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Risk factors contributing to lack of mammography screening include Hispanic ethnicity as well as demographic, socioeconomic, and health system variables.

Health Disparities in Receipt of Screening Mammography in Latinas: A Critical Review of Recent Literature

Kristen J. Wells, PhD, MPH, and Richard G. Roetzheim, MD, MSPH

Background: Increased use of screening mammography is associated with lower death rates from breast cancer in the United States. Despite recommendations that women over 40 years of age should obtain regular screening mammography at least every 2 years, many women do not adhere to these guidelines. Historically, women from underserved and minority populations have been less likely to receive screening mammography.

Methods: A critical review of recent research literature was conducted to evaluate whether Latinas are less likely to receive screening mammography, determine whether disparities in screening mammography persist when controlling for other variables, and examine what other variables are associated with screening mammography. The articles were obtained from a search of the PubMed database.

Results: Fifteen published articles met the inclusion criteria and were critically reviewed. The unadjusted odds ratios (ORs) of the association between Hispanic ethnicity and screening mammography ranged from 0.40 to 0.93. For the most part, the ORs adjusted for other variables in multiple logistic regression analyses increased (range: 0.3 to 1.67). Age, education, income, health insurance, having a usual source of care, and having a recent visit to a physician were consistently related to screening mammography in multiple logistic regression analysis.

Conclusions: Hispanic ethnicity is a risk factor for lack of adherence to screening mammography. However, other demographic, socioeconomic, and health system variables account for some of the disparity related to Hispanic ethnicity.

From the Health Outcomes & Behavior Program at the H. Lee Moffitt Cancer Center & Research Institute, Tampa, Florida (KJW, RGR) and the Department of Family Medicine at the University of South Florida (RGR), Tampa, Florida.

Submitted February 28, 2007; accepted August 8, 2007.

Address correspondence to Richard G. Roetzheim, MD, MSPH, Department of Family Medicine, University of South Florida, 12901 Bruce B. Downs Boulevard, MDC 13, Tampa, FL 33612. E-mail: rroetzbe@hsc.usf.edu

No significant relationship exists between the authors and the companies/organizations whose products or services may be referenced in this article.

The editor of *Cancer Control*, John Horton, MB, ChB, FACP, has nothing to disclose.

Abbreviations used in this paper: OR = odds ratio.

Introduction

It has long been recognized that some populations suffer a greater burden from cancer than other populations.^{1,2} The National Cancer Institute defines cancer health disparities as “differences in the incidence, prevalence, mortality, and burden of cancer and related adverse health conditions that exist among specific population groups in the United States.”³ Several influential reports have highlighted the problem of cancer health disparities.^{4,6} As a result, eliminating cancer health disparities is an increasingly important focus of research and government action. Also, eliminating health disparities is now a core public health goal for *Healthy People 2010*.⁷

Underserved populations are composed of people who receive less than their fair share of services in society. Research has shown that underserved populations are more likely to be diagnosed with preventable cancers, to be diagnosed at later stages for cancers that are amenable to early detection with screening, to receive no treatment for cancer or treatment that does not meet current standards of care, and to die of cancers that are potentially curable.^{4,8} Populations that are at greatest risk include racial and ethnic minorities, the uninsured, and persons of lower socioeconomic status.

Breast Cancer

Breast cancer is the most common cancer among women and is the second-leading cause of cancer death in the United States.⁹ In 2007, an estimated 180,000 new cases will be diagnosed, with almost 41,000 deaths due to this disease.⁹ Breast cancer death rates have been falling steadily since 1989,¹⁰ a trend that has been attributed to earlier detection with screening mammography. Breast cancer incidence rates peaked in 1998 and have been declining since. A more recent pronounced drop in breast cancer incidence has been attributed to declining use of postmenopausal hormone replacement.¹¹

Significant racial and ethnic disparities in breast cancer incidence, mortality rates, and survival rates exist in the United States. The highest incidence rate is found among white women (141.1 cases per 100,000 women), whereas African American, Alaskan Native, Hispanic, Indian/Pakistani, Native American, Native Hawaiian, and Vietnamese women are more likely to be diagnosed at a later stage.^{8,12,13} Breast cancer survival rates are also shorter in Hawaiians, Mexicans, Native Americans, Puerto Ricans, and South and Central Americans.^{8,13,14} The reasons behind these disparities in cancer outcomes are complex and interact. Some research points to differences in biological factors, socioeconomic status, access to care, lifestyle factors, and behavioral characteristics of certain cultures.^{12,14,15}

Breast Cancer Screening

Three methods of breast cancer screening have been widely advocated: patient self breast examination, breast examination by a trained health professional, and screening mammography. Screening mammography has been the most widely studied, with at least nine major randomized controlled trials completed.¹⁶ In pooled analyses, screening mammography has been associated with a reduction in breast cancer mortality of approximately 25%.¹⁷ The Preventive Services Task Force recommends screening mammography, with or without clinical breast examination, every 1 to 2 years for women aged 40 years and older.¹⁸ The American Cancer Society recommends yearly mammography and clinical breast examination beginning at the age of 40, along with the option of breast self-examination.¹⁹

A large body of research indicates that racial and ethnic minority women are less likely to receive breast cancer screening. The purpose of this paper is to critically review recent literature evaluating disparities in breast cancer screening related to Hispanic ethnicity. The critical review was designed to answer the following research questions: (1) Are Latinas less likely to receive screening mammography than women of other races and ethnicities? (2) Do disparities in adherence to screening mammography related to Hispanic ethnicity persist when controlling for socioeconomic, demographic, health system, and psychosocial variables? (3) What variables are associated with higher odds of screening mammography when included in multiple logistic regression analyses?

Methods

Study Identification

We searched the National Library of Medicine using the PubMed database to identify articles published from 1997 to 2007 in English that included human participants. The inclusion criteria included (1) published original research articles, (2) population-based sample of participants from the United States, and (3) multiple logistic regression analysis that addressed the association between Hispanic ethnicity and receipt of screening mammography after adjusting for other variables. We limited the review to articles published in the past 10 years because cancer screening practices are constantly evolving, and it is important to evaluate current evidence of disparities. The research was limited to population-based samples to reduce selection bias in studies that used convenience samples. Research articles that did not report adjusted odds ratios (ORs) were excluded because adjusted ORs were required to answer the research questions. Research articles that compared Hispanic subgroups were also eliminated

Table 1. — Characteristics of Articles That Did Not Meet Study Criteria

Study Criteria	Number Excluded From Literature Search	Number Excluded From Review of References	Total
Not population-based sample	19	0	19 (11%)
Not US sample	2	1	3 (2%)
Review article	1	0	1 (1%)
No OR provided with Hispanic ethnicity as a predictor of mammography	145	9	154 (87%)
Total	167	10	177

because they did not address whether Hispanic ethnicity was related to screening mammography when compared to other ethnic and racial groups.

A search of the PubMed database was conducted by combining the terms “Latina” and “Hispanic” with “mammogram” and “mammography.” This search produced 180 citations, and the abstracts or articles of these citations were reviewed. Thirteen articles met the inclusion criteria. Twelve additional citations were identified by searching the references cited in the 13 qualifying articles as studies that might qualify for inclusion. The abstracts or articles of these 12 citations were reviewed, and two met the inclusion criteria. In total, 192 articles or abstracts were reviewed, and 15 articles met the inclusion criteria. Table 1 reviews the reasons that articles were excluded from the study. The majority of articles (87%) were excluded because they did not report the ORs of the association between mammography and Hispanic ethnicity with other variables as predictors.

One author reviewed five articles, and the other author reviewed 10 articles. The following information was abstracted from each article: (1) the sample and population, (2) the outcome measure, (3) the predictors used in logistic regression analysis, (4) the rate of mammography or unadjusted OR by race and ethnicity, (5) the adjusted OR for Hispanic ethnicity, and (6) predictors of mammography that were significant in multiple logistic regression analysis. The data were recorded in an electronic Microsoft Word table designed for the study. Unadjusted ORs were calculated for studies that did not report them when the rates of mammography screening were provided for Hispanic participants and the reference group used in logistic regression analysis. One author reviewed all of the data abstracted for accuracy. Both authors critically reviewed and summarized the information abstracted from the articles.

Results

Description of Research Studies

The 15 articles that met inclusion criteria for the review had significant variation in terms of data source, population sampled, timing of the outcome measure, and

other predictor variables (Table 2).²⁰⁻³⁴ Of these 15 articles, seven (40%) analyzed data from national surveys, including the Behavioral Risk Factor Surveillance System, the Medical Expenditure Panel Survey, and the National Health Interview Survey. There was no overlap in the

data collected using the National Health Interview Survey as each study used data from a different year.^{20,24,30} Two studies that used the 1996 Medical Expenditure Panel Survey data differed in the study sample, outcome, and the predictors used.^{27,34} The remaining eight articles presented data from populations in California,^{21,23,25,26,33} Colorado,²⁹ Florida,³¹ and Massachusetts²² and from a sample of Medicare patients.²⁸ The majority of studies (67%) assessed screening mammography use over the previous 2 years. One study (7%) evaluated screening mammography over the past 12 months, one study (7%) evaluated receipt of screening mammography during the lifetime, and three studies (20%) evaluated screening mammography in multiple time periods. As shown in Table 1, logistic regression predictors included several demographic, socioeconomic, healthcare, and psychosocial variables.

The studies reviewed were similar in terms of the reference group used and the source of mammography data. Thirteen studies (87%) compared Hispanic participants to non-Hispanic white participants. Fourteen studies (93%) used self report, and one study used Medicare claims as the outcome measure of mammography screening.

Unadjusted Odds Ratios

Thirteen studies (87%) reported unadjusted ORs or the information needed to calculate ORs (Table 3). For studies evaluating mammography in the past 2 years, the unadjusted ORs for Hispanic women ranged from 0.40 to 0.93, indicating that in general Hispanic ethnicity is a barrier to mammography. The three studies that reported the lowest ORs (0.40 to 0.42) had smaller sample sizes, ranging from 326 to 1,255, and were surveys conducted with women of particular communities, such as residents of Colorado, inner-city residents in eastern Massachusetts, and residents of Orange County, California, rather than national samples.^{22,26,29} Of the three studies that reported the highest ORs (0.82 to 0.93), two used data from the 1996 Medical Expenditure Panel Survey.^{27,34} The other study reported data from the California Women’s Health Survey.³³

Of the five studies that reported confidence intervals, three indicated that women of Hispanic ethnicity were significantly less likely to receive a mammogram

in the previous 2 years^{20,28} and during the woman's lifetime.³⁰ However, these studies had characteristics that might be related to these findings. Two of the three studies focused on an older population,^{28,30} and the third study was conducted using 1991 National Health Interview Survey data,²⁰ which would have measured mammography prior to many health initiatives designed to reduce disparities in mammography.

Adjusted Odds Ratios

Table 3 presents the adjusted ORs reported by the studies that met inclusion criteria. The adjusted ORs for the association between Hispanic ethnicity and screening mammography ranged from 0.3 to 1.67. In all but one study,²² controlling for additional demographic, socioeconomic status, health system, or psychosocial predictors in logistic regression analyses increased the ORs

Table 2. — Characteristics of Studies Evaluating Mammography With Hispanic Ethnicity as a Predictor

Reference	Sample/Population/Dataset	Measure of Mammography	Race/Ethnic Groups	Other Predictors of Mammography in Multiple Logistic Regression Analysis
Abraido-Lanza et al ²⁰ (2004)	11,744 women aged 40 yrs and older; 1991 National Health Interview Survey, National probability sample	Self-report of screening mammogram in previous 2 yrs	Hispanic vs non-Hispanic	Age, education, family income, usual source of care, private health insurance, recent health maintenance visit
Bazargan et al ²¹ (2003)	120 Hispanic and African American women aged 40+, randomly sampled from public housing units in Los Angeles	Self-report of mammogram in previous 12 months	Hispanic vs African American	Age, education, income, physician visits, health insurance, physician recommendation
David et al ²² (2005)	326 women aged 40+ who spoke English or Haitian Creole in eastern Massachusetts, sampled using a probability sample	Self-report of mammogram in the previous 2 yrs and lifetime use of mammography	Hispanic vs non-Hispanic white	Regular health care provider, increased knowledge about breast cancer, education, private health insurance, age, employment, marital status, fatalistic attitude on cancer, beliefs about breast cancer, length of stay in the United States
De Alba et al ²³ (2005)	3,828 immigrant women aged 40+ randomly sampled from California; 2001 California Health Interview Survey	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Age, income, education, health insurance, usual source of care, health status, English language, citizenship
Goel et al ²⁴ (2003)	4,607 women aged 50 to 74 randomly sampled from the US population; 1998 National Health Interview Study	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Age, marital status, region of residence, education, income, health status, smoking, concurrent illnesses, body mass index, hospitalizations in past year
Hiatt et al ²⁵ (2001)	1,599 women aged 40+ randomly sampled from neighborhoods served by eight public health clinics in San Francisco and Contra Costa County, California	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Age, education, insurance, household income, marital status, employment, hysterectomy, estrogen replacement therapy, having a regular clinic, infrequent use of medical services scale, years in San Francisco Bay area, foreign birth, area of residence
Hubbell et al ²⁶ (1997)	430 women aged 40+ randomly sampled from Orange County, California	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Breast cancer-related knowledge, attitudes, age, marital status, household income, insurance status, education, employment, country of birth
Jones et al ²⁷ (2003)	4,444 women aged 40+ randomly sampled from US population; 1996 Medical Expenditure Panel Survey	Self-report of mammogram in previous year and in previous 2 yrs	Hispanic vs non-Hispanic white	Age, education, income, health insurance, usual source of care, marital status, employment, physician visits, disability, residence in metropolitan statistical area
Kagay et al ²⁸ (2006)	146,669 women aged 65+ randomly chosen from among Medicare patients residing in SEER registry areas; Medicare-SEER linked dataset	Mammogram in previous 24 months assessed by Medicare claims	Hispanic vs non-Hispanic white	Age, physician visits, income, education, comorbidity, SEER geographic site

Table 2. — Characteristics of Studies Evaluating Mammography With Hispanic Ethnicity as a Predictor (continued)

Reference	Sample/Population/Dataset	Measure of Mammography	Race/Ethnic Groups	Other Predictors of Mammography in Multiple Logistic Regression Analysis
Kakefuda and Stallones ²⁹ (2006)	1,255 women aged 24 to 82 sampled either randomly or using a probability sample; 1993 Colorado Behavioral Risk Factor Survey or the Colorado Farm Family Health and Hazard Survey	Self-report of mammogram in previous 2 yrs	Hispanic white and Hispanic non-white vs non-Hispanic white	Age, education, marital status, self-perceived general health, health insurance, financial barriers to seeing a doctor, primary source of health care, residence
Lees et al ³⁰ (2005)	10,447 women aged 50 to 70 sampled using a multistage area probability design; 2000 National Health Interview Study	Self-report of mammogram in lifetime	English-speaking Hispanic, Spanish-speaking Hispanic vs non-Hispanic white	Region of country, duration of residence, age, self-reported health status, education, poverty status, number of doctor visits in last year, insurance status, usual source of care
Metsch et al ³¹ (1998)	784 women aged 40+ sampled using a stratified random sample of residents of Dade County, Florida	Self-report of mammogram in previous year, 1 to 2 yrs ago, or never	Hispanic vs non-Hispanic white	Physician as a source of information, general physical checkup within last 12 months, age, education
Qureshi et al ³² (2000)	18,245 women aged 40 to 49 who participated in the 1992–1993 Behavioral Risk Factor Surveillance System	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Receipt of Pap smear, receipt of cholesterol screening, seatbelt use, current smoker, current alcohol use, health insurance, healthcare access problem, education, marital status
Rodríguez et al ³³ (2005)	1,634 women aged 40+ randomly sampled 1998 California Women's Health Survey	Self-report of mammogram in previous 2 yrs	Foreign-born Hispanic, US-born Hispanic vs non-Hispanic white	Age, poverty level, education, employment, insurance, marital status, child-birth in the last 3 yrs
Sambamoorthi and McAlpine ³⁴ (2003)	1,540 women aged 50 to 64; 1996 Medical Expenditure Panel Survey	Self-report of mammogram in previous 2 yrs	Hispanic vs non-Hispanic white	Age, education, poverty status, insurance, usual source of care

for Hispanic ethnicity as a predictor of adherence to mammography screening. The study conducted by David et al²² reported a decrease in the OR for Hispanic ethnicity when it was adjusted for other predictor variables in a multiple logistic regression analysis, but neither the adjusted nor unadjusted OR for Hispanic ethnicity was a significant predictor of mammography screening.²²

After adjusting for other predictor variables, Hispanic ethnicity was still a significant risk factor for lack of mammography in the past 2 years in two studies.^{26,28} A third study found that Hispanic ethnicity was a significant predictor of having a mammogram in the more distant past.³¹ Two of the studies that found a significant association were based on smaller community samples in Dade County, Florida,³¹ and Orange County, California.²⁶ The other study sampled Medicare beneficiaries, limiting the sample to women 65 years of age or older.²⁸ Hispanic ethnicity was not a significant predictor of adherence to mammography screening in any of the studies that analyzed national survey data.

The remaining studies did not find that Hispanic ethnicity was a risk factor for lack of recent or lifetime mammography. Rodríguez et al³³ calculated separate adjusted ORs for Hispanics born in the United States and Hispanics born outside the United States and found that when controlling for other variables, foreign-born Hispanic women were more likely to receive a mammogram in the past 2 years when compared to non-Hispanic white women. In multiple logistic regression analysis, Hispanic women born in the United States were equally as likely to receive a mammogram as non-Hispanic white women.³³

Significant Predictor Variables in Multiple Logistic Regression Analysis

Several demographic, socioeconomic, health system, and psychosocial variables were associated with adherence to mammography screening in logistic regression analyses. Inclusion of these variables increased the ORs for Hispanic ethnicity in most studies.

Demographic Variables

Age: Eight of 14 studies reported that age was a significant predictor of mammography screening in multiple logistic regression analysis.^{23,25,27-29,31,33,34} Interpreting the results of these studies is difficult because the studies used different age ranges in the logistic regression analyses. In general, women between the ages of 50 and 64 years were more likely to receive mammography screening than women age 40 to 49 years (adjusted OR range: 1.37 to 2.09).^{23,25,27,29,31} In a study comparing women within the 50-to-64 age group, women age 55 to 59 years were more likely to be screened and women age 60 to 64 years were as likely to be screened as women age 50 to 54 years.³⁴

Some studies reported that women over the age of 64 were as likely to be screened as women age 40 to 49 (adjusted OR range: 0.9 to 1.09).^{25,27,29} However, another study of Medicare beneficiaries found that the ORs of mammography screening decreased with age.²⁸ Six studies did not find an association between age and receipt of screening mammography in multiple logistic regression analysis.^{20-22,24,26,30}

Marital Status: Another demographic variable, marital status, was not consistently related to mammography screening in multiple logistic regression analysis. While two studies reported a relationship between being widowed (adjusted OR: 0.66)²⁷ or unmarried (adjusted OR: 0.74)³³ and lack of recent

Table 3. — Percentage of Latinas Adherent to Mammography and ORs of Adherence to Mammography

Reference	Significant Predictors of Mammography in Logistic Regression Analysis	Unadjusted OR (Confidence Interval) for Hispanic or Percentage Adherent	Adjusted OR (Confidence Interval) for Hispanic
Abraido-Lanza et al ²⁰ (2004)	Education, family income, health insurance, source of care, previous health maintenance visit	OR: 0.71 (0.57–0.88) 47.4% Hispanic 56% non-Hispanic white	OR: 1.25 (0.83–1.87)
Bazargan et al ²¹ (2003)	Health insurance, physician recommendation	Not reported	OR: 0.42
David et al ²² (2005)	Regular health care provider, increased knowledge about breast cancer, education, private health insurance	Mammogram past 2 yrs: OR: 0.42 (0.093–1.93) Mammogram lifetime: OR: 2.29 (0.71–7.44)	Mammogram past 2 yrs: OR: 0.3 (0.1–1.4) Mammogram lifetime: OR: 2.7 (0.7–10.2)
De Alba et al ²³ (2005)	US citizenship, years living in US, age, health insurance, usual source of care	Not reported	Mammogram in past 2 yrs: OR: 0.79 (0.52–1.20) Mammogram lifetime: OR: 0.69 (0.45–1.06)
Goel et al ²⁴ (2003)	Not reported	OR: 0.68 Hispanic: 66% Non-Hispanic white: 74%	OR: 0.97 (0.72–1.30)
Hiatt et al ²⁵ (2001)	Age, health insurance, regular clinic, infrequent use of medical services, English language	OR: 0.63 Hispanic: 63% Non-Hispanic white: 73%	OR: 1.1 (0.6–2.2)
Hubbell et al ²⁶ (1997)	Marital status, health insurance	OR: 0.42 Hispanic: 61% Non-Hispanic white: 79%	OR: 0.5 (0.3–0.9)*
Jones et al ²⁷ (2003)	Age, education, income, health insurance, usual source of care, marital status, physician visits, disability, residence in metropolitan statistical area	Mammogram 12 months: OR: 0.96 Hispanic: 50.8% Non-Hispanic white: 51.9% Mammogram 24 months: OR: 0.93 Hispanic: 66.9% Non-Hispanic white: 68.5%	OR: 1.39 (1.08–1.78) OR: 1.43 (1.07–1.91)
Kagay et al ²⁸ (2006)	Age, education, income, physician visits, comorbidity, SEER registry site	OR: 0.58 (0.55–0.61)	OR: 0.70 (0.67–0.74)*
Kakefuda and Stallones ²⁹ (2006)	Age (24–39 yrs), education, health insurance, no primary source of health care	Hispanic white: 32.14% Hispanic non-white: 45.59% Non-Hispanic white: 54.38% Hispanic white: OR: 0.40 Hispanic non-white: OR: 0.70	Hispanic white: OR: 0.91 (0.33–2.5) Hispanic non-white: OR: 1.59 (0.84–3.03)

Table 3. — Percentage of Latinas Adherent to Mammography and ORs of Adherence to Mammography (continued)

Reference	Significant Predictors of Mammography in Logistic Regression Analysis	Unadjusted OR (Confidence Interval) for Hispanic or Percentage Adherent	Adjusted OR (Confidence Interval) for Hispanic
Lees et al ³⁰ (2005)	Not reported	English-speaking Hispanic: OR: 0.74 (0.61–0.90) Spanish-speaking Hispanic: OR: 0.55 (0.43–0.70)	English-speaking Hispanic: OR: 0.92 (0.71–1.21) Spanish-speaking Hispanic: OR: 1.05 (0.71–1.54)
Metsch et al ³¹ (1998)	Age, physician as a source of information, general physical checkup within last 12 months	Mammogram within the past year: OR: 0.65 Hispanic: 52.6% Non-Hispanic white: 63.2% African American: 61.2% Other: 40.0% Mammogram more than 1 year ago: OR: 0.89 Hispanic: 8.0% Non-Hispanic white: 8.9% African American: 10.3% Other: 30.0% Mammogram never or more than 2 yrs ago: OR: 1.69 Hispanic: 39.4% Non-Hispanic white: 27.8% African American: 28.6% Other: 30%	OR of having a more recent mammogram vs a distant mammogram: OR: 0.67 (0.47–0.96)*
Qureshi et al ³² (2000)	Pap smear within 3 yrs, cholesterol screening, seatbelt use, current smoker, health insurance, healthcare access, education	OR: 0.66 Hispanic: 54.9% Non-Hispanic white: 64.7% African American: 61.3%	OR: 0.97 (0.8–1.2)
Rodríguez et al ³³ (2005)	Health insurance, poverty, marital status, employment, age	Foreign-born Hispanic: OR: 0.55 US-born Hispanic: OR: 0.85 Foreign-born Hispanic: 66% US-born Hispanic: 75% Non-Hispanic white: 78%	Foreign-born Hispanic: OR: 1.67 (1.23–2.22)* US-born Hispanic: OR: 1.10 (0.83–1.45)
Sambamoorthi and McAlpine ³⁴ (2003)	Age, education, health insurance, usual source of care	OR: 0.82 (0.53–1.25)	OR: 0.97 (0.70–1.34)

* Statistically significant odds ratio.

mammography screening, four studies that reported ORs for marital status in multiple logistic regression analysis found no association.^{25,26,29,32}

Immigration Status: The relationship between immigration status and adherence to mammography screening is unclear and appears to be associated with the population sampled. Five studies evaluated the association between nativity or citizenship and mammography screening.^{22,23,25,26,33} One study found that among immigrant women, naturalized citizens were more likely to be screened than noncitizens (adjusted OR: 1.67).²³ Another study found that foreign-born Hispanics were more likely to obtain mammography than non-Hispanic white women (adjusted OR: 2.15).³³ Native-born Hispanic women were as likely to receive mammography when compared to non-Hispanic white women.³³ The other two studies that reported ORs did not find an association between foreign birth and

mammography.^{25,26} All five studies sampled state or community populations.

Socioeconomic Status Variables

Education: For the most part, the studies reviewed reported that women with at least some college education were more likely to receive a screening mammogram (adjusted OR range: 1.36 to 3.69).^{27,29,32,34} The evidence for the relationship between high school education and mammography is equivocal. Two studies found that a high school education was associated with higher odds of mammography compared to less than a high school education,^{22,27} but two other studies did not find that relationship.^{32,34} In the studies that reported an association between education and mammography screening, education was entered into the multiple logistic regression as a continuous variable or categorized using several categories. Of the eight studies that did not

find an association between education and mammography in logistic regression analysis, four did not report the adjusted ORs.^{21,24,30,31} Three of the studies that did not find an association between education and mammography screening dichotomized education near or at the completion of high school.^{25,26,33} The remaining study that did not find an association between education and mammography screening in logistic regression analysis sampled an immigrant population.²⁷

Income: Four studies reported that income was a significant predictor of mammography screening in multiple logistic regression analysis (adjusted OR range: 1.02 to 1.69).^{20,27,28,33} Two of these articles found that women in the highest income category were more likely to get mammography than women in the lowest income category.^{27,33} Other studies did not find this association.^{23,25,26,34}

Employment: Five studies evaluated the association between employment and receipt of mammography using multiple logistic regression analysis,^{22,25-27,33} but only three studies reported the adjusted ORs.^{25,26,33} All three studies sampled populations in California. One study found that full-time employment was associated with higher odds of mammography (adjusted OR: 1.27).³³ The other two studies that reported adjusted ORs did not find that employment was related to mammography screening.^{25,26} However, these studies dichotomized employment as “employed” and “unemployed.”

Health System Variables

Health Insurance: All 11 studies that reported ORs using health insurance as a predictor of mammography screening in multiple logistic regression analysis found an association between health insurance and adherence to mammography screening (adjusted OR range: 1.7 to 8.5).^{20-23,25-27,29,32-34} In evaluating the relationship between mammography screening with type of insurance (public vs private), both David et al²² and Hiatt et al²⁵ found that private insurance was associated with higher odds of mammography screening than public insurance. Fee-for-service and health maintenance organization insurance were both associated with higher odds of screening mammography compared to having no insurance.³⁴

Usual Source of Care: Having a usual source of health care was strongly associated with receipt of screening mammography. All of the studies that investigated having a usual source of care as a predictor of screening mammography and reported adjusted ORs found that having a usual source of care was significantly associated with screening mammography (adjusted OR range: 1.24 to 3.4).^{20,22,23,25,27,29,34} One study found that several types of usual care providers (primary care physicians, other physicians, and other facilities and non-physician providers) were all associated with receipt of screening mammography.³⁴

Physician Visits/Health Maintenance Visits:

Most studies reported that recently receiving health care from a physician was associated with higher adjusted OR of receiving mammography (adjusted OR range: 1.15 to 4.17).^{20,25,27,28,31} Two studies evaluated the type of physician visit and found that outpatient, office, or primary care visits were associated with higher odds of receiving screening mammography, whereas visits to the emergency room were associated with lower odds or the same odds of receiving a mammogram as not being seen in the emergency room.^{27,28} Being hospitalized was also associated with lower odds of receiving screening mammography.²⁸

Psychosocial Variables

Four studies that met study inclusion criteria evaluated psychosocial predictors of mammography screening. Two evaluated knowledge of breast cancer and attitudes towards breast cancer and breast cancer screening.^{22,26} One study found that knowledge about breast cancer was related to higher odds of ever having a mammogram (adjusted OR: 2.8),²² but another study found that knowledge about risk factors for breast cancer and symptoms of breast cancer were not related to mammography screening.²⁶ Various measures of attitudes towards breast cancer prevention, screening, and treatment were not associated with mammography screening in multiple logistic regression analyses.^{22,26} Two studies also examined the relationship between other health behaviors and mammography,^{24,32} but only one study reported the ORs.³² Significant associations were found between mammography screening and having received a Pap smear within the past 3 years (adjusted OR: 8.99), having ever received cholesterol screening (adjusted OR: 2.64), always or almost always using a seatbelt (adjusted OR: 1.47), and not being a current smoker (adjusted OR: 0.71).³² The use of alcohol was not related to mammography screening in logistic regression analysis.³²

Discussion

A review of the unadjusted ORs for the study found that Hispanic ethnicity appears to be a barrier to mammography. The studies with the lowest ORs for Hispanic ethnicity as a predictor of screening mammography had smaller sample sizes and were conducted in community-based samples. Three of the five studies that reported confidence intervals found that women of Hispanic ethnicity were significantly less likely to receive a mammogram. A review of these three specific studies provides information regarding the disparity for mammography screening due to Hispanic ethnicity and points to differences from the national studies in time of data collection, sampling methods, and number of Latinas

included in the study. One study sampled women in Orange County, California, a state with a large number of undocumented immigrants who may not qualify for government screening programs provided to US citizens.²⁶ Also, the participants in this study were interviewed in 1992 and 1993, a time before many interventions to reduce health disparities were implemented. In this study, having health insurance was the strongest predictor of mammography screening in multiple logistic regression analysis (adjusted OR: 8.5; confidence interval: 3.5 to 18.6), indicating that women who lacked health insurance might have had few resources to obtain mammography.²⁶ In the sample of inner-city women from Massachusetts, the number of Latinas sampled was small ($n = 22$), although the reference group of non-Hispanic white participants was much larger ($n = 80$).²² Therefore, the OR was sensitive to the small number of Latina women ($n = 3$) who did not obtain screening mammography, which is reflected in the non-significant OR. The study conducted in Colorado used two different sampling sources, the 1993 Colorado Behavioral Risk Factor Surveillance System (CBRFSS) and the 1993–1997 Colorado Farm Family Health and Hazard Survey (CFFHHS).²⁹ The CBRFSS was conducted in all counties of Colorado, while the CFFHHS was conducted in only eight counties in northeastern Colorado. Therefore, the study had a higher than average proportion of farmers, few of whom were Hispanic and most of whom had health insurance. While the study was based on population-based sampling, it actually sampled two populations — the residents of the state of Colorado and residents of eight counties in northeastern Colorado. It also sampled the eight northeastern Colorado counties twice. Thus, while it appears that the OR for one study may represent an actual difference in screening in the community sampled,²⁶ the other two studies are limited by a small sample of Latinas²² and combining the samples of two populations.²⁹

When the ORs for Hispanic ethnicity were adjusted by controlling for other predictors in multiple logistic regression analysis, the ORs for Hispanic ethnicity were increased, indicating that other factors accounted for some of the disparity in mammography screening related to Hispanic ethnicity. Similar to the results found in the review of the unadjusted ORs, two of the studies that found that Hispanic ethnicity was a significant predictor of adherence to mammography screening in logistic regression analysis were based on community samples, and the third study was limited to women 65 years of age or older. Both community studies were conducted in states with a high number of immigrants who may have lacked access to health care and other services because they are not citizens.

The results of the review of both adjusted and unadjusted ORs indicate that while Hispanic ethnicity might be a barrier to adherence to mammography

screening, it is a stronger barrier in elderly women and in certain communities. Studies based on community samples found that Hispanic ethnicity is a stronger barrier to mammography screening than those studies based on national surveys, which represent a more diverse population of Hispanics and also a more diverse population of other racial and ethnic groups.

Only one demographic variable, age, was reported as a significant predictor of adherence to mammography screening in several studies with high adjusted ORs (range: 1.37 to 2.09). Women between the ages of 50 and 64 years were more likely to receive screening mammography compared to younger women. Among the 50-to-64 age group, women between the ages of 55 and 59 years were most likely to be screened,³⁴ a finding that is similar to the results of another recent study.³⁵ Among elderly women, screening mammography appears to decrease with age,²⁸ which is similar to the results of other recent research.³⁶

Two socioeconomic status variables, income and education, were related to adherence to screening mammography in half of the studies reviewed. In studies that used a range of educational categories, a college education was associated with a higher adjusted OR for adherence to screening mammography (range: 1.36 to 3.69). The relationship between having a high school education and adherence to screening mammography was less clear. Several other recent studies have found that higher education is associated with adherence to mammography screening in a range of populations.³⁷⁻⁴³ Four out of eight studies reviewed found an association between income and adherence to screening mammography, which is similar to the findings of several other recent studies in various populations.^{37-39,41-44} The adjusted ORs for income as a predictor of screening mammography were lower than for college education (range: 1.02 to 1.69).

The most consistent predictors of adherence to screening mammography were health system variables. Having health insurance was associated with higher odds of adherence to screening mammography in all studies that reported adjusted ORs for health insurance, which corresponds to the findings of other research studies.^{37,39,40,43,45,46-49} Private insurance was associated with higher odds of screening mammography than public insurance. Similar to the results of a number of other studies,^{37,41,43,46-48,50} having a usual source of care was also associated with higher odds of screening mammography in all studies that reported using that variable in logistic regression analysis. Having recently received health care from a physician was also associated with higher odds of receiving mammography, although having emergency room care was not associated with receipt of screening mammography. The magnitudes of these associations were also strong as reflected in adjusted ORs for each variable (health insurance: 1.7 to 8.5; usual source of care: 1.24 to 3.4; physician's visits: 1.15 to 4.17).

Few studies included psychosocial variables as predictors in multiple logistic regression analysis, so the review of these variables is based on a limited number of studies. In the articles reviewed, other health behaviors were reported as significant predictors of mammography adherence. Attitudes toward breast cancer prevention, screening, and treatment were not significantly associated with mammography adherence. Knowledge about breast cancer was related to mammography screening, but knowledge about breast cancer risk factors and symptoms was not related to mammography. Previous research has found that many women, particularly Hispanic women, report that screening mammography is not necessary in the absence of symptoms of breast cancer, indicating a lack of knowledge.⁵¹ None of the studies reviewed included measures of acculturation, health literacy, mood, self-efficacy, social support, or perceived risk of breast cancer, all of which may be important predictors of adherence to screening mammography.^{36,52-55}

Other variables included in logistic regression analyses had limited support. These variables included immigration, employment, and marital status. The support for immigration status as a predictor of mammography was limited to two out of five studies,^{23,33} and each evaluated different aspects of immigration (nativity and citizenship). The research evaluating immigration as a predictor was limited to studies that sampled state or community populations. The support for employment as a predictor of mammography was also limited to one study that reported full-time employment was related to mammography. Marital status was found to be associated with screening mammography in two out of six studies, indicating less support for this demographic variable.

Taken together, the results of this critical review indicate that Hispanic ethnicity alone may be a significant predictor of adherence to mammography in some communities, but in general, the disparity in adherence to mammography screening due to Hispanic ethnicity is a result of lack of access to health care and lower socioeconomic status. Other research supports these findings. Racial and ethnic differences are found in education and poverty status, with minority women having lower education^{56,57} and Hispanics and African Americans being more likely to live in poverty than whites.^{43,57,58} The cost of health care is a barrier that many women with low incomes have difficulty overcoming. The rate of non-insurance for Hispanics in the United States is almost three times higher than that for non-Hispanic whites,⁵⁸ which limits the health care that Hispanics receive. Women who lack health insurance may be less likely to have a usual source of care, which was a consistent predictor of adherence to mammography screening.

Our study has a number of limitations that affect its generalizability. The study is based on a critical review of 15 articles published in the past 10 years that included ORs from multiple logistic regressions. The results may

be limited because unpublished articles, book chapters, and dissertations might present additional data that were not considered in this critical review. Future studies should expand the selection of research to these sources. In addition, because our critical review evaluated articles published within the last 10 years, we were unable to evaluate changes in mammography screening adherence over time. Most of the studies used self-reports of mammography screening. Also, the study did not include a meta-analysis of data presented in the study, which would have allowed for the analysis of pooled data from several populations. Although our study did not measure the quality of each article included in the study, we reviewed only population-based studies to eliminate studies based on more limited samples.

The critical review of research evaluating Hispanic ethnicity as a predictor of adherence to mammography identified a number of gaps in the literature. Further research using national survey data should be conducted to evaluate the role of nativity, employment, and psychosocial variables in predicting mammography with Hispanic ethnicity as a predictor. In the future, a meta-analysis should be conducted using the data presented in each study.

Conclusions

This critical review of the literature found that women of Hispanic ethnicity were less likely to receive mammography screening compared with non-Hispanic white women. This disparity is more pronounced in community samples and in elderly women. A review of the literature also indicated that the disparity in mammography due to Hispanic ethnicity was attenuated when controlling for health system and socioeconomic variables. Interventions designed to reduce disparities in screening mammography related to Hispanic ethnicity should focus on increasing access to health care, such as providing affordable health insurance and increasing access to health care providers. Future research in population-based studies should evaluate employment, nativity, and a range of psychosocial variables as predictors of mammography screening.

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