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SOCIOECONOMIC STATUS DOES NOT EXPLAIN ETHNIC/RACIAL DISPARITIES IN CERVICAL CANCER SCREENINGS

A Thesis in

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Abstract

Background: In recent years, successful screening strategies have lowered rates of cervical cancer in the United States. Researchers often attribute ethnic/racial differences in screenings among minorities to access to care. Prior literature shows mixed evidence for ethnic/racial disparities in cervical cancer screening usage. This study examined ethnic/racial differences in screenings and whether socioeconomic status (SES) explained the differences in cervical cancer screening among ethnic/racial groups.

Methods: Using data from the 2008 Medical Expenditure Panel Survey, this study measured whether minority women (Black, Asian, and Hispanic) age 21-70, received fewer Pap tests within the past three years compared to non-Hispanic White women (N= 8622). This study used logistic regression to determine whether SES (income, education, employment) explained ethnic/racial differences in cervical cancer screenings (Pap test in past 3 years).

Results: In the study sample, the authors found that 91% of Black women (p<.001) and 77% of Asian women (p<.001) received a Pap test within the past three years, compared to 86.73% of non-Hispanic White women. Controlling for insurance status and age, the odds that Black women received screening were 1.91 times the odds of non-Hispanic women getting a Pap test (OR: 1.91, 95% CI: 1.48-2.45). Puerto Ricans had odds nearly twice as high as non-Hispanic Whites (OR: 2.01, 95% CI: 1.10-3.67) and other Latina women had odds that were 1.78 times the odds of non-Hispanic Whites receiving a Pap test (OR: 1.78,95% CI: 1.25-2.52). The odds for Asians receiving screening were 0.46 lower compared to the odds of non-Hispanic Whites. (OR: 0.46, 95% CI: 0.35-0.61). Privately and publicly insured women had odds that were 4.54 and 1.71 times those of uninsured women respectively (OR: 4.54, 95% CI: 3.70-5.56; and OR: 1.71, 95% CI: 1.33-2.19). Further, controlling for SES, ethnic/racial differences remained in the odds of screening for Blacks and Hispanic women (Mexican, Puerto Rican, Other Latinas) (OR: 2.12, 95% CI: 1.63-2.77; OR: 1.61, 95% 1.23-2.12; OR: 1.99, 95% CI: 1.08-3.66; OR: 2.09, 95% CI: 1.42-3.07) compared to non-Hispanic White women. After controlling for SES, private and public insurance was associated with more screening compared to no insurance (OR: 3.69, 95% CI 2.89-4.69; OR: 1.93, 95% CI: 1.47-2.54). However, the odds ratio for screenings for privately insured women did drop from 4.54 to 3.69, after controlling for SES. Middle-income women [125-199% or 200-399% federal poverty line (FPL)] had odds of screening that were 35% and 32% lower than the poorest women (≤100 FPL) respectively. Finally, women with a college education or more had odds that were 2.45 higher of receiving pap tests and the odds for women with a high school education or equivalent were 1.28 higher than women with less than a high school education. Including SES factors yielded no significant effects for women who were employed versus those who were not.

Conclusion: Ethnic/racial differences exist in cervical cancer screenings use. Although a significant predicator, SES did not explain the observed ethnic/racial differences. Results indicate that Asian women receive fewer screenings compared to non-Hispanic Whites. Furthermore, although the results indicate Mexican women have higher rates of screenings compared to non-Hispanic Whites, their rates are the lower compared to other races/ethnicities except for Asians. Future studies should consider exploring why these populations receive fewer screenings. This study can assist public health practitioners and policy makers develop targeted interventions to increase screenings among the racial/ethnic and low SES women.

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Acknowledgements

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Chapter 1

Introduction

Cervical cancer, one of the most curable and preventable cancers, frequently occurs due to the human papillomavirus [HPV] (Campbell et al., 2006; NCI, 2011). According to the Centers for Disease Control and Prevention (CDC), 50 % of sexually active individuals have HPV, a leading cause of cancer of cervix in women (DHHS, 2010). A Pap test checks for abnormal cell growth and has significantly decreased cervical cancer mortality. Research shows approximately 60 % of women who acquire cervical cancer did not receive any form of screening (Campbell et al., 2006).

Cervical cancer is highly preventable. However, a lack of screening in minorities can lead to greater cervical cancer incidence and mortality (Jennings-Dozier & Lawrence, 2000; Flores & Bencomo, 2009). Among the most noted explanations for the screening inconsistency are having no insurance, low income, low education, and unemployment (Buki, Jamison, Anderson, & Cuadra, 2007; Margolis et al., 1998, Hewitt et al., 2004). The current literature shows that there is mixed evidence for ethnic/racial disparities in cervical cancer screenings. In addition, limited research examines socioeconomic status (SES) components, such as income, education, and employment and its effect on cervical cancer screenings.

The purpose of this study is two-fold. The first aim is to examine the association between ethnicity/race and cervical cancer screenings. The second goal is to examine whether SES explains the association between ethnicity/race and cervical cancer screenings. Examining SES's role in ethnic/racial screening disparities helps understand why the screening gap exists. Furthermore, understanding SES's association with ethnic/racial screening disparities can help develop targeted interventions specific to ethnic or racial group. Ultimately, this could result in lower incidence of cervical cancer.

Chapter 2

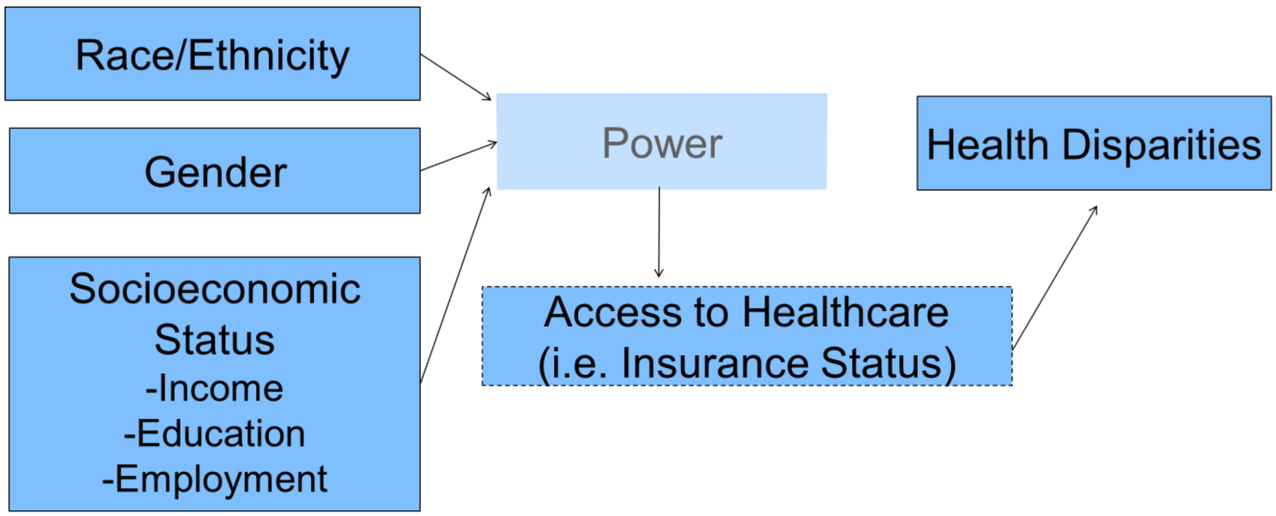
Background and Conceptual Framework

The National Cancer Institute (2011) estimates 12,200 new cases and 4,210 deaths in the United States per year are due to cervical cancer. The CDC states cervical cancer is highly treatable if found early (2011). The overall U.S. incidence rate among all ages for cervical cancer from 1975 to 2007 was 9.59 per 100,000 women. The overall death rate among all ages for cervical cancer from 1975 to 2007 was 3.44 per 100,000 (SEER, 2007). The incidence rate in blacks was higher at 12.6 per 100,000 women than for Whites at 8.4 per 100,000 women. Similarly, the Hispanic cervical cancer incidence rate was also a higher than non-Hispanics at 14.2 per 100,000. Cervical cancer incidence rate was slightly lower for Asian/Pacific Islanders at 8.3 per 100,000; 54.7 percent of White women were more likely to be diagnosed with cervical cancer in the early stages versus only 44-48 percent of minority women (Watson et al., 2008).

While the incidence rates and cervical cancer mortality are clear, the use of screenings among minority women appears to be unclear. Some studies have found that minority women receive fewer screenings than their White counterparts (Bazargan & Bazargan, 2004; Feresu et al. 2008). However, Hewitt and Breen (2004) found that compared to White women, rates of screenings in African American and Hispanic women were higher. Abraido-Lanza and colleagues found no cervical cancer screenings difference among Latina women compared to non-Hispanic White women (2004). Additionally, access to health care also predicts screenings among minority women (Coughlin & Uhler, 2002; Taylor et al., 2009; Caskey, Lindau, & Alexander, 2009). Furthermore, literature suggests that SES factors such as education, income, employment status are strong predictors of screenings (Abraido-Lanza, Chao & Gammon, 2004; Bazargan et al., 2004). However, epidemiological paradoxes,[explain what's paradoxical here, especially since you say SES and gender] , are also reported when examining race/ethnicity, SES, and gender simultaneously (Jackson &Williams, 2006). The conflicting evidence warrants examining screenings behavior among minority women and investigating the association with SES factors.

Theoretically, Link and Phelan's (1995) fundamental causes concept explains that socioeconomic resources such as knowledge, money, power, prestige, and social connections help to "determine the extent to which people are able to avoid risks for morbidity and mortality" (Link and Phelan, 1995, p. 1). In other words, an individual having access to resources such as knowledge, money, and power is better equipped at avoiding illness than a person who does not have access. Thus, Link and Phelan claim SES is a "fundamental cause" of disparities. The social standing of an individual can give him/her access to resources or power, and therefore is a strong predictor of health (Jackson & Williams, 2006). While SES is a strong determinant of health disparities, intersections among ethnicity/race, gender, and SES can also account for the variations in health. Intersectionality theory helps to understand how health can differ due to race, gender and class (Schulz & Mullings, 2006). This theory claims that race, gender, and class can be a gateway to social capital. Figure 1 illustrates the conceptual model, where the interactions among ethnicity/race, gender, and SES give an individual power to get access to care. This study operationalizes the power construct by using access to healthcare (i.e. insurance status) as proxy for power. The ability to gain access to healthcare then determines the difference in health behaviors (i.e. screening behavior). Therefore, compared to White women, minority women of lower class are expected to be at a significant disadvantage due to decreased power.

Figure 1: Conceptual Framework



Chapter 3

Research Methods and Data

Data Collection

The 2008 full-year consolidated dataset from the U.S. Medical Expenditure Panel Survey (MEPS) was the data source for this study. Sponsored by The Agency for Health Care Research and Quality (AHRQ) and the National Center for Health Statistics, MEPS is a longitudinal panel survey that collects nationally representative information. Some advantages of choosing MEPS were richness of data and lack of use in prior research. MEPS collected data on U.S. non-institutionalized individuals about health care utilization and spending, medical costs, and insurance coverage. MEPS also provided information regarding health status, employment, access to care, demographic, and other socioeconomic characteristics. The overall response rate for the 2008 MEPS full year data was 59.3% (Agency for Healthcare Research and Quality, 2010). Furthermore, MEPS generated probability weights to adjust for bias and help with population estimates.

This study's sample size included 8,622 individuals. The eligibility criteria based on the screening guidelines included females aged 21-70 who have not undergone a hysterectomy. Multiple outlets such as the American Cancer Society (ACS), U.S. Preventive Services Task Force (USPSTF), and American College of Obstetricians and Gynecologist (ACOG) have established specific cervical cancer screening guidelines shown in Table 1. Each outlet listed different guidelines in terms of frequency, onset, and termination of the Pap tests. The ACS, USPSTF, and ACOG recommended that screening should begin 3 years after a women is sexually active but no later than age 21 (CDC, 2011). However, guidelines differed for the frequency and termination of Pap tests. The ACS and the ACOG recommended Pap tests annually for women under 30. The ACS and the ACOG recommended Pap tests every two to three years for women 30 and over with 3 negative tests. The USPSTF recommended a Pap tests every three years. The ACS recommended women over 70 years with three consecutive normal tests can discontinue use. The USPSTF suggested women over 65 could discontinue use if their pap tests are negative and they are not at a higher risk for cervical cancer. ACOG does not have an upper age limit to discontinue Pap test use (CDC, 2011). Furthermore, this study did not include women who received a hysterectomy and women over age 70 because the cervical cancer screening guidelines recommend these women to discontinue Pap test use (CDC, 2011). Therefore, including these women could have led to overestimating the disparity. This study used USPSTF's guidelines because they were the least restrictive therefore including the most women in this study

Table 1: Cervical Cancer Screening Guidelines

	American Cancer Society (ACS Nov, 2002)	**U.S. Preventive Services Task Force (USPSTF, Jan 2003)**	**American College of Obstetricians and Gynecologists (ACOG, Aug 2003)**
When to start	Approximately 3 years after onset of vaginal intercourse, but no later than age 21	Within 3 years of onset of sexual activity or age 21, whichever comes first	Approximately 3 years after onset of sexual intercourse, but no later than age 21
Intervals **Conventional Pap test**	Annually, every 2-3 years for women≥30 with 3 negative cytology test	At least every 3 years	Annually, every 2-3 years for women≥30 with 3 negative cytology test
When to stop	Women ≥70 years with ≥3 recent, consecutive negative tests and no abnormal rest in prior 10 years	When >65 years with negative tests, who are not otherwise at high risk for cervical cancer	Inconclusive evidence to establish upper age limit
Post total hysterectomy	Discontinue it for benign reasons and no prior history of high grade CIN	Discontinue it for benign reasons	Discontinue it for benign reasons and no prior history of high grade CIN

-Table adapted from the Centers for Disease Control and Prevention (CDC, 2011)

Analysis of ethnicity/race

This study examined cervical cancer screenings among women who self-identified as non-Hispanic Black, Asian, Mexican, Puerto Rican, other Latina, and non-Hispanic White. This study disaggregated the Hispanic race category because previous studies did not examine group difference among subpopulations. Data restrictions prevented the authors from disaggregating other races. The authors were interested in cervical cancer screening use among women aged 21 -70 (N= 8,622). The ACS, USPSTF, and ACOG screening guidelines recommended screening to begin no later than at age 21 and could be stopped at age 70 (CDC, 2011). Using these guidelines, the analytic sample was narrowed to only include these women.

Socioeconomic Status

In this study, three measures included simultaneously in Model 2 defined socioeconomic status: income, education, and employment status. Family income as a percentage of the federal poverty line was a categorical income variable. The family income categories were negative or poor (less than 100%) [reference group], near poor (100% -124%), low income (125% -199%), middle income (200% -399%), and high income (greater than or equal to 400%). Dummy variables were created for each income category for analyses. Education had three categories: less than high school [reference group], high school or GED, and college or more. Employment status was gathered by asking individuals 16 years and older questions regarding their job status. Data collection occurred in two waves: Panel 12 and 13. The study aggregated Panel 12 and 13 to compile employment status. Individual who reported, “currently employed”, and “employed during the reference period” (i.e. Panel 12 or 13), were considered as employed. If participants reported, “not employed with no job to return to”, they were considered unemployed (Medical Expenditure Panel Survey, 2008).

Outcome measures

The primary outcome measure for cervical cancer screenings was self-reported Pap test. Reported values ranged from 1 to 6 (1 = within the past year, 2 = within past 2 years, 3 = within past 3 years, 4 = within past 5 years, 5 = more than 5 years, and 6 = never). Women who received a Pap test within the past three years were considered as screened because they met the USPSTF's cervical cancer guidelines (CDC, 2011).

Covariates

The study controlled for health insurance status. Health insurance status was measured as a categorical variable that ranged from 1 to 3 (1 = private, 2 = public [government provided], 3 = uninsured [reference group]) (Hewitt et al., 2004; Margolis et al., 1998).

Analysis approach

This study used logistic regression to examine whether ethnic/racial disparities exist in cervical cancer screenings and whether SES moderated this relationship. The primary independent variable of interest in this study was SES. The dependent variable was Pap test in last 3 years. The authors ran analyses in STATA software package 12.0 (Stata Statistical Software, State College, PA). First, the authors calculated sample descriptive statistics shown in Table 2. Secondly, a multivariate logistic regression model helped analyze the association of SES with cervical cancer screenings. The authors also checked for systematic differences in the outcome variable by missing covariates. There were no systematic differences in the outcome variable by covariates. However, Asians and Puerto Ricans were more likely to have missing values for the outcome variable. Additionally, the authors checked the robustness of the results by using a probit model (see Appendix B). The regression equations for each hypothesis are:

Hypothesis 1: *Compared to White women, minority women have a lower prevalence of Pap tests within the past 3 years.*

$$Y_{\text{pap-test}} = \beta o + \beta 1\ (\text{ethnicity/race}) + \beta 2(\text{age}) + \beta 3\ (\text{insurance status}) + \varepsilon$$

Hypothesis 2: *Socioeconomic status explains ethnic/racial disparities in Pap tests.*

$$Y_{\text{pap-test}} = \beta o + \beta 1(\text{ethnicity/race}) + \beta 2(\text{age}) + \beta 3(\text{insurance status}) + \beta 4\ (\text{income}) + \beta 5(\text{education}) + \beta 6(\text{employment status}) + \varepsilon$$

Table 3 reported the odds ratio and the confidence intervals. Reporting the odds ratio helped to assess the probability of the event occurring in people who received screenings versus people who did not.

Chapter 4

Results

Table 2 lists the sample statistics. Compared to non-Hispanic Whites (86.73%), the Pap test use rates for Blacks (91.14%; $p<.001$), and Asians (77.34%; $p<.001$) were statistically significantly different. Women of Asian origin were significantly most likely to be college educated (54.98%; $p<.001$ vs. 35.76%) and have a family income greater than 400% of the poverty line (46.98%; $p<.001$ vs. 40.80%) compared to non-Hispanic Whites. Among the Mexican women in the sample, only 8.06% earned a college degree ($p<.001$) and 41.95% were uninsured ($p<.001$). About 31% of Puerto Rican women had family income less than 100% of the poverty line ($p<.001$) and were most likely to be unemployed (48.70%; $p<.001$) compared to non-Hispanic Whites (30.66%).

Ethnic/Racial Differences in Pap tests

In Table 3, Model 1 shows the results of the logistic regression for the seven ethnic/racial groups for Pap test use controlling for age and insurance status. The logistic regression (N= 8261) showed that compared to non-Hispanic White women, Asian women had lower odds of being screened (OR: 0.46, 95% CI: 0.34-0.61). Black, Puerto Ricans and other Latina women had higher odds of screening within the past three years compared to non- Hispanic White women (OR: 1.91, 95% CI: 1.48-2.45; OR: 2.01; 95% CI: 1.10-3.67; and OR: 1.78, 95%, CI: 1.25-2.52). Both privately and publicly insured women had comparatively higher odds of being screened (OR: 4.54, 95% CI: 3.70-5.56; and OR: 1.71, 95% CI: 1.33-2.19). Furthermore, for each year of age, the odds of a woman being screened decreased by 2% (OR: 0.98, 95% CI: 0.98-0.99).

Ethnic/Racial Differences in Pap test including Socioeconomic Status

When controlling for income, education and employment (socioeconomic status [SES]), similar finding emerged in Model 2 (Table 3). The addition of SES in Model 2 did not explain the racial/ethnic difference in Pap test screening. Compared to non-Hispanic Whites, Blacks and Hispanic women (Mexican, Puerto Rican, Other Latinas) had higher odds of being screened (OR:2.12, 95% CI: 1.63-2.77; OR:1.61, 95% 1.23-2.12; OR: 1.99, 95% CI:1.08-3.66; OR:2.09, 95% CI: 1.42-3.07). The findings for Mexican women became statistically significant after the addition of SES variables in Model 2 compared to the results in Model 1. Asian women had lower odds of being screened controlling for SES factors (OR: 0.41, 95% CI: 0.29-0.56) than non-Hispanic Whites. Furthermore, privately insured women had lower odds of being screened (OR: 3.69, 95% CI 2.89-4.69), while publically insured had higher odds (OR: 1.93, 95% CI: 1.47-2.54) compared to uninsured women. Women's income that fell within 125-199% and 200-399% of the poverty line had lower odds of being screened (OR: 0.65, 95% CI: 0.49-0.86; OR: 0.68, 95% CI: 0.51-0.92). Finally, compared to women with less than a high school diploma, women with a college education or more had odds that were 2.45 times higher of receiving pap tests and women with a high school education or equivalent had odds that were 1.28 times higher of being screened. Similar to Model 1, odds of screenings decreased 2% for each year of age increase after controlling for SES factors (OR: 0.98, 95% CI: 0.98-0.99). Model 2 yielded no significant effects for women who were employed versus those who were unemployed.

Table 2: Demographic characteristics of women ages 21-70 Years Old (N = 8,622) in the U.S. Results from the medical expenditures panel survey (2008)

	Black	Asian	Mexican	Puerto Rican	Other Latinos	Non-Hispanic White	Other Races
	%	%	%	%	%	%	%
Pap test Use (in last 3 yrs)	91.14***	77.34***	85.43	88.83	88.03	86.73	87.45
Age (mean)	40.28***	41.49	37.55***	37.81***	40.96**	42.54	39.03***
Insurance Status							
Private Insurance	53.96***	75.86	40.83***	39.38***	44.78***	74.30	55.97***
Public Insurance	27.31***	10.77	17.23***	43.52***	20.90***	12.16	23.51***
Uninsured	18.74***	13.38	41.95***	17.10***	34.33***	13.55	20.52***
Family Income[a]							
≤ 100%	28.73***	7.34**	28.47***	31.09***	19.90***	12.00	23.51***
100-124%	6.96***	3.10	9.86***	5.18	7.13**	4.14	4.85
125-199%	19.39***	12.23	23.41***	20.21**	20.40***	12.26	17.91*
200-399%	28.20	30.34	25.84***	24.35	33.17	30.80	27.24
≥400%	16.72***	46.98***	12.43***	19.17***	19.40***	40.80	26.49***
Education							
Less than High School	17.34***	11.57*	48.70***	31.82***	32.79***	7.98	21.61***
High School or GED	64.58***	33.45***	43.24***	52.84	46.46***	56.26	58.05
College or More	18.07***	54.98***	8.06***	15.34***	20.72***	35.76	20.34***
Employment Status							
Employed	65.10*	65.74	52.17***	51.30***	62.46***	69.34	63.43*
Unemployed	34.90**	34.26	47.83***	48.70***	37.54***	30.66	36.57*

[a] Relative to federal poverty thresholds
Compared to Non-Hispanic Whites
*** P<0.01; **<0.05;*<0.10

Table 3: Pap test use in U.S. among women ages 21 to 70 years. Results from are from logistic regression using the medical expenditures panel survey (2008)

Cervical Cancer Screenings: Pap test				
	Model 1		Model 2	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Ethnicity/Race				
Black	1.91***	1.48-2.45	2.12***	1.63-2.77
Asian	0.46***	0.34-0.61	0.41***	0.29-0.56
Mexican	1.19	0.94-1.52	1.61***	1.23-2.12
Puerto Rican	2.01**	1.10-3.67	1.99**	1.08-3.66
Other Latinos	1.78***	1.25-2.52	2.09***	1.42-3.07
Other Races	1.13	0.72-1.80	1.30	0.79-2.15
Non-Hispanic White	1.00		1.00	
Age	0.98***	0.98-0.99	0.98***	0.98-0.99
Insurance Status				
Private	4.54***	3.70-5.56	3.69***	2.89-4.69
Public	1.71***	1.33-2.19	1.93***	1.47-2.54
Uninsured	1.00		1.00	
Family Income[a]				
≤ 100%			1.00	
100-124%			0.88	0.60-1.29
125-199%			0.65***	0.49-0.86
200-399%			0.68***	0.51-0.92
≥400%			1.07	
Education				
Less than High School			1.00	
High School or GED			1.28**	1.01-1.63
College or More			2.45***	1.76-3.41
Employment Status				
Employed			1.15	0.94-1.42
Unemployed			1.00	
Screening within the past year vs. more than three years				
[a] Relative to federal poverty thresholds				
*** P<0.01; **<0.05;*<0.10				

Chapter 5

Discussion

There is conflicting evidence regarding cervical cancer screening among minority women, which means studies need to be conducted to understand the prevalence of Pap test use. The major study findings show that SES does not explain ethnic/racial disparities in Pap test use. These results show minority women except Asians receive more Pap tests compared to non-Hispanic White women. This finding of lower rates of screening among Asian women is congruent with previous literature (Nguyen et al., 2002; Islam et al., 2006). The most common explanations for low rates of screening are fear of Pap tests and cultural beliefs (Nguyen et al. , 2002).

Additionally, there is prior evidence supporting higher levels of screenings among Blacks and Hispanics (Coughlin & Uhler, 2002; Taylor et al., 2009; Caskey, Lindau, & Alexander, 2009). However, previous studies fail to examine screening difference among Hispanics. This study disaggregated the Hispanic population showing that, even though higher prevalence of screenings among minority women is found, the screening rates among Mexican women are lower compared to Blacks, Puerto Ricans, and other Latinas. It is important to disaggregate Hispanic women because of group differences. Disaggregating the Hispanic women leads to a more accurate understanding of subpopulations and their needs. Difference in screenings is most likely due to enabling factors such as access to healthcare, education, insurance status, and income (Miranda et al., 2010; Rodriguez, Ward, & Perez-Stable, 2005). The authors found that Mexican women are more likely to be uninsured, which is similar to prior findings (James, Thomas, Lillie-Blanton, & Garfield, 2007). Increasing access to care would likely help increase screening rates for Mexican women.

This study considered the role of ethnicity/race and SES simultaneously. When ethnicity/race and SES are concurrently considered, counterintuitive patterns are observed. The association among ethnicity/race and SES are complex, and many paradoxes appear as a result of their interactions (Jackson & Williams, 2006). For instance, the Hispanic paradox refers to the finding that Latinos have better health outcomes despite the low socioeconomic standing (Jackson & Williams, 2006). This study finds evidence for this paradox among Latinas as well as Blacks. Results from model 2 show that even after adding SES variables, the ethnic/racial differences in Pap test use persisted. Therefore, minorities, with the exception of Asians, fulfilled the epidemiological paradox of having greater screenings than their White counterparts regardless of their low SES. This study adds to the growing body of knowledge about the epidemiological paradox.

Further, the study found an anomalous finding in the income variable. Women whose income falls in either 125-199% or 200-399% of the FPL are less likely to be screened than the poorest women (≤100 FPL). One explanation for this finding can be that the poorest women are more likely to be covered under Medicaid. Preventative screenings such as Pap tests are covered under Medicaid (Ranji, Salganicoff, Stewart, Cox & Doamekpor, 2009). However, middle-income (125-199% or 200-399% of the FPL) women also could represent the underinsured. Even though they have access to healthcare, preventive screenings such as Pap tests could not be covered. Therefore, interventions should consider targeting screening program toward the underinsured, since they seem to be the most vulnerable population.

There are several limitation to be considered. First, Asians and Puerto Ricans were the most likely to have missing values in the outcome variable, which could indicate the presence of bias. However, due to the small amount of missingness the results can still be generalizable with reasonable confidence. Second, seeking to incorporate a comprehensive measure of SES was a challenge. SES measurement is complex. In this study, SES is measured by examining income, education, and employment simultaneously. Although many measures of income exist in MEPS, only family income represents income. Additionally, education only includes highest degree earned when entering MEPS. Although employment status can be a proxy for occupation, however it may not capture an individual's occupation. The measurement of SES could lead to construct validity issues. Additionally, the study only includes a regular Pap test as a measure for cervical cancer screenings. Other methods such as HPV DNA testing and liquid-based cytology help screen for cervical cancer. However, since MEPS only collected data on Pap tests, the analysis is limited. If women were screened using the other techniques, the conclusion of this study can be questioned. This study includes women age 21-70. The selection criteria for age can also be a source of debate. All the screening guidelines recommend starting Pap tests three years after sexual intercourse or age 21. However, MEPS does not measure sexual maturity, which could exclude some women.

Although this study has several limitations, some of its strengths include the ability to apply some of its findings nationally and the use of proper statistical tools. By using MEPS, a nationally representative dataset, the results from this study can be generalized to the female population in the United States. Controlling for income, education, and employment status did not explain the ethnic/racial disparities. SES factors are not the sole reason for difference in screenings. Factors such as lack of recommendation from medical provider, lack of education about pap tests, and fear of pap tests may also contribute to ethnic/racial differences. Future research should examine the epidemiological paradox, and consider analyses by age intervals and marital status. Furthermore, researchers should continue to consider examining group difference among races. Finally, although the researchers find that minority women have an advantage in Pap test use despite their SES; policymakers should not overlook the needs for this population. Public health policy should continue to address health disparities concerning minority women.

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Appendix A

STATA Codes

```
clear
cd "C:\Documents and Settings\ari5008\Desktop\Thesis_Files"
set mem 1000m
use "C:\Documents and Settings\ari5008\Desktop\Thesis_Files\h121edit4.dta"
** create log file**

/*log using CCS1_output.log, replace*/
** generating race variable**
drop  race- notinsured

generate race=.
replace race=1 if racex==1 & hispanx ==2
replace race=2 if racex==2 & hispanx ==2
replace race=3 if racex==4 & hispanx ==2
replace race=4 if hispcat ==4
replace race=5 if hispcat == 1
replace race=6 if hispcat == 2|hispcat ==3|hispcat ==5|hispcat ==91|hispcat ==92
replace race = 7 if racex==5|racex==6|racex==3
** narrowing data to only female**
keep if sex == 2
** narrowing data to women without hysterectomy**
keep if hyster53 == 2
** narrowing data to women 21 to 70**
keep if age08x<71&age08x>20
** Create variable for insured**
generate insured=.
replace insured = 1 if inscov == 1
replace insured = 2 if  inscov ==2
replace insured = 0 if inscov == 3
**generating a binary CCS variable**
generate CCS=.
replace CCS=1 if papsmr53==1|papsmr==2| papsmr==3
replace CCS=2 if papsmr53==4|papsmr==5| papsmr==6
**generating education level variable**
generate Edulevel=.
replace Edulevel=1 if hideg==1
replace Edulevel= 2 if hideg==2|hideg==3
replace Edulevel=3 if hideg==4|hideg==5|hideg==6

replace CCS=. if CCS==0
**generating employment status variable**

generate empstatus=.
```

```
replace empstatus = 1 if
        empst31==1|empst31==2|empst31==3|empst42==1|empst42==2|empst42==3|empst53==
        1|empst53==2|empst53==3
replace empstatus = 0 if empst31==4|empst42==4|empst53==4

generate notemployed=.
replace notemployed = 1 if empstatus ==0
replace notemployed = 0 if empstatus ==1

**Changing CCS to (0 - 1)**
generate CCS2=.
replace CCS2=1 if CCS==1
replace CCS2=0 if CCS ==2
**Changing Insured to (0 - 1)**
generate instat=.
replace instat=1 if insured ==1
replace instat = 0 if insured ==2

generate uninsured =.
replace uninsured = 1 if insured ==2
replace uninsured =0 if insured ==0

**Changing employment status to (0-1)**DO NOT USE***
generate employed=.
replace employed =1 if empstatus ==1
replace employed =0 if empstatus ==2
replace employed = . if empstatus ==.

generate unemployed=.
replace unemployed = 1 if empstatus ==2
replace unemployed = 0 if empstatus ==1
replace unemployed = . if empstatus ==.

**Breaking income up**
******generating poor (0-1)**
generate poor=.
replace poor =1 if povcat08==1
replace poor = 0 if povcat08>1
******generating near poor (0-1)**
generate npoor=.
replace npoor=1 if povcat08==2
replace npoor=0 if povcat08>2|povcat08<2
******generating low income (0-1)**
generate lincome=.
replace lincome=1 if povcat08==3
replace lincome=0 if povcat08>3|povcat08<3
```

```
******generating middle income (0-1)**
generate mincome=.
replace mincome=1 if povcat08==4
replace mincome= 0 if povcat08>4|povcat08<4
******generating high income (0-1)**
generate hincome=.
replace hincome=1 if povcat08==5
replace hincome=0 if povcat08<5

**Breaking Race up**
******generating white (0-1)**
generate white=.
replace white=1 if race ==1
replace white =0 if race>1
******generating black (0-1)**
generate black=.
replace black =1 if race ==2
replace black =0 if race>2|race<2
******generating asian (0-1)**
generate asian=.
replace asian = 1 if race ==3
replace asian = 0 if race>3|race<3
*****generating mexican (0-1)**
generate mexican=.
replace mexican= 1 if race ==4
replace mexican = 0 if race>4|race<4
*****generating puerto rican (0-1)**
generate puertorican=.
replace puertorican = 1 if race ==5
replace puertorican = 0 if race>5|race<5
*****generating other latinos (0-1)**
generate olatinos=.
replace olatinos= 1 if race==6
replace olatinos = 0 if race>6|race<6

****generating other races (0-1)**
generate oraces=.
replace oraces=1 if race ==7
replace oraces = 0 if race<7


**Breaking Education up**
******generating Less than HS (0-1)**
generate lesshs=.
replace lesshs = 1 if Edulevel==1
replace lesshs=0 if Edulevel>1
```

```
******generating HS or equiv. (0-1)**
generate hs=.
replace hs=1 if Edulevel ==2
replace hs=0 if Edulevel>2|Edulevel<2
*****generating College or more (0-1)**
generate college=.
replace college = 1 if Edulevel ==3
replace college = 0 if Edulevel<3|Edulevel>3

**Breaking up insurance status***
generate private=.
replace private = 1 if insured ==1
replace private = 0 if insured>1

generate public=.
replace public = 1 if insured ==2
replace public = 0 if insured>2|insured<2

generate notinsured=.
replace notinsured = 1 if insured == 3
replace notinsured = 0 if insured<3


**Applying Weight**
svyset [pw =  perwt08f]

**Running logistic regression without SES**
xi: svy: logistic CCS2 i.race age08x i.insured
**Running logistic regression with SES**
svy: logistic CCS2  i.race age08x i.insured i.povcat08 i.Edulevel  i.empstatus



** generating missing variable**
generate CCS_missing=.
replace CCS_missing =1 if CCS2==.
replace CCS_missing = 0 if CCS2~=.
foreach var in povcat08 Edulevel employed instat race{
tab CCS_missing `var', chi
}

xi: reg CCS_missing i.race
**Getting sample Descriptives**
sort race
by race: summarize age08x
```

```
tab insured race, col
tab Edulevel race, col
tab povcat08 race, col
tab empstatus race, col
tab CCS2 race, col

*** Checking for significance for the Descriptives***
xi: regress CCS2 i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress age08x i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress private i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress public i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress uninsured i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress poor i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress npoor i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress lincome i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress mincome i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress hincome i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress lesshs i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress hs i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress college i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress empstatus i.black i.asian i.mexican i.puertorican i.olatinos i.oraces
xi: regress notemployed i.black i.asian i.mexican i.puertorican i.olatinos i.oraces

**probit model**

xi: svy: probit CCS2 i.race age08x i.insured
mfx
svy: probit CCS2  i.race age08x i.insured i.povcat08 i.Edulevel  i.empstatus
mfx

xi: probit CCS2 i.race age08x i.insured [pw=   perwt08f]
probit CCS2  i.race age08x i.insured i.povcat08 i.Edulevel  i.empstatus [pw=   perwt08f]
```

Appendix B

Test of Robustness: Probit Model

```
. xi: svy: probit CCS2 i.race age08x i.insured
i.race            _Irace_1-7          (naturally coded; _Irace_1 omitted)
i.insured         _Iinsured_0-2       (naturally coded; _Iinsured_0 omitted)
(running probit on estimation sample)

Survey: Probit regression

Number of strata   =         1                 Number of obs      =      8261
Number of PSUs     =      8261                 Population size    =  76333116
                                               Design df          =      8260
                                               F(   9,    8252)   =     30.72
                                               Prob > F           =    0.0000
```

CCS2	Coef.	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
_Irace_2	.3156042	.066586	4.74	0.000	.185079	.4461294
_Irace_3	-.4339543	.0815677	-5.32	0.000	-.5938476	-.274061
_Irace_4	.0770216	.0655849	1.17	0.240	-.0515414	.2055845
_Irace_5	.3523519	.1560828	2.26	0.024	.0463905	.6583133
_Irace_6	.2841471	.0956153	2.97	0.003	.096717	.4715771
_Irace_7	.0735639	.1288517	0.57	0.568	-.1790178	.3261455
age08x	-.0092425	.0018124	-5.10	0.000	-.0127952	-.0056897
_Iinsured_1	.8178263	.0568378	14.39	0.000	.7064099	.9292427
_Iinsured_2	.3080309	.0731993	4.21	0.000	.1645419	.4515199
_cons	.9238242	.0919208	10.05	0.000	.7436364	1.104012

```
Marginal effects after svy:probit
      y  = Pr(CCS2) (predict)
         =   .8860103
```

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
_Irace_2*	.0525116	.00972	5.40	0.000	.033452	.071571	.122067
_Irace_3*	-.1039062	.02301	-4.52	0.000	-.149001	-.058812	.050656
_Irace_4*	.0142958	.01178	1.21	0.225	-.008794	.037385	.089666
_Irace_5*	.0547101	.019	2.88	0.004	.017477	.091943	.013154
_Irace_6*	.0465482	.01324	3.52	0.000	.020596	.072501	.040379
_Irace_7*	.0135962	.02282	0.60	0.551	-.031131	.058323	.023939
age08x	-.0017828	.00035	-5.15	0.000	-.002462	-.001104	41.8668
_Iinsu~1*	.1926722	.01517	12.70	0.000	.162933	.222412	.717881
_Iinsu~2*	.0516185	.01052	4.91	0.000	.030998	.072239	.130797

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. svy: probit CCS2  i.race age08x i.insured i.povcat08 i.Edulevel  i.empstatus
(running probit on estimation sample)

Survey: Probit regression

Number of strata   =         1                Number of obs      =      7540
Number of PSUs     =      7540                Population size    =  68621129
                                              Design df          =      7539
                                              F(  16,   7524)    =     19.97
                                              Prob > F           =    0.0000
```

CCS2	Coef.	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
race						
2	.3726511	.0730043	5.10	0.000	.2295423	.5157598
3	-.5108359	.0889772	-5.74	0.000	-.6852559	-.3364159
4	.2359725	.0748449	3.15	0.002	.0892556	.3826893
5	.3530533	.1618807	2.18	0.029	.0357221	.6703846
6	.3554948	.1053057	3.38	0.001	.1490663	.5619232
7	.1513636	.1376753	1.10	0.272	-.1185183	.4212456
age08x	-.0091988	.0019963	-4.61	0.000	-.0131121	-.0052854
insured						
1	.7186622	.0676871	10.62	0.000	.5859767	.8513477
2	.37566	.0785687	4.78	0.000	.2216435	.5296765
povcat08						
2	-.0840057	.1061954	-0.79	0.429	-.2921783	.1241669
3	-.2607249	.080348	-3.24	0.001	-.4182293	-.1032205
4	-.2298349	.0810147	-2.84	0.005	-.3886464	-.0710234
5	.0081394	.0956337	0.09	0.932	-.1793293	.1956082
Edulevel						
2	.132732	.0675295	1.97	0.049	.0003553	.2651087
3	.4749016	.0891569	5.33	0.000	.3001291	.649674
1.empstatus	.0904277	.0569236	1.59	0.112	-.0211584	.2020139
_cons	.7951164	.1207005	6.59	0.000	.5585098	1.031723