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ORIGINAL PAPER

Perceived discrimination and cancer screening behaviors in US Hispanics: the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study

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Abstract

Purpose Perceived discrimination has been associated with lower adherence to cancer screening guidelines. We examined whether perceived discrimination was associated with adherence to breast, cervical, colorectal, and prostate cancer screening guidelines in US Hispanic/Latino adults.

Methods Data were obtained from the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study, including 5,313 Hispanic adults aged 18–74 from Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA, and those who were within appropriate age ranges for specific screening tests were included in the analysis. Cancer screening behaviors were assessed via self-report. Perceived discrimination was measured using the Perceived Ethnic Discrimination Questionnaire. Confounder-adjusted multivariable polytomous logistic regression models assessed the association between perceived discrimination and adherence to cancer screening guidelines.

Results Among women eligible for screening, 72.1 % were adherent to cervical cancer screening guidelines and 71.3 % were adherent to breast cancer screening guidelines. In participants aged 50–74, 24.6 % of women and 27.0 % of men were adherent to fecal occult blood test guidelines; 43.5 % of women and 34.8 % of men were adherent to colonoscopy/sigmoidoscopy guidelines; 41.0 % of men were adherent to prostate-specific antigen screening guidelines. Health insurance coverage, rather than perceived ethnic discrimination, was the variable most associated with receiving breast, cervical, colorectal, or prostate cancer screening.

Conclusions The influence of discrimination as a barrier to cancer screening may be modest among Hispanics/Latinos in urban US regions. Having health insurance facilitates cancer screening in this population. Efforts to increase cancer screening in Hispanics/Latinos should focus on increasing access to these services, especially among the uninsured.

Keywords Perceived discrimination · Cancer screening · Cancer disparities · Epidemiology · Prevention

Introduction

Cancer has recently surpassed heart disease as the leading cause of death among Hispanics/Latinos in the USA [1]. Although the incidence of many major cancers including

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breast, cervical, colorectal, and prostate cancer is lower in Hispanics/Latinos than in non-Hispanic whites, Hispanics/Latinos are more likely than non-Hispanic whites to be diagnosed at later stages of cancer when the disease is more difficult to treat [1]. Lower rates of cancer screening in Hispanics/Latinos may contribute to their excess of late-stage cancer diagnoses [2]. Hispanics/Latinos are less likely than non-Hispanic whites to receive screening for major cancers [2, 3]. Previous research has identified multiple individual and system level determinants of cancer screening in Hispanics/Latinos including education, acculturation, annual household income, health insurance coverage, health-care access, physician supply, knowledge about cancer, and mistrust of the medical system [3–10]. Recent evidence suggests that perceived discrimination is a barrier to preventive health behaviors, including cancer screening [11–14].

The Institute of Medicine identified racial and ethnic discrimination as one of the underlying contributors to health disparities [15]. Perceived discrimination may be conceptualized as a stressor that has broad consequences for health [16]. Discrimination may trigger a stress response and decrease an individual's self-control resources, which may lead to nonparticipation in healthful behaviors, such as following cancer screening guidelines [16]. A meta-analysis of studies concluded that individuals who perceived that they had experienced discrimination were less likely to engage in favorable health behaviors than those who did not report perceiving discrimination [16]. Perceived discrimination has been associated with lower likelihood of receiving Pap smears in African-American women [12]. Perceived discrimination in the medical setting has been associated with failure to meet the recommendations in clinical guidelines for prostate, colorectal, and breast cancer screening [11, 13, 14].

While several studies have examined the association between perceived discrimination and cancer screening in African-Americans, few studies have investigated this association among Hispanics/Latinos. The Hispanic Community Health Study/Study of Latinos (HCHS/SOL) obtained information on perceptions of discrimination and cancer screening behaviors across categories of Hispanic/Latino adults defined by national background. Unlike some prior studies, HCHS/SOL data captured detailed information on the timing of cancer screening tests, making it possible to examine recency as well as lifetime receipt of screening tests. We analyzed data from the HCHS/SOL Sociocultural Ancillary Study (SCAS) to determine whether perceived discrimination is associated with adherence to cancer screening based on contemporary screening guidelines at the time of the baseline examination. We compare three different groups: those who have been screened and are adherent to the guidelines, those who have been screened but are not adherent to the guidelines, and those who have never been screened. We hypothesized that adherence to screening guidelines would be lower among those who perceive discrimination. Understanding the effect of perceived discrimination on adherence to cancer screening across the various subgroups of Hispanics will serve to inform the design of culturally tailored, targeted interventions that increase cancer screening adherence in Hispanics.

Materials and methods

Participants

The HCHS/SOL is a multicenter observational study of 16,415 Hispanic/Latino men and women aged 18–74 years. The details of the study have been described elsewhere [17, 18]. Briefly, between 2008 and 2011, participants were recruited from four regions in the USA: Bronx, NY; Chicago, IL; Miami, FL; and San Diego, CA, using a two-stage probability sampling of households in selected census tracts. The cohort includes persons identified as Dominican, Central American, Cuban, Mexican, Puerto Rican, South American, or mixed/other. The SCAS is an ancillary study of the HCHS/SOL that enrolled a subset of 5,313 participants who, upon completing the main HCHS/SOL examination, were invited to return for additional psychosocial assessment that included measures of perceived discrimination and cancer screening within 6 months of their baseline examination. IRB approval was obtained at each field center and the coordinating center.

Cancer screening behaviors

The HCHS/SOL Cancer Questionnaire was used to measure cancer screening behaviors. This questionnaire inquired about the receipt of the following cancer screening tests: mammogram, Pap smear, fecal occult blood test (FOBT), colonoscopy/sigmoidoscopy, and prostate-specific antigen (PSA).

To assess breast cancer screening, women were asked "A mammogram is an X-ray of the breast to look for breast cancer. Have you ever had a mammogram?" If yes, participants were asked "When did you have your most recent mammogram to check for breast cancer?" Possible responses included "a year ago or less," "more than 1 but not more than 2 years ago," "more than 2 but not more than 5 years ago," and "over 5 years ago." Cervical cancer screening was assessed by asking women "A Pap smear is an examination to detect cancer of the neck of the uterus or cervix. Have you ever had a Pap smear?" If participants

answered yes, they were asked "When did you have your most recent Pap smear?" Possible responses included "a year ago or less," "more than 1 but not more than 2 years ago," "more than 2 but not more than 5 years ago," and "over 5 years ago."

To assess FOBT screening, both men and women were asked "Have you ever had a fecal occult blood test done with your doctor, in a clinic or using a home kit?" If they answered yes participants were then asked, "When was the last time you had a fecal occult blood test done with your doctor, in a clinic or using a home kit?"

To assess colonoscopy and/or sigmoidoscopy, participants were asked "Have you ever had either a colonoscopy or sigmoidoscopy?" Possible responses were "yes, a colonoscopy," "yes, a sigmoidoscopy" and "no." If participants answered yes to having either a colonoscopy or sigmoidoscopy, they were asked "When did you have your most recent colonoscopy/sigmoidoscopy?" Responses included "a year ago or less," "more than 1 year ago but not more than 5 years ago," "more than 5 but not more than 10 years ago," and "over 10 years ago."

To assess PSA screening, men were asked "Have you ever heard of a PSA or prostate-specific antigen test?" Respondents that answered "yes" were asked "Have you ever had a PSA test?" Possible responses included "No," "Yes, I had a blood test but I don't know if it checked PSA," and "refused." If men reported having a PSA, they were asked "When did you have your most recent PSA?" and possible responses included "A year ago or less," "More than 1 but not more than 2 years ago," "More than 2 but not more than 5 years ago," and "over 5 years ago."

Adherence to cancer screening guidelines

Adherence to breast, cervical, colorectal, and prostate cancer screenings was defined as a three-level categorical variable (screened, adherent; screened, non-adherent; or not screened). Each type of cancer screening was assessed separately within recommended age group and sex. For the purpose of this study, adherence to cancer screening guidelines was defined according to guidelines from United States Preventive Services Task Force (USPSTF) and the American Cancer Society (ACS) that were in effect during the study years (2008–2011). An 'adherent' participant was defined as a participant who was screened within the recommended time frame. A 'non adherent' participant was defined as a participant who was screened, but outside the recommended time frame. For each screening test, participants who reported never receiving the test were categorized as "not screened." A detailed description of adherence by cancer screening guidelines is provided in subsequent text and summarized in Online Resource 1.

Breast and cervical cancer screening

From 2008 to 2011, the ACS recommended that women 40 and older obtain a mammogram every year [19]. In this same age group, the USPSTF recommended obtaining a mammogram every 1–2 years [20]. The ACS and USPSTF both recommended an annual Papanicolaou (Pap) smear in women beginning 3 years after first vaginal intercourse but not later than 21 years of age [19, 21]. Since age of vaginal intercourse was not assessed, all women of reproductive age (age 18 years or older) were included in the analyses regarding cervical cancer screening. Cervical cancer screening analyses were restricted to women aged 18 years or older, and breast cancer analyses were restricted to women aged 40 years or older. Women participants were categorized as "screened, adherent" if they reported receipt of the screening test within 2 years, "screened, non-adherent" if they reported receipt of the screening test over 2 years prior, and "not screened" if never screened.

Colorectal cancer screening

For men and women aged 50 and over, the ACS and USPSTF recommend an annual FOBT, a sigmoidoscopy every 5 years, or a colonoscopy every 10 years [19, 22]. Participants aged 50 years and older were categorized as "screened, adherent" if they reported FOBT within 1 year and as "screened, not-adherent" if they reported FOBT over 1 year ago. Participants aged 50 years and older were categorized as "screened, adherent" if they reported receipt of a colonoscopy within 10 years, receipt of a sigmoidoscopy within 5 years, or receipt of both within 10 years. Those who reported not being sure if they received a sigmoidoscopy or colonoscopy were categorized as "screened, adherent" if they received the test within 5 years.

Prostate cancer screening

Until recently, annual PSA testing beginning at age 50 in men was recommended by the ACS and the USPSTF [19, 23]. Participants were categorized as "screened, adherent" if they reported receipt of the PSA test within 1 year. Those who reported receipt of the PSA test 2 years ago or more were categorized as "screened, non-adherent."

Perceived discrimination

Perceived discrimination was measured using the Brief Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ). This 17-item scale has been validated in Hispanics/Latinos [24]. The PEDQ includes four subscales of perceived discrimination: (1) exclusion/rejection; (2) stigmatization/disvaluation; (3) discrimination at

work/school; (4) threat/anger. The items in each subscale begin with "Because of my ethnicity or race…" and end with a description of some form of mistreatment. For each of the subscales, participants were asked how often they "had these experiences in their lifetime." Responses are on a scale from 1 (never happened) to 5 (happened very often). The items were added to create a summary score (possible score range 17–85); higher scores indicate greater perceived discrimination. The Cronbach's alpha for internal consistency of the PEDQ was 0.87 for English and 0.91 for Spanish, indicating that the instrument is valid in English and Spanish.

Covariates

Age, education, national background, nativity, duration of residency in the USA, annual household income, health insurance status, health-care use, and family history of cancer were assessed via self-report. Age group was categorized in 10-year intervals (18–29, 30–39, 40–49, 50–59, 60–69, 70–74). Education was categorized into high school or less, high school equivalent, or greater than high school. The following national backgrounds were considered: Dominican, Central American, Cuban, Mexican, Puerto Rican, South American, mixed/other. Nativity was assessed as a binary variable [US born (within 50 US states and District of Columbia) or foreign-born (born outside 50 US states and District of Columbia)]. Annual household income was assessed as a three-level variable (<$30,000, ≥$30,000, missing). Participants reporting public or private insurance were categorized as insured and those that reported no insurance were categorized as uninsured. Family history of cancer in first-degree relatives was considered as a binary yes/no variable.

Statistical analysis

The distribution of categorical variables was described using frequencies and weighted percentages. Differences in perceived discrimination by sex among persons eligible for cancer screening were assessed using Student's t tests. Differences in colorectal cancer screening by sex were assessed using Pearson's Chi-square test. Multivariable polytomous logistic regression models were fit to assess the association between perceived discrimination and cancer screening adherence. Models were adjusted for a set of potential confounders chosen a priori including demographic and socioeconomic behaviors that might confound the association of interest. We present findings from a model with relevant covariates associated with cancer screening including age group, nativity, field center, insurance status, and annual household income since further adjustments did not yield different results. Other confounders assessed via self-report but not included in the final model were education, national background, duration of residency in the USA, health-care use, and family history of cancer. All analyses accounted for the complex sampling design of HCHS/SOL and were conducted using SAS-callable SUDAAN 11.0 (RTI International, Research Triangle Park, NC).

Results

Population

This analysis included 3,095 women aged 18–74 years and 840 men aged 50–74 years with complete data on cancer screening behaviors and Perceived Ethnic Discrimination Questionnaire (45 were excluded for missing data), and no personal history of cancer (203 were excluded for cancer history). The SCAS sample that completed questionnaires on discrimination and cancer screening was similar to the overall HCHS/SOL study population in terms of region of residence and nativity. There were slightly higher proportions of Dominicans, women and higher educated people in SCAS compared to the overall HCHS/SOL study population (data not shown).

The distribution of sociodemographic characteristics by sex is presented in Table 1. Two groups of women are presented for comparison: 18- to 74-year-olds and 40- to 74-year-olds. The majority of participants were Mexican followed by Cuban, Puerto Rican, Dominican, Central American, and South American. Overall, most respondents reported being born outside of the USA, having resided in the USA for over 10 years, having a high school education or less, and having an annual household income of <$30,000 (Table 1). By self-report, 52.9 % of women 18–74 years old and 40.7 % of men 50–74 years old were uninsured.

Screening adherence

Table 2 reports the percentage of men and women adhering to cancer screening guidelines. Among women, 72.1 % (95 % CI 69.2, 74.7 %) received a Pap smear within the recommended time frame and 71.3 % (95 % CI 67.7, 74.6 %) received a mammogram during the recommended time frame. In participants aged 50–74, adherence to recommendations for any colorectal cancer screening modality, including FOBT or colonoscopy or sigmoidoscopy, was not different between men and women. Adherence to FOBT was 24.6 % (95 % CI 19.4, 30.6 %) among women and 27.0 % (95 % CI 22.9, 31.5 %) among men. Adherence to colonoscopy/sigmoidoscopy guidelines was significantly higher among women than among men: 43.5 %

Table 1 Demographic characteristics by cancer screening specific age group and sex, HCHS/SOL SCAS

	Cervical cancer screening Women, age 18–74 (n = 3,095) % (95 % CI)	Breast and colorectal cancer screening Women, age 40–74 (n = 2,267) % (95 % CI)	Colorectal and prostate cancer screening Men, age 50–74 (n = 840) % (95 % CI)
National background			
Dominican	13.6 (11.0, 16.5)	12.7 (10.1, 15.9)	8.5 (6.3, 11.6)
Central American	7.8 (6.3, 9.6)	6.6 (5.3, 8.3)	6.0 (4.4, 8.0)
Cuban	17.8 (14.0, 22.4)	22.3 (17.8, 27.5)	32.1 (25.8, 39.2)
Mexican	37.6 (33.4, 42.1)	33.3 (28.4, 38.6)	25.5 (20.7, 31.1)
Puerto Rican	14.8 (12.4, 17.5)	17.5 (14.3, 21.2)	20.1 (16.2, 24.7)
South American	4.7 (3.8, 5.8)	5.8 (4.6, 7.3)	6.5 (4.8, 8.6)
Mixed/Other	3.8 (2.5, 5.7)	1.8 (1.2, 2.8)	1.3 (0.7, 2.4)
Region of residence			
Bronx	32.2 (27.2, 37.6)	31.1 (26.3, 36.3)	27.0 (22.1, 32.6)
Chicago	15.1 (12.5, 18.1)	11.9 (9.8, 14.3)	13.6 (10.7, 17.0)
Miami	27.7 (22.3, 33.8)	33.1 (27.2, 39.6)	39.4 (31.9, 47.4)
San Diego	25.1 (20.8, 30.0)	23.9 (19.2, 29.3)	20.0 (15.6, 25.4)
Age group			
18–29	22.0 (19.6, 24.5)	–	–
30–39	20.6 (17.9, 23.7)	–	–
40–49	24.4 (22.0, 27.0)	42.6 (39.3, 45.9)	–
50–59	18.4 (16.6, 20.3)	32.0 (28.9, 35.3)	54.8 (50.2, 59.3)
60–69	11.6 (9.7, 13.7)	20.0 (17.1, 23.2)	35.3 (31.1, 39.7)
70–74	3.1 (2.2, 4.2)	5.5 (4.0, 7.4)	9.9 (7.3, 13.4)
Education			
High School or Less	32.3 (29.3, 35.4)	35.8 (32.1, 39.7)	40.6 (35.8, 45.6)
High School Equivalent	26.0 (23.7, 28.5)	23.3 (20.4, 26.4)	18.5 (15.7, 21.8)
Greater than High School	41.7 (38.2, 45.3)	40.9 (37.0, 45.0)	40.9 (36.4, 45.5)
Nativity			
US Born	20.0 (17.5, 22.9)	9.5 (8.0, 11.4)	8.7 (6.3, 11.9)
Foreign-born	80.0 (77.2, 82.5)	90.5 (88.6, 92.1)	91.3 (88.1, 93.7)
Years in USA, mean	19.6 (18.4–20.8)	22.5 (20.8–24.2)	27.9 (25.7–30.2)
Annual household income			
<$30,000	68.3 (65.2, 71.2)	70.6 (66.5, 74.3)	68.4 (63.3, 73.2)
≥$30,000	24.3 (21.2, 27.7)	22.4 (18.7, 26.6)	28.6 (24.0, 33.7)
Missing	7.4 (6.0, 9.1)	7.0 (5.6, 8.7)	3.0 (1.9, 4.7)
Health insurance			
Insured	52.9 (49.7, 56.1)	55.5 (51.5, 59.4)	59.3 (54.2, 64.2)
Uninsured	47.1 (44.0, 50.3)	44.5 (40.6, 48.5)	40.7 (35.8, 45.8)
Could not see PCP when needed in last 12 months			
Yes	16.4 (14.0, 19.1)	19.0 (15.8, 22.7)	14.3 (10.7, 18.7)
No	83.6 (80.9, 86.1)	81.0 (77.3, 84.2)	85.7 (81.3, 89.3)
Family history of cancer			
Yes	23.9 (21.8, 26.0)	30.1 (27.3, 33.0)	27.9 (23.9, 32.3)
No	76.2 (74.0, 78.2)	69.9 (67.0, 72.7)	72.1 (67.7, 76.1)

CI confidence interval, *PCP* primary care provider

Table 2 Mean discrimination (PEDQ) scores and cancer screening adherence by sex, HCHS/SOL SCAS

	Women, age 18–74		Men, age 50–74		*p* value*
	Subgroup *n*	*n* = 3,095 Mean (95 % CI)	Subgroup *n*	*n* = 840 Mean (95 % CI)	
Perceived discrimination (PEDQ score)	3,095	24.0 (23.6, 24.4)	840	25.4 (24.3, 26.5)	0.01
	Subgroup *n*	% (95 % CI)	Subgroup *n*	% (95 % CI)	*p* value*
Pap smear (18–74 years)					–
Screened, adherent to guidelines	2,222	72.1 (69.2, 74.7)	–	–	
Screened, not adherent to guidelines	642	18.5 (16.2, 20.9)	–	–	
Not screened	212	9.5 (8.1, 11.2)	–	–	
Mammography (40–74 years)					–
Screened, adherent to guidelines	1,683	71.3 (67.7, 74.6)	–	–	
Screened, not adherent to guidelines	333	15.2 (13.0, 17.8)	–	–	
Not screened	244	13.5 (11.1, 16.3)	–	–	
FOBT/colonoscopy/sigmoidoscopy (50–74 years)					0.27
Screened, adherent to guidelines	663	52.1 (46.5, 57.7)	373	48.8 (43.9, 53.8)	
Screened, not adherent to guidelines	127	11.8 (8.3, 16.6)	79	10.3 (7.6, 13.9)	
Not screened	505	36.1 (31.4, 41.1)	331	40.9 (36.0, 45.9)	
FOBT (50–74 years)					0.80
Screened, adherent to guidelines	287	24.6 (19.4, 30.6)	213	27.0 (22.9, 31.5)	
Screened, not adherent to guidelines	280	22.8 (18.5, 27.7)	154	21.4 (17.4, 26.0)	
Not screened	714	52.6 (47.3, 57.9)	411	51.7 (46.8, 56.5)	
Colonoscopy/sigmoidoscopy (50–74 years)					0.01
Screened, adherent to guidelines	535	43.5 (37.8, 49.5)	272	34.8 (30.0, 39.9)	
Screened, not adherent to guidelines	52	6.4 (3.4, 11.6)	30	4.5 (2.6, 7.8)	
Not screened	705	50.1 (44.7, 55.5)	480	60.7 (55.0, 66.1)	
PSA screening (50–74 years)					–
Screened, adherent to guidelines	–	–	277	41.0 (36.1, 46.2)	
Screened, not adherent to guidelines	–	–	217	30.1 (25.9, 34.7)	
Not screened	–	–	199	28.9 (24.3, 33.9)	

All values (except the number of subjects) weighted for study design and nonresponse

CI confidence interval, *FOBT* fecal occult blood test, *PEDQ* Perceived Ethnic Discrimination Questionnaire, *PSA* prostate-specific antigen

* *p* values calculated using Student's *t* test for continuous variables and Chi-square tests for categorical variables

(95 % CI 37.8, 49.5 %) of women and 34.8 % (95 % CI 30.0, 39.9 %) of men were adherent to colonoscopy/sigmoidoscopy guidelines. An estimated 41.0 % (95 % CI 36.1, 46.2 %) of men were adherent to PSA screening guidelines.

Perceived discrimination

Perceived discrimination scores were significantly higher among men than among women ($p = 0.01$). The mean PEDQ score was 24.0 (95 % CI 23.6, 24.4) among women and 25.4 (95 % CI 24.3, 26.5) among men. The results of multivariable polytomous logistic regression models studying the association between perceived discrimination and cancer screening adherence among women and men are reported in Tables 3 and 4, respectively. Among women, we observed no significant association of perceived discrimination with breast or cervical or colorectal cancer screening in unadjusted or adjusted analyses (Table 3). Among men, a one-point increase in PEDQ score was associated with a 4 % increase in odds of being screened but not adherent to FOBT guidelines compared to being screened and adherent (OR 1.04, 95 % CI 1.01–1.07). However, a similar one-point increase in PEDQ score was associated with a 4 % decrease in odds of being screened at all for colorectal cancer via colonoscopy and/or sigmoidoscopy, compared to being screened and adherent (OR 0.96, 95 % CI 0.94, 0.99) (Table 4).

Table 3 Association between perceived discrimination and cancer screening among women

	Pap smear (18–74 years) $n = 2{,}716$ OR (95 % CI)[a]	Mammography (40–74 years) $n = 1{,}997$	FOBT and/or colonoscopy and/or sigmoidoscopy (50–74 years) $n = 1{,}362$	FOBT (50–74 years) $n = 1{,}188$	Colonoscopy and/or sigmoidoscopy (50–74 years) $n = 1{,}198$
PEDQ score, 1 unit increase[b]					
Screened, adherent to guidelines	Ref	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	1.00 (0.99, 1.02)	0.99 (0.97, 1.01)	0.85 (0.32, 2.28)	1.02 (0.97, 1.07)	0.97 (0.92, 1.03)
Not screened	0.99 (0.97, 1.02)	0.98 (0.96, 1.01)	0.93 (0.47, 1.81)	1.01 (0.97, 1.05)	0.98 (0.96, 1.00)
Nativity, foreign-born versus US born[c]					
Screened, adherent to guidelines	Ref	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	1.53 (0.95, 2.46)	**1.82 (1.04, 3.21)**	1.00 (0.96, 1.03)	2.16 (0.88, 5.33)	0.38 (0.10, 1.51)
Not screened	1.62 (0.97, 2.70)	1.32 (0.59, 2.95)	0.99 (0.97, 1.01)	1.47 (0.62, 3.47)	0.83 (0.43, 1.60)
Health insurance status, insured versus not insured[d]					
Screened, adherent to guidelines	Ref	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	**1.99 (1.52, 2.61)**	**3.07 (2.16, 4.36)**	**4.54 (1.56, 13.26)**	**2.61 (1.24, 5.49)**	**6.96 (1.25, 38.9)**
Not screened	1.06 (0.65, 1.73)	**2.97 (1.88, 4.70)**	**2.53 (1.80, 3.57)**	**2.29 (1.44, 3.65)**	**2.94 (2.12, 4.08)**

The bold values indicate statistically significant results

OR odds ratio, *CI* confidence interval, *FOBT* fecal occult blood test, *PEDQ* Perceived Ethnic Discrimination Questionnaire, *Ref* referent category

[a] All values, except *n*, are weighted to account for complex survey design

[b] OR of not receiving screening as per guidelines for each 1 unit increase in PEDQ score, adjusted for age group, nativity, field center, annual household income, and insurance status

[c] OR of not receiving screening as per guidelines of those born within the USA compared to those born outside of US states, adjusted for PEDQ score, age group, field center, annual household income, and insurance status

[d] OR of not receiving screening as per guidelines compared to those without insurance compared to those with insurance, adjusted for PEDQ score, age group, nativity, field center, and annual household income status

Table 4 Association between perceived discrimination and cancer screening among men

	FOBT and/or colonoscopy and/or sigmoidoscopy (50–74 years) $n = 833$ OR (95 % CI)[a]	FOBT (50–74 years) $n = 771$	Colonoscopy and/or sigmoidoscopy (50–74 years) $n = 776$	PSA screening (50–74 years) $n = 643$
PEDQ score, 1 unit increase[b]				
Screened, adherent to guidelines	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	1.02 (0.98, 1.05)	**1.04 (1.01, 1.07)**	1.03 (0.97, 1.08)	1.00 (0.97, 1.02)
Not screened	0.98 (0.96, 1.01)	1.01 (0.99, 1.04)	**0.96 (0.94, 0.99)**	0.99 (0.96, 1.02)
Nativity, foreign-born versus US born[c]				
Screened, adherent to guidelines	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	2.36 (0.91, 6.11)	1.15 (0.49, 2.71)	1.62 (0.22, 11.70)	1.64 (0.72, 3.71)
Not screened	1.06 (0.54, 2.07)	0.73 (0.35, 1.49)	1.84 (0.82, 4.12)	1.54 (0.62, 3.86)
Health insurance status, insured versus not insured[d]				
Screened, adherent to guidelines	Ref	Ref	Ref	Ref
Screened, not adherent to guidelines	**3.92 (2.17, 7.09)**	**1.97 (1.05, 3.67)**	**3.43 (1.49, 7.89)**	**2.62 (1.57, 4.38)**
Not screened	**5.10 (3.17, 8.21)**	**4.36 (2.43, 7.82)**	**4.51 (2.81, 7.23)**	**3.96 (2.14, 7.34)**

The bold values indicate statistically significant results

CI confidence interval, *FOBT* fecal occult blood test, *PEDQ* Perceived Ethnic Discrimination Questionnaire, *Ref* referent category

[a] All values are weighted, except *n*, to account to complex survey design

[b] OR of not receiving screening as per guidelines for each 1 unit increase in PEDQ score, adjusted for age group, nativity, field center, annual household income, and insurance status

[c] OR of not receiving screening as per guidelines of those born within the USA compared to those born outside of US states, adjusted for PEDQ score, age group, field center, annual household income, and insurance status

[d] OR of not receiving screening as per guidelines compared to those without insurance compared to those with insurance status, adjusted for PEDQ score, age group, nativity, field center, and annual household income

Other covariates

Nativity

US–born women were significantly more likely to be screened via mammography outside the recommended guidelines than foreign-born women (OR 1.82, 95 % CI 1.04–3.21). Nativity was not consistently associated with behaviors across cancer sites. There was no association between nativity and cancer screening adherence for cervical cancer screening, prostate cancer screening, or colorectal cancer screening in both women and men.

Health insurance status

Insurance status was an important predictor of cancer screening for both women and men. Among women, not having health insurance was a significant independent predictor of not adhering to guidelines on Pap smear testing, mammography, and colonoscopy/sigmoidoscopy (Table 3). Among women, here was also a statistically significant association between not having insurance and not being screened via mammography, FOBT, and colonoscopy/sigmoidoscopy. Among men, not having health insurance was a significant independent predictor of not adhering to FOBT and colonoscopy/sigmoidoscopy guidelines (Table 4). Not having insurance was associated with higher likelihood of not being screened via FOBT, colonoscopy/sigmoidoscopy, and PSA. Insured participants and uninsured participants had similar PEDQ scores, suggesting that they were equally likely to report perceived discrimination.

Discussion

Cancer is now the leading cause of death among Hispanics/Latinos in the USA [1]. Early detection of cancer through screening may reduce cancer morbidity and increase 5-year survival rates [1]. We evaluated data from a large, multicenter epidemiological study of Hispanics/Latinos from diverse backgrounds in four US urban areas to determine whether perceived discrimination, defined by the PEDQ, a measure of lifetime ethnicity-related discrimination, was associated with lack of receiving cancer screening. In contrast to previous studies, we found no evidence of a significant association between perceived discrimination and cancer screening in women. In men, the association between discrimination and colorectal cancer screening reached nominal levels of statistical significance, albeit the direction of the association was not consistent with our hypothesis and the results were not consistent across screening tests.

In the Black Women's Health Study, a convenience sample of African-American women, higher perceived everyday discrimination was associated with reduced cervical cancer (Pap test) screening, but was unassociated with colorectal cancer screening [12]. In the multiethnic California Health Interview 2003 and 2005 Surveys (CHIS), women who reported higher levels of discrimination in the medical care context ("medical discrimination") were significantly less likely to be screened for both colorectal and breast cancer. This finding persisted after controlling for ethnicity and several health-related factors including access to health insurance and usual source of care. The CHIS questionnaire specifically asked about whether individuals perceived discrimination in medical settings, and the discordance between CHIS and the present study may suggest that it is important to capture discrimination that is perceived to occur specifically within health-care settings [13]. In the CHIS, however, no association between medical discrimination and colorectal cancer screening was observed in men [13]. Discrepancies among the findings in the Black Women's Health Study, the CHIS, and our study may be explained by different measurement properties of specific self-reported discrimination scales, or by variability among groups in the experience and effects of discrimination. The CHIS sample was much larger and included not only Hispanic/Latinos but also African-American, Asian, and American Indian/American Indians, and all participants were Californians, unlike our sample which included US residents from four different states. Other specific characteristics of the HCHS/SOL cohort that may be important include a predominance of Spanish speakers and immigrants living in large urban centers who were recruited using door-to-door recruitment methods. In the CHIS, the respondents were selected by random digit telephone number dialing and included participants from rural, suburban, and urban settings. It is possible that the presence of extensive safety net services and community resources in the four HCHS/SOL centers, including government-funded screening programs, may mitigate any relationship between discrimination and screening behaviors that may exist elsewhere.

Several limitations of our study warrant discussion. Definitions of cancer screening adherence were based on cancer screening guidelines that are subject to debate. There is much controversy regarding the age to begin screening and the appropriate frequency for each screening tests, and screening guidelines differ between major cancer organizations. However, screening guidelines from two national organizations (ACS and the USPSTF) were used to guide the definitions. During the time of study recruitment, the screening guidelines from different organizations were more consistent with each other than they are at the current time.

Even with consistent guidelines in place, recommendations about cancer screening likely vary among primary

care providers and may be dependent on individual patient characteristics. In the case of cervical cancer, for example, one primary care provider may have advised a female who initiated sexual activity during her early teenage years to initiate screening for cervical cancer at age 18, while another may have advised to initiate screening at age 21. This study did not account for the variability in provider recommendations for cancer screening. Indeed, evidence suggests that factors such as a patient's ethnicity, level of education, and income may influence provider recommendations for cancer screening [24–26].

Our measure of perceived discrimination is a measure of lifetime discrimination rather than current, everyday, or medical discrimination. In a prior study, measures of everyday discrimination were strongly correlated with the global measure of perceived discrimination that was used here [27].

Another limitation was assessment of information about cancer screening behaviors via self-report which is potentially subject to recall bias. It has been established that self-reported data may tend to overestimate the true measure of cancer screening utilization. Validation studies have reported that estimates of cancer screening rates are inflated in self-reported data, particularly among Blacks and Hispanic/Latinos [28, 29]. This study did not account for the participants' levels of health knowledge and cancer awareness. It is possible that items in the HCHS/SOL cancer questionnaire used to measure cancer screening behaviors may not have been understood by participants with low levels of education and cancer awareness, leading to misclassification. Participants may have answered questionnaires in a way perceived as desired and/or expected, leading to false-positive responses to questions about screening practices and underreporting of discrimination [30]. Lastly, the data used in this study were cross-sectional. Thus, causal inferences about the associations reported in this study cannot be made.

Of note, screening rates for breast, cervical, colorectal, and prostate cancer in this cohort of Hispanic/Latinos are lower than the Healthy People 2020 goals [31]. The percentages of screening reported in this cohort are also generally lower than studies using data from 2010 National Health Interview Survey (NHIS) [31]. Cervical cancer screening among Hispanic/Latina women was 76.9 % in NHIS and 72.1 % in HCHS/SOL, both measures below the *Healthy People 2020* target of 93.0 % [32]. In this study, not having health insurance was a significant independent predictor of not receiving screening and not being up to date with screening. The powerful effect of health insurance status was seen for every screening test and among both men and women. These results are consistent with data from the 2010 NHIS and 2010 ACS, which indicated that uninsured compared to insured persons were less likely to report receiving recent cancer screening. For example, uninsured women 40 and older were less likely to report receiving a mammogram within the past two years (31.5 vs. 70.7 %, respectively) [33].

The HCHS/SOL SCAS cohort was mostly foreign-born and reported low levels of education, income, and health insurance coverage. Because having insurance has been identified as a key determinant of cancer screening, policies that increase insurance coverage among Hispanics/Latinos may increase screening rates in this population. The Affordable Care Act (ACA) has the potential to result in large reductions in uninsurance rates among Hispanics/Latinos [34]. It remains to be seen how the implementation of the ACA will affect access to screening services in this vulnerable population [34], and an estimated 33.1 % of Hispanics/Latinos may remain presently uninsured [35]. Several states with large numbers of Hispanic/Latino residents including Texas and Florida have not taken the steps encouraged by the ACA to expand Medicaid to low-income adults. Additionally, more than five million undocumented people living in the USA (over 80 % of whom are Hispanic/Latino) will remain uninsured in the foreseeable future [34]. In this population with high levels of uninsured, increasing health-care coverage and awareness of the existing state and sliding scale screening services may be important ways to increase screening. Finally, we speculate that in the Hispanic population, barriers relating to health insurance and related factors probably overwhelm or obscure any possible effects of discrimination on cancer screening adherence.

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