoking status, weight status, marital status, number of children and adults living in household, emotional support, metropolitan vs. nonmetropolitan residence, age, and survey year.

^b Log odds (standard errors) reported; weighted.